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# Foreword

*Timothy K. Perttula*

This special volume of the *Bulletin of the Texas Archeological Society*, the Society's 70th, focuses on Spanish Colonial archeology and historical research in Texas. Its original impetus was a symposium of papers on Spanish Colonial archeology held at the 1996 Annual Meeting of the Texas Archeological Society in San Antonio, along with the interest fostered by the 1997 and 1998 Texas Archeological Society Field Schools held at Mission Espiritu Santo de Zuñiga (41VT11) in Victoria County, Texas (Thomas R. Hester, Principal Investigator).

The 29 papers in the "Spanish Colonial Archeological and Historical Research in Texas" section of this volume range across the breadth and scope of current Spanish colonial studies in our state. They deal with the following themes: first entradas and trails; Native American history during the Spanish colonial era; Spanish colonial missions, presidios, and civil settlements (*ranchos*) in Texas, including *acequias* and grist mills; material culture studies (particularly lithics, Native-made and Spanish-made ceramics, and glass beads), and the use and exploitation of wild and domesticated animals by the mission inhabitants.

Through the concerted efforts of many archeologists, historians, and archivists—both professional and avocational—and building on the many excellent studies completed in the first three-quarters of the 20th century, our understanding of Spanish Colonial Texas has grown by leaps and bounds in the last 20 years or more (see Hester 1989; Simons and Hoyt 1992; Gilmore 1995; de la Teja 1997, 1998), and there is every reason to expect this trend to continue for the foreseeable future. Truly, Spanish Colonial archeology and history is alive and well in Texas. To foster a broader appreciation among the public and in our educational system of the Spanish colonial era in Texas and surrounding states, I think that the year 2000 would be a propitious and exciting time for the Texas Archeological Society, the Texas State Historical Association, the Texas Catholic Historical Society, the Texas Historical Commission, and other organizations to join together to organize a conference on Spanish Colonial archeology and history in Texas. From this conference should come publications and scholarly articles, public exhibits and Websites, CD-ROMs, and other materials that can convey to the interested public the rich and diverse archeological and historical heritage (both Native American, Mexican, and European) of the Spanish colonial era in Texas.

I would like to thank the many volume authors that contributed to the Spanish Colonial archeological and historical section of the *Bulletin*. I also appreciate the help and assistance provided by Linda W. Ellis, Associate Editor, and several professional colleagues that served as peer reviewers for the papers. These include C. Britt Bousman, John W. Clark, Pam Headrick, Thomas R. Hester, Nancy A. Kenmotsu, Nancy G. Reese, Steve A. Tomka, and Mariah F. Wade.

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# Spanish Colonial Archeology in Texas: Where We Are and Where Should We Be Going from Here?

*Anne A. Fox*

Contrary to the impressions of the general public, Spanish colonial sites in Texas include more than just Franciscan missions. The Spanish also built presidios and founded towns. They constructed houses and parish churches, established ranches out in the countryside, and built dams and irrigation systems, sugar mills, grist mills, brick and lime kilns, and other industrial sites.

Few Spanish colonial mission sites had been investigated by Texas archeologists before 1962 (Tunnell and Newcomb 1969:iii), with the exception of excavations in the late 1930s under the direction of the National Park Service in connection with the restoration of Mission Senora del Espiritu Santo at Goliad (Figure 1). Since no report was written by the archeologists on the project, no one had the benefit of what was learned there until a later study was done of the artifacts (Mounger 1959).

Texas archeologists began working in the 1960s at known sites with visible ruins—Mission San Lorenzo at Camp Wood, the San Antonio missions, and the Alamo—nice, solid sites we could see and identify. Since most of us had little experience in historical archeology, we learned by trial and error how to recognize and understand wall foundations; what kinds of construction to anticipate; how the buildings should be arranged; and what sorts of artifacts we should encounter. Using the techniques we had learned for excavating prehistoric sites, we began to examine and record historic structures for the first time. Fortunately, the fact that we were on unfamiliar ground encouraged us to proceed cautiously, recording everything in field notes and measured drawings. We gradually learned how to use the time-honored techniques in new ways, how to recognize and record structural details, when to trench and when to open large areas, and most recently when it was appropriate to use heavy machinery such as a backhoe or Gradall to recover certain types of information. We learned to do our research before we went into the field, and to plan our excavations based on the results, rather than digging first and then deciding later what we had found.

After a while, we realized that we had only examined mission sites, and began to also look for the presidios and settlements that usually went along with them. We began to think about how to find Spanish sites that were no longer visible on the surface, sites about which we had little information beyond a few mentions in the documents. Some of our missions and presidios had been moved at least once, and some of them had been moved several times. How could we find these sites?

To answer this need, Kathleen Gilmore proposed a four-pronged method to find these "lost" sites. In order to properly identify a site, one should construct a model of the site based on the expected geographic location, topographic features, the physiographic nature of the area, and the cultural remains that should be present. Armed with such a model, one could go forth and find the lost sites, and she proceeded to prove it by locating and identifying the San Xavier mission complex in Central Texas (Gilmore 1969).

Thinking in this manner and persevering despite obstacles and disappointments, we gradually learned that all four of these requirements must be met before we could with assurance say we had found a particular Spanish site. For instance, at Mission Espiritu Santo in Mission Valley north of Victoria, despite the fact that we were sure we had the right location and some very convincing ruins, until we finally recovered Spanish artifacts during testing operations we could not say with certainty that we had the right site.

Another thing we have learned is that it is hard to get much information when we are limited to small, scattered excavation units. We can get a

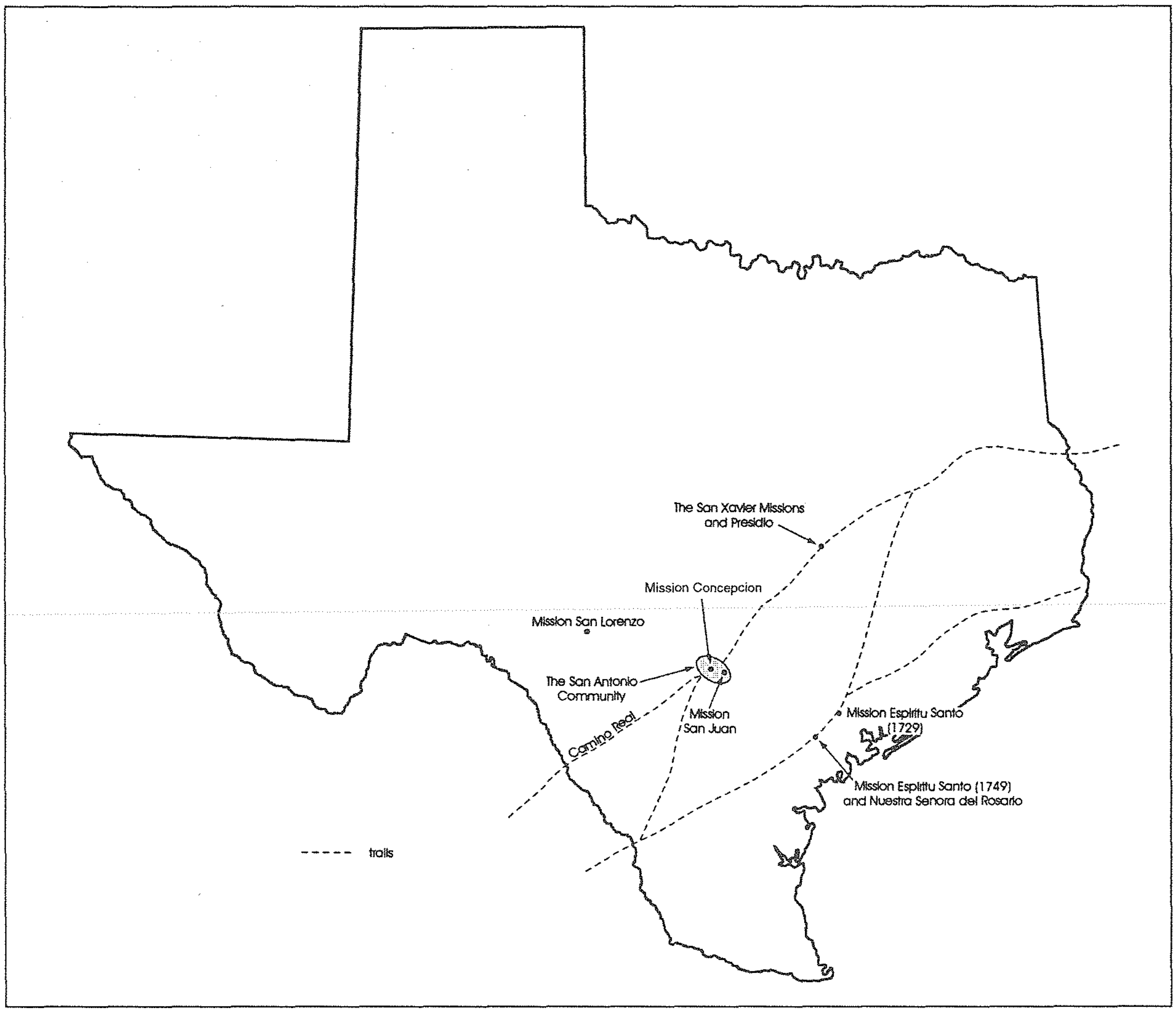


Figure 1. Selected Spanish Colonial Sites and Trails in Texas.

sample but not much more. Small units can be helpful, however, if they are carefully placed based on intensive documentary research beforehand. Jake Ivey proved this at Mission Concepcion in San Antonio in 1981 (Ivey and Fox 1999), when he was able to reconstruct the entire outline of the mission that had disappeared by the 1890s. However, for the most part, the best structural information from Spanish colonial sites that has been recovered has come from large, horizontal excavations such as those carried out by Curtis Tunnell at Mission San Lorenzo (Tunnell and Newcomb 1969), Mardith Schuetz at Mission San Juan Capistrano in San Antonio (Schuetz 1968), and Kathleen Gilmore at Mission Rosario at Goliad (Gilmore 1974).

We have also learned how vitally important it is to record every minute detail of what we see in the ground. Such careful recording will pay off, sometimes when another archeologist works nearby and can suddenly relate what you found to what he or she is finding, sometimes years later when we have learned more about colonial sites and see things in these previous excavation reports that we did not understand at the time. Our understanding of Spanish colonial sites, and the way past peoples were thinking, is of necessity cumulative, with one discovery building upon another.

Nevertheless, everything always seems to go back eventually to the accuracy of our understanding of the Spanish documents. And this is where we have usually been dependent upon historians and translators for our information. This is appropriate, and we need to cooperate and work with people in other related fields of research. The problem is that sometimes translators skip over the little, niggling details that are terribly important to the archeologist, but not so important to the historian. Also, translators sometimes differ with each other, which can add to our confusion. For these reasons, some of us have learned that with determination and a good Spanish dictionary we can read the documents, at least well enough to know when we need help. Then we can ask our specialist friends for translations of small sections, rather than whole documents.

So we have excavated in known sites, we have found some missing ones thanks to the "Gilmore Method," and we have learned our way around in the Spanish archives and the county courthouse records. We wish for larger projects where we could learn more, but are nearly always limited by time and money. Where should we be going from here? How can we make the most of what opportunities we have to learn more about Spanish colonial archeology?

We are branching out to examine other aspects of the Spanish colonial period such as dams and *acequias* (see Cox, this volume) and civilian settlements and Indian camps, finding and identifying new sites (see Horell, this volume), and expanding our knowledge of those we already know about. In addition we are doing in-depth studies of specific artifact types, learning how to gain more from the information we recover.

The best and most recent example of the way we should be looking at our Spanish colonial sites is the 1997 and 1998 Texas Archeological Society Field School at the site of Mission Espiritu Santo in Mission Valley, north of Victoria (Walter and Hester 1998; Walter 1997, Walter, this volume). Careful advance research and planning resulted in a thorough investigation of a frontier mission, including every aspect of mission life: not just the buildings but the people that lived there; the quarry from which the stone was obtained; the kiln that produced the lime for construction; and the irrigation system that helped produce the food to sustain the mission inhabitants (Rinker et al., this volume). We seldom, if ever, put such a large group of people in the field doing archeology as was done there, but the important thing is the comprehensive picture that has evolved of the mission as an institution.

It seems that the public and professional interest in the archeology of Spanish colonial sites in Texas has revived and is growing. The question now is, how do we direct that interest and enthusiasm into research that is more than just more shovel tests and one meter squares producing disjointed results? We must do more than just continue in the same way.

It is time to reexamine our earlier reports for deeper meanings, more details, and for clues to further research efforts. Comparative studies of architectural practices must be pursued, along with a better understanding of industries such as brick making, lime burning, sugar making, and pottery making. We need to reach out to other archeologists and historians in the Southwest who may know more about these things. Perhaps this means getting together whenever possible; in short, we need less expensive meetings than the large national society meetings. It means corresponding with our peers everywhere: did I hear someone say the Internet? The Spanish were not eager experimenters. They were very conservative in how they did things. Their habits and customs did not change appreciably from the 17th century to the early 19th century. What has been learned in Florida (e.g., McEwan 1993) or California (e.g., Costello and Hornbeck 1989) is probably applicable to what was happening here as well.

Take the whole subject of food—where it was coming from, how it was prepared and eaten, and what was done with the garbage? Questions like this may not seem earth-shaking at first, but everything we find on a site is related to them—hearths, pottery sherds, and animal bone—and not just what they are but where they are. Discussion of these topics should be addressed in our final reports. It is time for some of us to write discussions that cover more than just the usual: where did we dig and what artifacts did we find? Instead, we should discuss what we have learned, and how can a particular excavation project be related to earlier work at a Spanish colonial site or at other similar ones? What questions do we still need to answer, and how can this be done?

Speaking of reports, we must do a better job of communicating our results as quickly as possible as the pace of Spanish colonial archeology quickens. Publication seems to take anywhere from six months to years or not at all. We need a means of sharing publication titles and authors, if nothing else. This does not mean we must hurry up and get the publication done and never mind the details, but it does mean have it finished before the next project comes along. How many of us do this now? We must try harder. Perhaps we need a conference to discuss this whole problem. Does every small testing project of a Spanish colonial site need to produce a separate published report? Is there a more efficient way to accomplish the exchange of information?

The scarcity of funding and pressure to preserve as much as possible of every Spanish colonial site have often resulted in minimal excavations. We may need to rethink this approach. Do we save everything for the future at the expense of learning what we need to know now? There must be a middle ground. We are challenged to refine our excavation and recording techniques in order to recover as much as we can from every project. Concentrated effort on detailed recording—maps, profiles, and photographs—will pay off in many ways. Preparation of the report will be facilitated by providing this information, and communication with the readers, both professional and avocational, will be improved. The next archeologist who follows that work on the site will know exactly what was done and where. The accumulation of knowledge contained in carefully written site reports will benefit every manager who later has to make decisions about the future of the site.

At the San Antonio Missions National Historical Park, we are learning that every hole in the ground can tell us something, even if it is that "there's nothing here." An orderly file of short reports from monitoring such small projects as tree planting and drainage alterations is invaluable for future planning of projects. We must not only monitor these alterations, but take notes, make sketches, and file them where they can be found.

What happens to the field notes, drawings, photographs, and artifacts when the project report is finished? The excavation is not completed until they are all put in order and deposited in a curation facility where the rest of us can refer to them. This is true for professional and avocational archeologists. Having these materials remain on the closet shelf or in our personal files will not help anyone. Putting our site records in order is often one of those things put off because we think it will take too long, but this is not necessarily true. We must sort things into folders, identify our photographs, and then follow the instructions of the facility where they are being taken for permanent curation. The curation facilities will be glad to help get materials in order and provide exact instructions and guidance on what is needed to complete the curation process,

So here is what we need to do:

More research in the archives: do not be intimidated, just plunge in;

More consultation with historians: we have a lot to offer them, as much as they have to give us;

Careful planning when we write proposals to be sure that the time and the budget are adequate to do a good job;

Thoughtful recording of excavation results and prompt report writing and publishing; and

Curation. Get those collections out of the closet.

It is exciting to see how many Texas archeologists are now beginning to take an interest in Spanish colonial sites. This should be encouraged by those of us who are already doing this kind of work, by readily sharing our knowledge and offering to advise and help other archeologists wherever possible.

Finally, it is shameful to see that little if any, emphasis is put on colonial archeology in our Texas colleges and universities. Course schedules would have us believe that Texas archeology stops at the end of the prehistoric period. Until students are encouraged to undertake Spanish colonial topics for thesis and dissertation research, we may well be limited to the piecemeal recovery of information from shovel tests and scattered one meter squares.

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# Named Indian Groups in Texas: A Guide to Entries in the *New Handbook of Texas*

*Michael B. Collins*

Ask the average citizen to name the Indians of Texas and the answer usually will include four or five names out of a short list of better known groups, including the Apache, Caddo, Comanche, Karankawa, Kiowa, Tejas, Tonkawa, and Wichita, some of which are not even bona fide ethnic units. Even a sophisticated answer will rarely exceed 20 or 30 names. Yet the dogged efforts of a handful of scholars, most notably T. N. Campbell of the University of Texas at Austin, have extracted close to 600 names for Native American groups from documents written early in the Euro-American settlement of the region that is now Texas. It is difficult to know exactly what kind of social or political unit is referred to by many of these names, often called "nations" in the Spanish documents. They could be bands, extended families, or tribes. Some names appear in a single document, others in multiple documents. In many cases, there is little more than a name and it is difficult to locate the named group geographically or learn much about the people or their way of life. However, when compiled into a single reference work, the existing information is of considerable value to historians, linguists, anthropologists, and archeologists.

*The New Handbook of Texas*, edited by Ron Tyler and published in 1996 by the Texas State Historical Association, is a six-volume encyclopedic treatment of all aspects of Texas, its peoples, history, arts, geography, and other topics (Tyler 1996). This edition replaces an earlier, two-volume work (Webb 1952) and supplement (Branda 1976). A few Native American group names appeared in the 1952 edition but a majority appear in the 1976 supplement. Entries in these three works are alphabetical and no topical or other indexing is provided, making it difficult to research named Indian groups by region or time period without knowing specific group names. This guide provides a tabulation of all of the named groups in *The New Handbook of Texas* by geographic location and time period and also identifies the author of the entry (Table 1).

Most of the document sources provided too little information for locations to be determined except in the most general sense, often consisting of statements such as "one of fifty nations, that lived north of the Rio Grande between Texas and New Mexico in the late 17th century." Therefore, this tabulation is based on only seven very broad regions of the state (Figure 1), and there is consid-

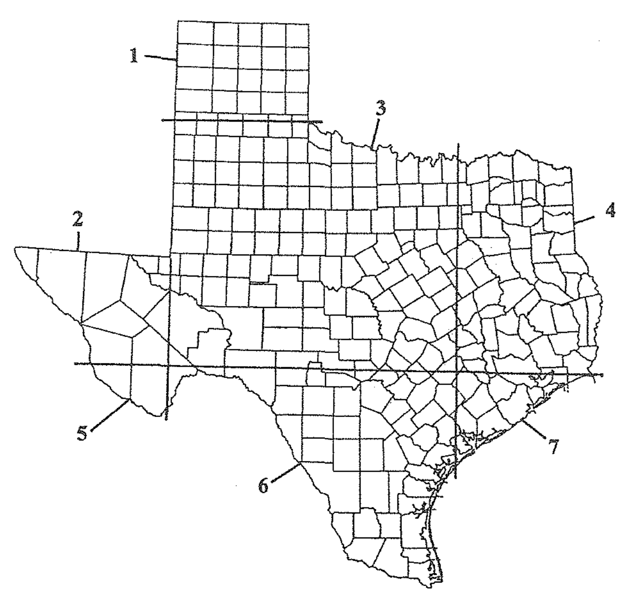


Figure 1. Seven Arbitrary Regions of Texas used to locate the Indian Groups in Table 1.

**Table 1. The Named Indian Groups of Texas in *The New Handbook of Texas*.**

| NAME | REGION | | | | | | | | CENTURY | | | | | AUTHOR | VOL | PAGES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 16 | 17 | 18 | 19 | 20 | | | |
| ABA | | | X | | | | | | | X | | | | TNC | 1 | 3 |
| ABAU | | | X | | | X | | | | X | | | | TNC | 1 | 4 |
| ABRIACHE | | | | | X | | | | X | | | | | TNC | 1 | 14 |
| ACHUBALE | | X | X | | | | | | | X | | | | TNC | 1 | 17 |
| ADAES | | | | X | | | | | | X | X | | | MHK | 1 | 21 |
| AGUAJUAMI | | | | X | | | | | | | X | | | TNC | 1 | 70 |
| AGUAPALAM | | | | | | X | | | | X | X | | | TNC | 1 | 70-71 |
| AGUASTAYA | | | | | | X | | | | | X | | | TNC | 1 | 71 |
| AGUA SUCIA | | | ? | | | | | | | X | | | | TNC | 1 | 71 |
| AGUIDA | | | X | | | | | | | X | | | | TNC | 1 | 72 |
| AHEHOUEN | | | | | | | X | | | X | | | | TNC | 1 | 72-73 |
| AHOUERHOPIHEIM | | | | | | | X | | | X | | | | TNC | 1 | 73 |
| AJELI | | | X | | | | | | | X | | | | TNC | 1 | 73 |
| AIS | | | | X | | | | | | | X | | | MHK | 1 | 76 |
| AKASQUY | | | | | | | X | | | X | | | | MHK | 1 | 76 |
| AKOKISA | | | | | | | X | | X | X | X | X | | TNC | 1 | 76 |
| ALABAMA-COUSHATTA | | | | X | | | | X | | | X | X | X | HNM | 1 | 77-81 |
| ALACHOME | | | | | | X | | | | X | X | | | TNC | 1 | 81 |
| AMEDICHE | | | | X | | | | | | | X | | | MHK | 1 | 145 |
| ANACHOREMA | | | | | | | X | | | X | | | | TNC | 1 | 158 |
| ANADARKO | | | | X | | | | | | X | X | | | TNC | 1 | 158 |
| ANAGADO | | | | | | X | | | X | | | | | MHK | 1 | 158 |
| ANAO | | | | X | | | | | | X | | | | TNC | 1 | 161 |
| ANAQUAS | | | | | | X | | | X | | | | | KSO | 1 | 161 |
| ANATHAGUA | | | | ? | | ? | ? | | | | X | | | TNC | 1 | 161-162 |
| ANCHIMO | | | X | | | | | | | X | | | | TNC | 1 | 162 |
| ANCHOSE | | | | | | ? | ? | | | | X | | | TNC | 1 | 162 |
| ANDACAMINO | | | | | | ? | | | | | X | | | TNC | 1 | 162 |
| ANNAHO | | | | X | | | | | | X | | | | TNC | 1 | 192 |
| ANNAS | | | | | | X | | | | | X | | | TNC | 1 | 192 |
| APACHE | X | X | X | | X | X | | | X | X | X | X | | JDC | 1 | 210-212 |
| APAPAX | | | | | | ? | ? | | | | X | | | TNC | 1 | 212 |
| APATIN | | | | | | X | | | | | X | | | TNC | 1 | 213 |
| APAYSI | | | | | | X | | | | X | | | | TNC | 1 | 213 |
| APION | | | | | | ? | | | | | X | | | TNC | 1 | 213 |
| ARANAMA | | | | | | X | | | | | X | X | | TNC | 1 | 215-216 |
| ARBADAO | | | | | | X | | | X | | | | | MHK | 1 | 221 |
| ARCAHOMO | | | | | | X | | | | | X | | | TNC | 1 | 222 |
| ARCOS BUENOS | | | | | X | | | | | X | | | | TNC | 1 | 235 |
| ARCOS PORDIDOS | | | | | X | | | | | X | | | | TNC | 1 | 235 |
| ARCOS TIRADOS | | | | | X | | | | | X | | | | TNC | 1 | 235 |
| ARCOS TUERTOS | | | X | | | | | | | X | | | | TNC | 1 | 235 |
| ARHAU | | | | | | | X | | | X | | | | MHK | 1 | 237 |
| ARIHUMAN | | | ? | | | ? | | | | X | | | | TNC | 1 | 237-238 |
| ASEN ARCOS | | ? | ? | | | | | | | X | | | | TNC | 1 | 263 |
| ATAJAL | | | | | | X | | | | X | | | | TNC | 1 | 271-272 |
| ATAKAPA | | | | | | | X | | | | X | X | X | DC | 1 | 272 |
| ATANAGUAYPACAM | | | | | | X | | | | | X | | | TNC | 1 | 272 |
| ATASACNEU | | | | | | ? | ? | | | | X | | | TNC | 1 | 272 |
| ATASTAGONIE | | | | | | X | | | | | X | | | anon | 1 | 275 |
| ATAYO | | | | | | X | | | X | | | | | TNC | 1 | 275 |
| ATIA and ATIASNOGUE | | | | | | ? | ? | | | | X | | | TNC | 1 | 278 |
| AVAVARE | | | | | | X | | | X | | | | | MHK | 1 | 318 |
| BAGUAM | | | | | | X | | | | X | | | | TNC | 1 | 334 |
| BAJUNERO | | ? | ? | | | | | | | X | | | | TNC | 1 | 342 |
| BAPACORA | | | | | | X | | | | X | | | | TNC | 1 | 375 |
| BATA | | | | X | | | | | | X | | | | TNC | 1 | 413 |
| BATAYOGLIGLA | | | | | X | | | | | X | X | | | TNC | 1 | 413 |
| BEAN | | | | | | X | | | | X | | | | TNC | 1 | 438 |
| BEITONIJURE | | ? | ? | | | | | | | X | | | | TNC | 1 | 466 |
| BIBIT | | | | | | X | | | | X | | | | TNC | 1 | 522 |
| BIDAI | | | | | | | X | | | X | X | X | | TNC | 1 | 523-524 |
| BILOXI | | | X | X | | | | X | | | | X | | MB | 1 | 545 |
| BISKATRONGE | | | | | | | X | | | X | | | | TNC | 1 | 555 |
| BLACK SEMINOLE | | | | | | X | | X | | | | X | | TE-G | 1 | 571-573 |
| BLOUNT | | | | X | | | | X | | | | X | | MHK | 1 | 600 |
| BOBIDA | | | ? | | | ? | | | | X | | | | TNC | 1 | 619 |
| BOBOLE | | | | | | X | | | | X | | | | TNC | 1 | 619-620 |
| BOROBAMO | | | ? | | | ? | | | | X | | | | TNC | 1 | 652 |
| BORRADO | | | | | X | X | | | | X | X | | | TNC | 1 | 652 |
| BRAZOS LARGOS | | | | | | X | | | | | X | | | TNC | 1 | 715 |
| CAAI | | | | X | | | X | | | X | | | | TNC | 1 | 879 |
| CABELLOS BLANCOS | | | | | X | | | | | X | | | | TNC | 1 | 881 |
| CABEZA | | | | | | X | | | | X | | | | TNC | 1 | 882 |
| CABIA | | | | | | | ? | | | X | | | | TNC | 1 | 883 |
| CACALOTE | | | | | X | X | | | | X | X | | | TNC | 1 | 883-884 |
| CACAXTLE | | | | | | X | | | | X | | | | TNC | 1 | 884 |
| CACHAE | | | | ? | | | ? | | | X | | | | TNC | 1 | 884 |
| CACHOPOSTAL | | | | | | X | | | | | X | | | TNC | 1 | 884 |
| CADDO | | | | X | | | | | X | X | X | X | X | TKP | 1 | 887-888 |
| CAGAYA | | ? | | ? | ? | ? | | | | X | | | | TNC | 1 | 891 |

**Table 1.** *(Continued)*

| NAME | REGION 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | CENTURY 16 | 17 | 18 | 19 | 20 | AUTHOR | VOL | PAGES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAGUATE | | | | | X | | | | X | | | | | TNC | 1 | 891 |
| CAIASBAN | | | | X | | | | | | X | | | | TNC | 1 | 891 |
| CAICACHE | | | | | | X | | | | | X | | | TNC | 1 | 891 |
| CAIMANE | | | | | | ? | | | | X | | | | TNC | 1 | 891 |
| CAISQUETEBANA | | | | | | | X | | | X | | | | TNC | 1 | 892 |
| CAMAI | | | | | | ? | | | | | X | | | TNC | 1 | 913 |
| CAMAMA | | | | | | ? | | | | | X | | | TNC | 1 | 913 |
| CAMOLE | | | | | | X | | | X | | | | | MHK | 1 | 922 |
| CANABATINU | | | | X | | | | | | X | | | | TNC | 1 | 950 |
| CANA | | | | | | X | | | | | X | | | TNC | 1 | 953 |
| CANAQ | | | | | X | | | | | X | | | | TNC | 1 | 955 |
| CANCEPNE | | | | ? | | | ? | | | | X | | | TNC | 1 | 956 |
| CANNAHA | | | | X | | | | | | X | | | | TNC | 1 | 960 |
| CANNAHIO | | | | X | | | | | | X | | | | TNC | 1 | 960 |
| CANONIDIBA | | | | X | | | | | | X | | | | TNC | 1 | 961 |
| CANONIZOCHITOUI | | | | X | | | | | | X | | | | TNC | 1 | 961 |
| CANTEY | | | | X | | | | | | X | | | | TNC | 1 | 961-962 |
| CANTONA | | | X | X | | X | | | | X | X | | | TNC | 1 | 962-963 |
| CANU | | | | X | | | | | | X | | | | TNC | 1 | 963 |
| CAPELLONE | | | | | | ? | | | | | X | | | TNC | 1 | 965 |
| CAQUIXADAQUIX | | | | X | | | | | | X | | | | TNC | 1 | 970 |
| CASA CHIQUITAS | | | | | | X | | | | | X | | | TNC | 1 | 1009 |
| CASAS MORADAS | | | | | X | | | | | X | | | | TNC | 1 | 1009 |
| CASIBA | | | | X | | | | | | X | | | | TNC | 1 | 1011 |
| CASO | | | | X | | | | | | | X | | | TNC | 1 | 1012 |
| CASSIA | | | | X | | | | | | X | | | | TNC | 1 | 1015 |
| CATAYE | | | | X | | | | | | X | | | | TNC | 1 | 1025 |
| CATQUEZA | | | | | | X | | | | X | | | | TNC | 1 | 1037 |
| CATUJANO | | | | | | X | | | | X | | | | TNC | 1 | 1043 |
| CAULA | | ? | ? | | | | | | | X | | | | TNC | 1 | 1044 |
| CAUX | | | | | | | X | | | | X | | | TNC | 1 | 1045 |
| CAVA | | | | | | | X | | | X | X | | | TNC | 1 | 1045 |
| CAXO | | | | X | | | | | | X | | | | TNC | 1 | 1050 |
| CAYNAAYA | | | | | | X | | | | X | | | | TNC | 1 | 1051 |
| CENIZO | | | | | | X | | | | X | X | | | TNC | 2 | 12 |
| CHAGUANE | | | | | | X | | | | X | X | | | TNC | 2 | 25 |
| CHAGUANTAPAM | | | | | | | X | | | X | | | | TNC | 2 | 25 |
| CHAPAMACO | | | | | | X | | | | | X | | | TNC | 2 | 43 |
| CHAQUANTIE | | | | X | | | | | | | X | | | TNC | 2 | 47-48 |
| CHARRO | | | | | | X | | | | | X | | | TNC | 2 | 51 |
| CHAYOPIN | | | | | | X | | | | X | X | | | TNC | 2 | 52-53 |
| CHEMPANATAHU | | | | | | X | | | | | X | | | TNC | 2 | 56-57 |
| CHENTI | | | X | | | | | | | | X | | | TNC | 2 | 58 |
| CHEROKEE | | | X | X | | | | X | | | | X | X | CAL | 2 | 61-63 |
| CHEYENNE | X | | | | | | | X | | | | X | | anon | 2 | 67 |
| CHICHITAME | | | | | X | X | | | | X | X | | | TNC | 2 | 73 |
| CHICKASAW | | | | X | | | | X | | | | X | | ML | 2 | 73 |
| CHILANO | | | | X | | | | | X | | | | | anon | 2 | 77-78 |
| CHILILI | | X | | | | | | | | X | | | | WESD | 2 | 82 |
| CHIZO | | | | | X | X | | | | | ? | | | TNC | 2 | 92 |
| CHOCTAW | | | | X | | | | X | | | | X | | JDC | 2 | 94-95 |
| CHOME | | | | | | X | | | | X | X | | | TNC | 2 | 96 |
| CHORRUCO | | | | | | | X | | X | | | | | MHK | 2 | 96-97 |
| CHUAPA * | | | | | | | | | | | | | | TNC | 2 | 103 |
| CIBOLA | | | X | | | | | | | X | | | | TNC | 2 | 107 |
| CIMATAGUO * | | | | | | | | | | | | | | TNC | 2 | 110 |
| CLANCLUIGUYGUEN | | | | | | X | | | | | X | | | TNC | 2 | 128 |
| CLUETAU | | | | | | X | | | | | X | | | TNC | 2 | 168 |
| COAHUILTECAN | | | | | | X | | | X | X | X | X | | anon | 2 | 171-174 |
| COAPITE | | | | | | X | X | | | | X | | | TNC | 2 | 176 |
| COAQUE | | | | | | | X | | X | | | | | TNC | 2 | 176 |
| COAYO | | | | | | X | | | X | | | | | MHK | 2 | 178 |
| COCO | | | | | | | X | | | | X | X | | TNC | 2 | 184-185 |
| COCOMA | | | | | | X | | | | X | | | | TNC | 2 | 185 |
| COCOMEIOJE | | | | | | X | | | | | X | | | TNC | 2 | 185 |
| COLABROTE | | | ? | | | | | | | X | | | | TNC | 2 | 195 |
| COLAS LARGAS | | | | | X | | | | | X | | | | TNC | 2 | 195 |
| COLORADO | | | | | X | | | | | X | | | | CAL | 2 | 227 |
| COMANCHE | X | X | X | | X | X | | | | | X | X | | CAL | 2 | 242-245 |
| COME CIBOLAS | | | | | X | | | | | X | | | | TNC | 2 | 247 |
| COMECRUDO | | | | | | X | X | | | X | X | | | TNC | 2 | 247 |
| COME | | | X | | | | | | | X | | | | TNC | 2 | 247 |
| COMOCARA | | | ? | | | | | | | X | | | | TNC | 2 | 253 |
| COMO | | | | | | X | | | X | | | | | MHK | 2 | 253 |
| CONA | X | | | | | | | | X | | | | | WESD | 2 | 254-255 |
| CONCHAMUCHA | | | X | | | | | | | X | | | | TNC | 2 | 256 |
| CONCHATE | | | | X | | | | | | | | X | | anon | 2 | 256 |
| CONCUGUYAPEM | | | | | | X | | | | | X | | | TNC | 2 | 262 |
| CONEJERO | X | | | | | | | | | X | X | | | HAA | 2 | 263 |
| CONEJO | | | | | X | | | | | X | | | | TNC | 2 | 263 |
| COOTAJANAM | | | | | | X | | | | | X | | | TNC | 2 | 316 |

**Table 1.** *(Continued)*

| NAME | REGION 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | CENTURY 16 | 17 | 18 | 19 | 20 | AUTHOR | VOL | PAGES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPANE | | | | | | X | X | | | | X | X | | TNC | 2 | 316 |
| COTONAME | X | | | | | | | | | | X | X | | TNC | 2 | 349 |
| COUPS DE FLECHES | | | | X | | | | | | | | X | | MHK | 2 | 370 |
| COUSHATTA | | | | X | | | | X | | | X | X | X | HNM | 2 | 372-373 |
| COYABEGUX | | | X | | | | | | | X | | | | MHK | 2 | 384 |
| CREEK | | | | | | | | X | | | | X | | JDC | 2 | 399-400 |
| CRUIAMO | | | | | X | | | | | X | | | | TNC | 2 | 428 |
| CUCHENDADO | | | | | | X | | | X | | | | | MHK | 2 | 432 |
| CUERO QUEMADO | | | | | | X | | | | | X | | | TNC | 2 | 434 |
| CUITAO | | | ? | | | | | | | X | | | | TNC | 2 | 434 |
| CUJACO | | | ? | | | | | | | X | | | | TNC | 2 | 434-435 |
| CUJALO | | | ? | | | | | | | X | | | | TNC | 2 | 434-435 |
| CUJANE | | | | | | | X | | | | X | | | TNC | 2 | 435 |
| CUNQUEBACO | | | ? | | | | | | | X | | | | TNC | 2 | 451 |
| CUTALCHICH | | | | | | X | | | X | | | | | MHK | 2 | 461 |
| DAQUINATINO | | | | X | | | | | | X | | | | MHK | 2 | 509 |
| DAQUIO | | | | X | | | | | | X | | | | MHK | 2 | 509 |
| DATANA | | | | X | | | | | | X | | | | TNC | 2 | 515 |
| DATCHO | | | | X | | | | | | X | | | | MHK | 2 | 515 |
| DEADOSE | | | X | | | X | X | | | | X | | | TNC | 2 | 546 |
| DECUBADAO | | | | | | ? | | | X | | | | | MHK | 2 | 558 |
| DELAWARE | | | | X | | | | X | | | X | X | | CAL | 2 | 568-569 |
| DETOBITI | | | X | | | | | | | X | | | | TNC | 2 | 608 |
| DICO | | | | X | | | | | | X | | | | TNC | 2 | 639 |
| DIENTES ALAZANES | ? | | | | ? | | | | | X | | | | TNC | 2 | 640 |
| DIJU | | | ? | | | | | | | X | | | | TNC | 2 | 643 |
| DOGUENE | | | | | | | X | | X | | | | | TNC | 2 | 670 |
| DOTCHETONNE | | | | ? | | | | | | X | | | | TNC | 2 | 682 |
| EBAHAMO | | | | | | X | X | | | X | | | | TNC | 2 | 776 |
| ECHANCOTE | | | X | | | | | | | X | | | | TNC | 2 | 779 |
| EMET | | | | | | | X | | | X | X | | | TNC | 2 | 861 |
| ENEPIAHE | | | | | | | X | | | X | | | | TNC | 2 | 868 |
| ERIGOANNA | | | | | | | X | | | X | | | | TNC | 2 | 882 |
| ERVIPIAME | | | X | | | X | | | | X | X | | | TNC | 2 | 886 |
| ESCANJAQUE | | | X | | | | | | | X | | | | TNC | 2 | 889 |
| ESPOPOLAME | | | | | | X | | | | X | | | | TNC | 2 | 896 |
| ESQUIEN | | | X | | | ? | ? | | | | X | | | WESD | 2 | 896 |
| ESTEPISA | | | X | | | ? | ? | | | | X | | | WESD | 2 | 898 |
| FLECHAS CHIQUITAS | | | X | | | | | | | X | | | | TNC | 2 | 1028-1029 |
| FLECHAS FEAS | | ? | ? | | | | | | | X | | | | TNC | 2 | 1029 |
| GARZA | | | | | | X | | | | | X | X | | TNC | 3 | 112 |
| GAVILAN | | | | | | X | | | | X | | | | TNC | 3 | 118 |
| GEIER | | | | | | X | | | | X | | | | TNC | 3 | 122 |
| GEOBARI | | | ? | | | | | | | X | | | | TNC | 3 | 127 |
| GEOTE | | | ? | | | | ? | | | | X | | | TNC | 3 | 136 |
| GINCAPE | | | | | | X | | | | | X | | | TNC | 3 | 173 |
| GUACALI | | | | | X | | | | | X | | | | TNC | 3 | 358 |
| GUAGEJOHE | X | | | | | | | | | | | X | | MHK | 3 | 366-367 |
| GUASA | | | | X | | | | | | X | X | | | TNC | 3 | 367 |
| GUAYCONE | | | | | | ? | ? | | X | | | | | MHK | 3 | 367 |
| GUAZAPAYOGLIGLA | | | | | X | | | | | X | X | | | TNC | 3 | 367 |
| GUEIQUESALE | | | | | | X | | | | X | | | | TNC | 3 | 367-368 |
| GUHLKAINDE | X | | | | | | | | | | ? | | | MHK | 3 | 371 |
| GUISOLE | | | | | | X | | | | | | X | | MHK | 3 | 374 |
| GUMPUSA | | | | | | X | | | | | X | | | TNC | 3 | 386 |
| HACANAC | | | | X | | | | | X | | | | | TNC | 3 | 398 |
| HAESER | | | | | | X | | | | X | | | | TNC | 3 | 402 |
| HAINAI | | | | X | | | | | | | ? | | | MHK | 3 | 406 |
| HANASINE | | | X | | | | | | | X | | | | TNC | 3 | 438 |
| HAN | | | | | | | X | | X | | | | | TNC | 3 | 440 |
| HAPE | | | | | | X | | | | X | | | | TNC | 3 | 445 |
| HAQUI | | | | X | | | | | | X | | | | TNC | 3 | 446 |
| HASINAI | | | | X | | | | | | X | X | X | X | RMM | 3 | 499-500 |
| HENIOCAN | | | | | | X | | | | X | | | | TNC | 3 | 561-562 |
| HIABU | | | | | | X | | | | X | | | | TNC | 3 | 584-585 |
| HIANAGOUY | | | | X | | | | | | X | | | | MHK | 3 | 585 |
| HIANTATSE | | | | X | | | | | | X | | | | MHK | 3 | 585 |
| HIGO | | | | | | X | | | X | | | | | MHK | 3 | 608 |
| HINEHI | | | X | | | | | | | X | | | | TNC | 3 | 627 |
| HINSA | | | X | | | | | | | X | | | | TNC | 3 | 629 |
| HONABANOU | | | | | | ? | | | | ? | | | | WESD | 3 | 681 |
| HOUANEIHA | | | | X | | | | | | X | | | | TNC | 3 | 710 |
| HUANE | | | | | | X | | | | X | | | | TNC | 3 | 755 |
| HUICASIQUE | | | X | | | | | | | X | | | | TNC | 3 | 778 |
| HUME | | | | | | X | | | | X | X | | | TNC | 3 | 781-782 |
| HUYUGUAN | | | | | | X | | | | X | | | | TNC | 3 | 808 |
| INAHAME | | | X | | | | | | | X | | | | TNC | 3 | 854 |
| INOCOPLO | | | | | | X | | X | | | X | | | TNC | 3 | 856 |
| ISUCHO | | | X | | | | | | | X | | | | TNC | 3 | 879 |
| JAGAVANS | | | | | | | X | | X | | | | | MHK | 3 | 902 |
| JANAQUE | | | ? | | | | | | | X | | | | TNC | 3 | 909 |

**Table 1.** *(Continued)*

| NAME | REGION 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | CENTURY 16 | 17 | 18 | 19 | 20 | AUTHOR | VOL | PAGES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUMANO | X | X | X | X | | | | | X | X | X | | | NPH | 3 | 1016-1018 |
| JUNCAL | | | | | | X | | | | X | | | | TNC | 3 | 1018 |
| JUNCED * | | | | | | | | | | | | | | TNC | 3 | 1018-1019 |
| KABAYE | | | | | | | X | | | X | | | | TNC | 3 | 1025 |
| KANNEHOUAN | | | | | | | X | | | X | | | | TNC | 3 | 1029 |
| KARANKAWA | | | | | | X | X | | X | X | X | X | | CAL | 3 | 1031-1033 |
| KEREMEN | | | | | | | X | | | X | | | | MHK | 3 | 1075 |
| KIABAHA | | | | | | | X | | | X | | | | TNC | 3 | 1084 |
| KICHAI | | | X | X | | | | | | | X | | | anon | 3 | 1086 |
| KICKAPOO | | | | X | | X | | X | | | | X | X | MCN | 3 | 1087-1089 |
| KIOWA APACHE | X | | | | | | | | | | | X | | JGM &HAA | 3 | 1120-1121 |
| KIOWA | X | | | | | | | | | | | X | X | MPM | 3 | 1121-1124 |
| KIRONONA | | | | | | | X | | | X | | | | TNC | 3 | 1131 |
| KITCHAI | | | | X | | | | | | | X | | | MHK | 3 | 1133 |
| KONKONE | | | | | | | X | | | X | | | | TNC | 3 | 1155 |
| KOUAN | | | | | | | X | | | X | | | | TNC | 3 | 1159 |
| KOUYAM | | | | | | | X | | | X | | | | TNC | 3 | 1159 |
| LACANE | | | | X | | | | | X | | | | | TNC | 3 | 1185 |
| LAS MULAS * | | | | | | | | | | | | | | TNC | 4 | 93 |
| LIMITA | X | | | | | | | | | | X | | | HAA | 4 | 200 |
| LLANEROS | X | | | | | | | | | | ? | | | MHK | 4 | 248 |
| LOS SURDOS | | | X | | | | | | | X | | | | TNC | 4 | 297 |
| LUGPLAPIAGULAM | | | | | | X | | | | | X | | | TNC | 4 | 333 |
| MACOCOMA | | | | | | X | | | | | X | | | TNC | 4 | 446 |
| MAHUAME | | | | | | X | | | | X | | | | TNC | 4 | 467-468 |
| MALAGUITA | | | | | | X | | | | | X | | | TNC | 4 | 471-472 |
| MALIACONE | | | | | | X | | | X | | | | | TNC | 4 | 473 |
| MAMUYA | | | | | X | | | | | X | | | | TNC | 4 | 481 |
| MANA | | | ? | | | | | | | X | | | | TNC | 4 | 481 |
| MANAM | | | | | | X | | | | X | | | | TNC | 4 | 481-482 |
| MANICO | | | | | | X | | | | X | X | | | TNC | 4 | 484-485 |
| MANO | | | ? | | | | | | | X | | | | TNC | 4 | 486 |
| MANOS COLORADAS | | | | | | X | | | | X | X | | | TNC | 4 | 486-487 |
| MANOS DE PERRO | | | | | | X | | | | | X | | | TNC | 4 | 487 |
| MANOS PRIETAS * | | | | | | | | | | | | | | TNC | 4 | 487 |
| MANOS SORDOS | | | | | ? | | | | | X | | | | TNC | 4 | 487 |
| MANSO | | | | | X | | | | X | | | | | TNC | 4 | 489-490 |
| MAPOCH | | | | | X | | | | | X | | | | TNC | 4 | 496 |
| MARIAME | | | | | | | X | | X | | | | | TNC | 4 | 506 |
| MASACUAJULAM | | | | | | X | | | | | X | | | TNC | 4 | 543 |
| MATUCAR | | | | | | X | | | | | X | | | TNC | 4 | 570 |
| MAYAPEM | | | | | | X | | | | | X | | | TNC | 4 | 583 |
| MAYEYE | | | X | | | X | X | | | | X | | | TNC | 4 | 586 |
| MELENUDO | | | X | | | | | | | | X | | | TNC | 4 | 608 |
| MENANQUEN | | | | | | X | | | | X | X | | | TNC | 4 | 612-613 |
| MENDICA | | | | | | X | X | | X | | | | | MHK | 4 | 618 |
| MEPAYAYA | | | | | | X | | | | X | | | | MHK | 4 | 627 |
| MERACOUMAN | | | | | | | X | | | X | | | | TNC | 4 | 627 |
| MERHUAN | | | | | | X | | | | | X | | | TNC | 4 | 633 |
| MESCAL | | | X | | | X | | | | X | X | | | TNC | 4 | 640 |
| MESQUITE | | | X | | X | X | | | | X | X | | | TNC | 4 | 642 |
| MIEMBROS LARGOS | | | | | X | | | | | X | | | | TNC | 4 | 715 |
| MORBANA | | | | | | X | | | | X | | | | MHK | 4 | 831 |
| MUELE | | | X | | | | | | | X | | | | TNC | 4 | 877 |
| MULATO | | | | | | X | | X | | | X | | | TNC | 4 | 879 |
| MURUAM | | | | | | X | | | | | X | | | TNC | 4 | 897-898 |
| NAAMAN | | | | | | | X | | | X | | | | TNC | 4 | 921 |
| NAANSI | | | | X | | | | | | X | | | | TNC | 4 | 921 |
| NABEDACHE | | | | X | | | | | | X | | | | MHK | 4 | 921 |
| NABEYXA | | | | X | | | | | | X | | | | TNC | 4 | 921-922 |
| NABIRI | | | | X | | | | | | X | | | | TNC | 4 | 922 |
| NACACHAU | | | | X | | | | | | X | X | | | TNC | 4 | 922 |
| NACANICHE | | | | X | | | | | | X | X | | | TNC | 4 | 922 |
| NACAU | | | | X | | | | | | X | X | | | TNC | 4 | 922 |
| NACISI | | | | X | | | | | | | X | | | MHK | 4 | 922 |
| NACOGDOCHE | | | | X | | | | | | X | X | | | TNC | 4 | 923 |
| NACONO | | | | X | | | | | | X | X | | | TNC | 4 | 930-931 |
| NADAMIN | | | | X | | | | | | X | | | | TNC | 4 | 931 |
| NAKANAWAN | | | | X | | | | | | | X | X | | TNC | 4 | 932 |
| NANATSOHO | | | | X | | | | | | X | X | | | TNC | 4 | 933 |
| NASAYAHA | | | | X | | | | | | X | | | | TNC | 4 | 937 |
| NATCHITOCH | | | | X | | | | | | X | | X | | TNC | 4 | 940 |
| NECHAUI | | | | X | | | | | | X | X | | | TNC | 4 | 965 |
| NECHE | | | | X | | | | | | X | X | | | TNC | 4 | 965 |
| NECPACHA | | | | | | X | | | | | X | | | TNC | 4 | 968 |
| NIGCO | | | | | | X | | | | | X | | | TNC | 4 | 1013 |
| NONAPHO | | | | | | X | | | | | X | | | MHK | 4 | 1030 |
| NONDACAU | | | | ? | | | | | | | X | | | MHK | 4 | 1030 |
| NOVRACH | | | ? | | | | | | | X | | | | TNC | 4 | 1053 |
| NUEZ | | | X | | | | | | | X | | | | TNC | 4 | 1075 |
| OBODEUS | | | | X | | | | | | | | X | | MHK | 4 | 1098 |

**Table 1.** *(Continued)*

| | REGION | | | | | | | | CENTURY | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 16 | 17 | 18 | 19 | 20 | AUTHOR | VOL | PAGES |
| OBORI | | | ? | | | | | | | X | | | | TNC | 4 | 1098 |
| OCANA | | | | | | X | | | | X | X | | | TNC | 4 | 1100 |
| ODOESMADE | | | | | | X | | | | X | | | | TNC | 4 | 1112-1113 |
| OINTEMARHEN | | | | | | | X | | | X | | | | MHK | 4 | 1129 |
| OMENAOSSE | | | | | | | X | | | X | | | | MHK | 4 | 1151 |
| OPOSME | | | | | X | | | | | X | X | | | TNC | 4 | 1158 |
| ORANCHO | | | ? | | | | | | | X | | | | TNC | 4 | 1160 |
| ORCAMPION * | | | | | | | | | | | | | | TNC | 4 | 1165 |
| ORCAN | | | | | | | X | | | X | | | | TNC | 4 | 1165 |
| ORCOQUIZA | | | | | | | X | | | | X | | | RBB | 4 | 1165 |
| OREJONE | | | | | | X | | | | | X | | | TNC | 4 | 1167-1168 |
| OROROSO | | | ? | | | | | | | X | | | | TNC | 4 | 1169 |
| OSATAYOGLIGLA | | | | | X | | | | | | X | | | TNC | 4 | 1175 |
| PAACHIQUI | | | | | | X | | | | X | | | | TNC | 5 | 1 |
| PAAC | | | | | | X | | | | X | X | | | TNC | 5 | 1-2 |
| PACHALAQUE | | | | | | ? | | | | | X | | | TNC | 5 | 2 |
| PACHAL | | | | | | X | | | | X | X | | | TNC | 5 | 2 |
| PACHALOCO | | | | | | X | | | | | X | | | TNC | 5 | 2 |
| PACHAQUE | | | | | | X | | | | X | | | | TNC | 5 | 2 |
| PACPUL | | | | | | X | | | | X | | | | TNC | 5 | 4 |
| PACUACHE | | | | | | X | | | | X | X | | | TNC | 5 | 4-5 |
| PAGUAN | | | | | X | | | | | X | X | | | TNC | 5 | 11-12 |
| PAIABUNA | | | X | | | | | | | X | | | | TNC | 5 | 12 |
| PAJALAT | | | | | | X | | | | | X | | | TNC | 5 | 18 |
| PAJARITO | | | | | X | X | | | | X | X | | | TNC | 5 | 18-19 |
| PAJASEQUE | | | | | | X | | | | | X | | | TNC | 5 | 19 |
| PAKANA MUSKOGEE | | | | X | | | | X | | | | X | | HNM | 5 | 19 |
| PALAQUESSON | | | | X | | | | | | X | | | | TNC | 5 | 21 |
| PAMAYA | | | | | | X | | | | X | X | | | TNC | 5 | 32-33 |
| PAMOQUE | | | | | | X | | | | | X | | | TNC | 5 | 33 |
| PAMPOPA | | | | | | X | | | | | X | | | TNC | 5 | 34 |
| PANASIU | | | | | | X | | | | X | | | | TNC | 5 | 35 |
| PANEQUO | | | | | | | X | | | X | | | | TNC | 5 | 35 |
| PANTAPARE | | | | | | X | | | | | X | | | TNC | 5 | 48 |
| PAQUITE | | | | X | | | | | | X | | | | MHK | 5 | 50 |
| PAPANAC | | | | | | X | | | | X | X | | | TNC | 5 | 51 |
| PARAMPAMATUJU | | | | | | X | | | | | X | | | TNC | 5 | 52 |
| PARANTONE | | | | | | X | | | | | X | | | TNC | 5 | 52 |
| PARCHAQUE | | | | | | X | | | | X | | | | TNC | 5 | 52 |
| PASCAGOULA | | | | X | | | | X | | | | X | | TNC | 5 | 79 |
| PASNACAN | | | | | | X | | | | | X | | | TNC | 5 | 81-82 |
| PASQUAL * | | | | | | | | | | | | | | TNC | 5 | 83 |
| PASTALOCA | | | | | | X | | | | X | X | | | TNC | 5 | 83-84 |
| PASTATE | | | X | X | | | | | | | X | | | TNC | 5 | 84 |
| PASTIA | | | | | | X | | | | | X | | | TNC | 5 | 84 |
| PATACAL | | | | | | X | | | | X | X | | | TNC | 5 | 86-87 |
| PATAGUO | | | | | | X | | | | X | X | | | TNC | 5 | 87 |
| PATALCA | | | | | | X | | | | X | X | | | TNC | 5 | 87 |
| PATAQUILLA * | | | | | | | | | | | | | | TNC | 5 | 87 |
| PATARABUEY | | | | | X | | | | | X | | | | TNC | 5 | 87 |
| PATIRI | | | | X | | | X | | | | X | | | TNC | 5 | 88 |
| PATUMACA | | | | | | X | | | | | X | | | TNC | 5 | 96 |
| PATZAU | | | | | | X | | | | X | X | | | TNC | 5 | 96 |
| PAUSANE | | | | | | X | | | | | X | | | TNC | 5 | 98 |
| PAUSAY | | | | | | X | | | | X | X | | | TNC | 5 | 98 |
| PAWNEE | | | | X | | | | X | | | X | | | JDC | 5 | 99-100 |
| PAYAYA | | | | | | X | | | | X | X | | | TNC | 5 | 101 |
| PAYUGUAN | | | | | | X | | | | X | X | | | TNC | 5 | 103-104 |
| PEANA | | | | | | X | | | | | X | | | TNC | 5 | 108 |
| PELONE * | | | | | | | | | | | | | | TNC | 5 | 132 |
| PENOY | | | | X | | | | | | X | | | | TNC | 5 | 144 |
| PENUNDE | | | ? | | | | | | | X | | | | MHK | 5 | 145 |
| PERPACUG | | | | | | X | | | | | ? | | | TNC | 5 | 156 |
| PERPEPUG | | | | | | X | | | | | X | | | TNC | 5 | 156 |
| PESCADO | | | | | X | | | | | X | X | | | TNC | 5 | 165 |
| PETAO | | | | | | | X | | | X | | | | TNC | 5 | 165-166 |
| PETARO | | | | | | | X | | | X | | | | TNC | 5 | 166 |
| PETICADO | | | | X | | | | | | | X | | | MHK | 5 | 168 |
| PETZARE | | | | | | | X | | | X | | | | TNC | 5 | 174 |
| PEUPUETEM | | | | | | X | | | | | X | | | TNC | 5 | 174 |
| PIEDRAS BLANCAS | | | | | | X | | | | X | | | | TNC | 5 | 193 |
| PIGUIQUE | | | | | | X | | | | | X | | | TNC | 5 | 199 |
| PINANACA | | | | | | X | | | | X | X | | | TNC | 5 | 206 |
| PINIQUU | | | | | | X | | | | X | X | | | TNC | 5 | 213 |
| PINOLE | | | | | X | | | | | X | | | | TNC | 5 | 215 |
| PINTO | | | | | X | | | | | | X | X | X | TNC | 5 | 217 |
| PIOU | | | | X | | | | | | X | | | | TNC | 5 | 218 |
| PIRO | | X | | | | | | | | X | | | | MHK | 5 | 218 |
| PITAHAY | | | | | | X | | | | X | | | | TNC | 5 | 219 |
| PITA | | | | | | X | | | | | X | | | TNC | 5 | 219 |
| PITALAC | | | | | | X | | | | | X | | | TNC | 5 | 219-220 |

**Table 1.** *(Continued)*

| | REGION | | | | | | | | CENTURY | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 16 | 17 | 18 | 19 | 20 | AUTHOR | VOL | PAGES |
| POJUE | | | X | | | | | | | X | | | | TNC | 5 | 253 |
| POLACME | | | | | X | | | | | | X | | | TNC | 5 | 254 |
| POMULUM | | | | | | X | | | | X | X | | | TNC | 5 | 262-263 |
| POSALME | | | | | X | | | | | X | X | | | TNC | 5 | 286 |
| POSTITO | | | | | | X | | | | | X | | | TNC | 5 | 291 |
| POTAWATOMI | | | X | X | | | | X | | | | X | | WESD | 5 | 295 |
| PRIETO | | | | | | X | | | | | X | | | TNC | 5 | 337 |
| PSAUPSAUO | | | | | | X | | | | | X | | | MHK | 5 | 365 |
| PUCHA | | | X | | | | | | | X | | | | TNC | 5 | 369 |
| PUCHAM | | | | | | X | | | | X | | | | TNC | 5 | 369-370 |
| PUGUAHIANE | | | X | | | | | | | X | | | | TNC | 5 | 370 |
| PULACUAM | | | | | | X | | | | X | | | | TNC | 5 | 370-371 |
| PULCHA | | | X | | | | | | | X | | | | TNC | 5 | 371 |
| PULIQUE | | | | | | X | | | | | X | | | TNC | 5 | 371 |
| QUAHADI | X | | X | | | | | | | | | X | | MHK | 5 | 377 |
| QUANATAGUO | | | | | | ? | | | | | X | | | TNC | 5 | 379 |
| QUAPAW | | | | X | | | | X | | | | X | | WESD | 5 | 380 |
| QUARAI | | X | | | | | | X | | X | | | | MHK | 5 | 381 |
| QUARA | | | | | | | X | | | X | | | | TNC | 5 | 381 |
| QUEMS | | | | | | X | | | | X | X | | | TNC | 5 | 385 |
| QUEPANO | | | | | | X | | | | X | X | | | TNC | 5 | 385 |
| QUEVENE | | | | | | X | | | X | | | | | TNC | 5 | 385 |
| QUIBAGA | | | | X | | | | | | X | | | | TNC | 5 | 385 |
| QUICUCHABE | | | X | | | | | | | X | | | | TNC | 5 | 385-386 |
| QUIDE | | | X | | | | | | | X | | | | anon | 5 | 386 |
| QUIGUAYA | | | | X | | | | | | X | | | | TNC | 5 | 386 |
| QUINET | | | | | | | X | | | X | | | | TNC | 5 | 390 |
| QUIOBORIQUE | | | X | | | | | | | X | | | | anon | 5 | 394 |
| QUIOUAHA | | | | X | | | | | | X | | | | TNC | 5 | 394 |
| QUISABA | | | X | | | | | | | X | | | | TNC | 5 | 394 |
| QUITACA | | | X | | | | | | | X | | | | TNC | 5 | 394 |
| QUITOLE | | | | | | X | | | X | | | | | MHK | 5 | 397 |
| QUIUTCANUAHA | | | | X | | | | | | X | | | | TNC | 5 | 397 |
| QUIVI | | | | | | | | | | | X | | | MHK | 5 | 397 |
| RIO COLORADO | X | | | | | | | | | X | | | | TNC | 5 | 581 |
| SACUACHE | | | | | | X | | | | X | | | | TNC | 5 | 750 |
| SADAMMO | | | | X | | | | | | X | X | | | TNC | 5 | 751 |
| SAESSE | | | | | | X | | | | X | X | | | TNC | 5 | 753-754 |
| SALAPAQUE | | | | | | X | | | | | X | | | TNC | 5 | 773-774 |
| SALINA | | | | | | X | | | | | X | | | MHK | 5 | 777 |
| SALINERO | | X | X | X | | | | | | X | X | | | TNC | 5 | 778-779 |
| SAMA | | | | | | X | | | | | X | | | TNC | 5 | 784 |
| SAMAMPAC | | | | | | X | | | | X | | | | TNC | 5 | 784 |
| SAMPANAL | | | | | | X | | | | X | | | | TNC | 5 | 787-788 |
| SANA | | | X | | | X | | | | X | X | | | TNC | 5 | 792 |
| SANDI | | | | | | | | | | | X | | | MHK | 5 | 834 |
| SAN FRANCISCO * | | | | | | | | | | | | | | TNC | 5 | 846 |
| SANIPAO | | | | | | X | | | | | X | | | TNC | 5 | 854 |
| SARACUAM | | | | | | ? | | | | | X | | | TNC | 5 | 894 |
| SASSORY | | | | X | | | | | | X | | | | TNC | 5 | 898 |
| SATAPAYOGLIGLA | | | | | X | | | | | X | X | | | TNC | 5 | 900 |
| SATATU | | | | | X | | | | | X | | | | TNC | 5 | 900 |
| SECMOCO | | | | | | X | | | | | X | | | TNC | 5 | 959 |
| SEGUJULAPEM | | | | | | X | | | | | X | | | TNC | 5 | 967 |
| SEMINOLE | | | | X | | | | X | | | | X | | JDC | 5 | 972-973 |
| SEMONAN | | | | | | X | | | | X | | | | TNC | 5 | 973-974 |
| SENCASE | | | | | | X | | | | | X | | | TNC | 5 | 974 |
| SEPINPACAM | | | | | | X | | | | | X | | | TNC | 5 | 976 |
| SEPUNCO | | | | | | X | | | | | X | | | TNC | 5 | 976 |
| SERECOUTCHA | | | | | | | X | | | X | | | | TNC | 5 | 976-977 |
| SHAWNEE | | | | X | | | | X | | | | X | | CAL | 5 | 1003 |
| SIACUCHA | | | X | | | | | | | X | | | | TNC | 5 | 1038 |
| SIAGUAN | | | | | | X | | | | X | X | | | TNC | 5 | 1038-1039 |
| SIANSI | | | | | | X | | | | | X | | | TNC | 5 | 1039 |
| SICO | | | | X | | | | | | X | | | | TNC | 5 | 1041 |
| SIGUIPAN | | | | | | X | | | | | X | | | TNC | 5 | 1046 |
| SIJAME | | | | | | X | | | | X | X | | | TNC | 5 | 1046 |
| SINICU | | | | | | X | | | | | X | | | TNC | 5 | 1061 |
| SINIPLE | | | | | X | | | | | X | | | | TNC | 5 | 1061 |
| SINOREJA | | | | | X | | | | | X | | | | TNC | 5 | 1062 |
| SIQUIPIL | | | | | | X | | | | | X | | | TNC | 5 | 1063 |
| SIUPAM | | | | | | X | X | | | X | X | | | TNC | 5 | 1068-1069 |
| SOUANETTO | | | | X | | | | | | | X | | | TNC | 5 | 1150 |
| SPICHEHAT | | | | | | | X | | | X | | | | MHK | 6 | 27 |
| SUAHUACHE | | | | | | X | | | | X | | | | TNC | 6 | 137 |
| SUAJO | | | X | | | | | | | X | | | | TNC | 6 | 137 |
| SULUJAM | | | | | | X | | | | | X | | | TNC | 6 | 147 |
| SUMA | | X | | | | | | | | X | X | | | TNC | 6 | 147 |
| SUMI | | | | | | X | | | | | X | | | TNC | 6 | 147 |
| SUNIGOGLIGLA | | | | | X | | | | | X | X | | | TNC | 6 | 151 |
| SUSOLA | | | | | | X | | | X | | | | | MHK | 6 | 156 |

**Table 1.** *(Continued)*

| NAME | REGION 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | CENTURY 16 | 17 | 18 | 19 | 20 | AUTHOR | VOL | PAGES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TABIRA | | X | | | | | | X | | X | | | | WESD | 6 | 190 |
| TACAME | | | | | | X | | | | | X | | | TNC | 6 | 190 |
| TADIVA | | | | X | | | | | | X | | | | TNC | 6 | 191 |
| TAENSA | | | | | | | | X | | | X | | | TNC | 6 | 192 |
| TAHIANNIHOUQ | | | | X | | | | | | X | | | | TNC | 6 | 193 |
| TAHOCULLAKE | | | | X | | | | X | | | | X | | TNC | 6 | 193 |
| TAHUUNDE | | | | | ? | | | | | | | | | MHK | 6 | 194 |
| TAIMAMAR | | | | | X | X | | | | X | | | | TNC | 6 | 194 |
| TAJIQUE | | X | | | | | | X | | X | | | | WESD | 6 | 195 |
| TAMCAN | | | | | | X | | | | | X | | | TNC | 6 | 198 |
| TAMIQUE | | | | | | X | | | | | X | | | TNC | 6 | 195 |
| TANIMA | | | X | | | | | | | | | X | | TNC | 6 | 201 |
| TANOAN | | X | | | | | | X | | X | | | | MHK | 6 | 202 |
| TANPACHOA | | X | | | | | | | X | | | | | TNC | 6 | 202-203 |
| TANPACUAZE | | | | | | X | | | | | X | X | | TNC | 6 | 203 |
| TAOVAYA | | | X | | | | | X | | | X | | | EBJ | 6 | 203 |
| TAQUITATOME | | | | | X | | | | | X | X | | | TNC | 6 | 203 |
| TARACONE | | | | X | | | | | | | X | | | MHK | 6 | 203 |
| TARAHA | | | | X | | | | | | X | | | | TNC | 6 | 203 |
| TAWAKONI | | | X | X | | | | X | | | X | | | MHK | 6 | 213 |
| TAZTASAGONIE | | | | | | X | | | | | X | | | MHK | 6 | 226 |
| TCHANHIE | | | | X | | | | | | X | | | | TNC | 6 | 226 |
| TEANAME | | | | | | X | | | | X | X | | | TNC | 6 | 232 |
| TEANDA | | | X | | | | | | | X | | | | TNC | 6 | 232 |
| TECAHUISTE | | | | | | X | | | | X | | | | MHK | 6 | 233 |
| TECOLOTE | | | | | X | | | | | | X | | | TNC | 6 | 233 |
| TEHAUREMET | | | ? | | | | | | | X | | | | WESD | 6 | 235 |
| TEJAS * | | | | | | | | | | | | | | anon | 6 | 242 |
| TEJON | | | | | | X | | | | | X | | | TNC | 6 | 242-243 |
| TELAMENE | | | ? | | | | | | | X | | | | anon | 6 | 243 |
| TENAWA | | | X | | | | | | | | | X | | TNC | 6 | 252 |
| TENU | | | ? | | | ? | | | | | X | | | TNC | 6 | 256 |
| TEPACHUACHE | | | | | | X | | | | X | | | | MHK | 6 | 256 |
| TEPELGUAN | | | X | | | | | | X | | | | | TNC | 6 | 256-257 |
| TEPEMACA | | | | | | X | | | | | X | | | TNC | 6 | 257 |
| TEROCODAME | | | | | | X | | | | X | | | | TNC | 6 | 258 |
| TETECORE | | | | | | X | | | | | X | | | TNC | 6 | 268 |
| TET | | | | | | X | | | | | X | | | TNC | 6 | 268 |
| TETZINO | | | | | | X | | | | | X | | | TNC | 6 | 268 |
| TEYA | X | | | | | | | | X | | | | | HAA | 6 | 454 |
| THECAMON | | | | | | | X | | | X | | | | TNC | 6 | 457-458 |
| TIGUA | | X | | | | | | X | | X | X | X | X | BW | 6 | 495-496 |
| TILIJAE | | | | | | X | | | | X | X | | | TNC | 6 | 497-498 |
| TILPACOPAL | | | | | | ? | | | | | X | | | TNC | 6 | 499 |
| TINAPIHUAYA | | | | | | ? | | | | | X | | | TNC | 6 | 502 |
| TINIBA | | | | X | | | | | | X | | | | TNC | 6 | 502-503 |
| TIOPANE | | | | | | X | | | | | X | | | TNC | 6 | 505 |
| TIOPINE | | | | | | X | | | | | X | | | TNC | 6 | 505 |
| TISHIM | | | ? | | | | | | | | X | | | TNC | 6 | 506 |
| TIXEMU | | | ? | | | | | | | X | | | | TNC | 6 | 509-510 |
| TLACOPSEL | | | | | | | X | | | | X | | | TNC | 6 | 510 |
| TLAXCALAN | | | | | | | | X | X | X | | | | TNC | 6 | 510 |
| TOAPA and TOAPARI | | | ? | | | | | | | X | | | | TNC | 6 | 510 |
| TOBO | | | | X | | | | | | X | | | | TNC | 6 | 512 |
| TOBOSO | | | | | | X | | | | X | X | X | | TNC | 6 | 512-513 |
| TOHAHA | | | X | X | | X | X | | | | X | | | TNC | 6 | 516-517 |
| TOHO | | | X | X | | X | X | | | X | | | | TNC | 6 | 517 |
| TOHOOKATOKIE | | | | | | | | X | | | | X | | MHK | 6 | 517 |
| TOJUMA | | | X | | | | | | | X | | | | TNC | 6 | 517 |
| TONKAWA | | | X | | | | | | | X | X | X | | JDC | 6 | 525-526 |
| TOPACOLME | | | | | X | | | | | X | X | | | TNC | 6 | 529 |
| TOP | | | X | | | | | | | | X | | | TNC | 6 | 529 |
| TOREME | | X | X | | | | | | | X | | | | TNC | 6 | 530 |
| TORTUGA | | | | | | X | | | | | X | | | TNC | 6 | 534 |
| TOV | | | | | | X | | | | | X | | | TNC | 6 | 537 |
| TOYAL | | | | | | | X | | | | X | | | TNC | 6 | 541-542 |
| TREMENTINA | X | | | | | | | | | X | | | | HAA | 6 | 560 |
| TSEPEHOEN | | | | | | | X | | | X | | | | TNC | 6 | 581 |
| TSERA | | | | | | | X | | | X | | | | TNC | 6 | 581 |
| TUCARA | | | | | | X | | | | | X | | | MHK | 6 | 582 |
| TUCUBANTE | | | | | | X | | | | | X | | | TNC | 6 | 584 |
| TUEIENZUM | | | X | X | | | | | | | X | | | TNC | 6 | 584 |
| TUETINI | | | | | X | | | | | | | | | MHK | 6 | 584 |
| TUGUMLEPEM | | | | | | X | | | | | X | | | TNC | 6 | 584 |
| TUMPATAGUO | | | | | ? | | | | | X | | | | MHK | 6 | 588 |
| TUNICA | | | | X | | | X | X | | | X | X | | TNC | 6 | 588-589 |
| TUP | | | X | | | X | | | | | X | | | TNC | 6 | 589 |
| TUSANE | | | | | | X | | | | | X | | | TNC | 6 | 599-600 |
| TUSOLIVI | | | X | | | | | | | | X | | | TNC | 6 | 600 |
| TUSONID | | | | | | X | | | | | X | | | TNC | 6 | 600 |
| UNOJITA | | | | | | X | | | | X | | | | MHK | 6 | 662 |

**Table 1.** *(Continued)*

| | REGION | | | | | | | | CENTURY | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAME | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 16 | 17 | 18 | 19 | 20 | AUTHOR | VOL | PAGES |
| UNPUNCLIEGUT | | | | | | X | | | | | X | | | TNC | 6 | 662 |
| URACHA | | | | | | X | | | | | X | | | TNC | 6 | 668 |
| USCAPEM | | | | | | X | | | | | X | | | TNC | 6 | 681 |
| UTACA | | | | | X | | | | | X | | | | TNC | 6 | 682 |
| VANCA | | | | | | X | | | | X | | | | TNC | 6 | 697 |
| VAQUERO | X | | | | | | | | X | X | | | | TNC | 6 | 710 |
| VENADO | | | | | | X | | | | | X | | | TNC | 6 | 721 |
| VENDE FLECHAS | | | | | | X | | | | | X | | | TNC | 6 | 721 |
| VIAYAN | | | | | | X | | | | | X | | | TNC | 6 | 733 |
| VIDIX | | | | X | | | | | | X | | | | TNC | 6 | 744-745 |
| VINTA | | | | X | | | | | | X | | | | TNC | 6 | 759 |
| WICHITA | | | X | | | | | | | | X | X | | EHE | 6 | 959 |
| XANNA | | | | X | | | | | | X | | | | TNC | 6 | 1102-1103 |
| XARAME | | | | | | X | | | | X | X | | | TNC | 6 | 1103 |
| XERIPAM | | | | | | X | | | | | X | | | TNC | 6 | 1103 |
| YAKWAL * | | | | | | | | | | | | | | TNC | 6 | 1107-1108 |
| YAMPARIKA | | | | | | | | X | | | X | X | | HAA | 6 | 1108 |
| YATASI | | | | X | | | | | | | | | | WESD | 6 | 1112 |
| YBDACAX | | | | | | X | | | | | X | | | TNC | 6 | 1114 |
| YEME | | | | | | X | | | | | | X | | TNC | 6 | 1119 |
| YGUACE | | | | | | ? | | | X | | | | | MHK | 6 | 1120 |
| YLAME | | X | X | | | | | | | X | | | | TNC | 6 | 1120 |
| YMAN | | | | | | X | | | | | X | | | MHK | 6 | 1120 |
| YMIC | | | | | | X | | | | | | X | | TNC | 6 | 1120 |
| YOJUANE | | | X | | | | | | | | X | | | TNC | 6 | 1123 |
| YORICA | | | | | | X | | | | X | X | | | TNC | 6 | 1123-1124 |
| YOWANI | | | | | | | | | | | | | | MHK | 6 | 1133 |
| YOYEHI | | | X | | | | | | | X | | | | TNC | 6 | 1133 |
| YPRANDE | | | | | | X | | | | | X | | | MHK | 6 | 1133 |
| YSBUPUE | | | | | | X | | | | | X | | | TNC | 6 | 1134 |
| YSCANI | | | X | | | | | | | | X | | | MHK | 6 | 1134 |
| YUE | | | | | | X | | | | | X | | | TNC | 6 | 1135 |
| YUTA | | | | | | X | | | | | X | | | MHK | 6 | 1135 |
| YXANDI | | | X | | | | | | | | X | | | TNC | 6 | 1135 |
| ZACPO | | | | | | X | | | | | X | | | TNC | 6 | 1138 |
| ZAUANITO | | | | X | | | | | | X | | | | TNC | 6 | 1146 |
| ZORQUAN | | | | | | X | | | | | X | | | TNC | 6 | 1155 |

erable uncertainty in some of the attributions even at this coarse resolution. It is advisable for anyone using this guide to consult groups in those areas adjacent to their area of interest. An eighth geographic category identifies groups who entered Texas from elsewhere as a direct result of displacement by European settlement. Also, no finer interval of time than a specific century is tabulated, although most of the documents are dated and one can find more specific chronological information by consulting the *New Handbook of Texas* entries.

No effort has been made to augment information provided in each of the Handbook entries. For example, in instances where a group's location is given only in reference to some other named group—group X lived inland from group Y—I did not check the group Y entry for locational information, and thus either left the location blank in the table or indicated an uncertain location.

Almost all of the entries have bibliographic citations, which is one of the more valuable kinds of information provided by *The New Handbook of Texas*. The completeness of bibliographic citation and the amount of research upon which each entry was based vary considerably by contributor. Campbell, for example, researched a large number of sources and considered synonymy, alternate spellings, and other issues more systematically than did some of the other contributors. Thus, the contributor is identified by initials for each entry. These are: HAA, H. Allen Anderson; MB, Megan Biesele; RBB, Robert Bruce Blake; DC, Dorothy Couser; JDC, Jeffrey D. Carlisle; TNC, Thomas N. Campbell; WESD, W. E. S. Dickerson; EHE, Earl H. Elam; TE-G, Trace Etienne-Gray; NPH, Nancy P. Hickerson; EBJ, Edward B. Jelks; MHK, Margery H. Krieger; CAL, Carol A. Lipscomb; ML, Monte Lewis; HNM, Howard N. Martin; JGM, J. Gilbert McAllister; MPM, Mildred P. Mayhall; RMM, Russell M. Magnaghi; MCN, M. Christopher Nunley; KSO, Kathryn Stoner O'Connor; TKP, Timothy K. Perttula; and BW, Bill Wright; all unsigned entries are identified as "anon" for anonymous.

A few names that appear in the documents or in secondary sources based on documents are invalid, erroneous, possibly mythical, or are Spanish descriptive terms applied to multiple groups. For those "names" for which an actual group seems not to exist, an asterisk (*) follows the entry in the table and no location or time period is provided.

## ACKNOWLEDGMENTS

Marcy Krupa assisted in creating the alphabetical list of names upon which Table 1 was built.

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# Artifacts, Archeology, and Cabeza de Vaca in Southern Texas and Northeastern Mexico

*Thomas R. Hester*


## ABSTRACT

The route followed by Cabeza de Vaca across southern Texas and northern Mexico in 1534 has been the subject of much debate among historians, anthropologists, and archeologists. Archeological data from the South Texas and northeast Mexico area are offered as support for a "southern route" initially proposed by Alex D. Krieger and later by T. N. Campbell.


## INTRODUCTION

This article reviews, from an archeological perspective, the route traveled by Alvar Nunez Cabeza de Vaca in 1534 across southern Texas and into northeastern Mexico. Of all the various routes published for Cabeza de Vaca over the past century, none make any sense (e.g., proposing a trek that went into East Texas or headed out across the Edwards Plateau; cf. Pupo-Walker 1993:Figure 1) in terms of the archeological and ethnohistorical record, except those of Krieger (1955, 1961, n.d.) and Campbell and Campbell (1981). This route (see also Chipman 1987:143, 145; Olson et al. 1997; Howard 1997), hereafter referred to as the "southern route" (Figure 1), takes Cabeza de Vaca and his group from the upper and central Texas coast, through southern Texas, into northeastern Mexico, and perhaps back into western Texas (Figure 2).

Since the bulk of the archeological literature for the major part of the route, that running across southern Texas, has been generated in only the last four decades, earlier scholars could not have taken full advantage of the Cabeza de Vaca chronicles in considering the various alternatives for the route. Even today, we can push the "southern route" a bit further south than Krieger and Campbell and Campbell because of what we have learned archeologically in this region.

## CABEZA DE VACA AND COASTAL NATIVE GROUPS

Based on the recent archeological studies by Ricklis (1994) on Galveston Island, new insights can be added to the initial phase of Cabeza de Vaca's capture and subsequent movements among coastal peoples. The Narvaez expedition, of which Cabeza de Vaca was a member, was shipwrecked in 1528 on the upper Texas coast, at a location they described as the Isla del Malhado; this was probably Galveston Island or a nearby area. The descriptions of the peoples they encountered match closely the archeological remains found by Ricklis, although they are perhaps broadly representative of upper coastal cultural adaptations in the early 16th century. Cabeza de Vaca records the use of the bow and arrow, fish weirs or traps, and a heavy reliance both on fish and roots during fall and winter on the island, as well as the exchange of hawk bells and beads, by the Spanish, for food and water (Krieger n.d.:44ff) . Special mortuary treatment was reserved for children and for "medicine men" (who were cremated), and Ricklis found that most grave goods were lavished on adult males and children. One adult burial contained what Ricklis (1994:476) describes as a "rat-tooth bloodletting instrument," which he infers to be a "shaman's possession," albeit not with a cremation. This has a possible link to an account of Cabeza de Vaca's, at some

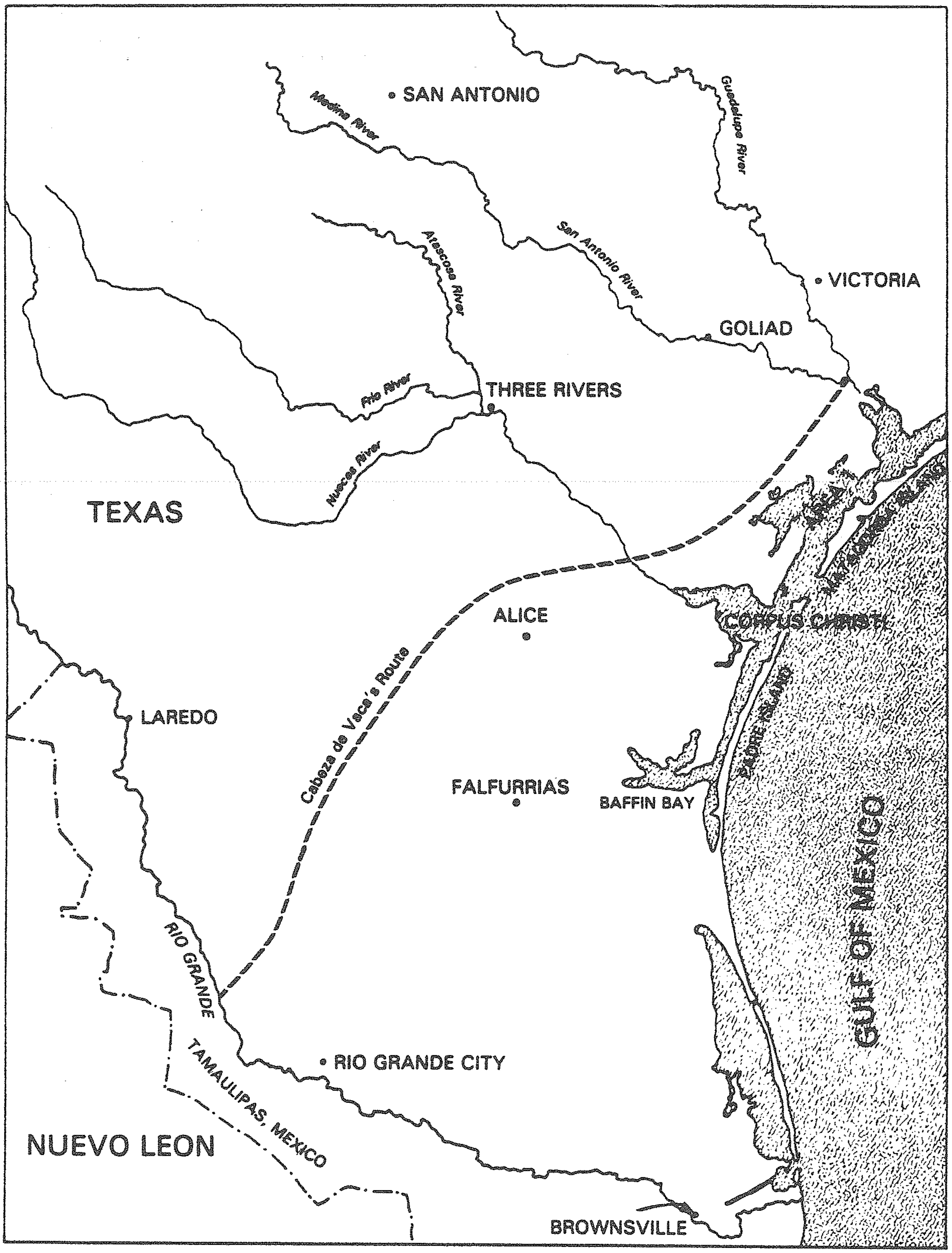


Figure 1. The Approximate Route of Cabeza de Vaca Through Southern Texas, adapted from Campbell and Campbell (1983: Figure 1). The interpretations in the present paper would push this route south of the town of Alice.

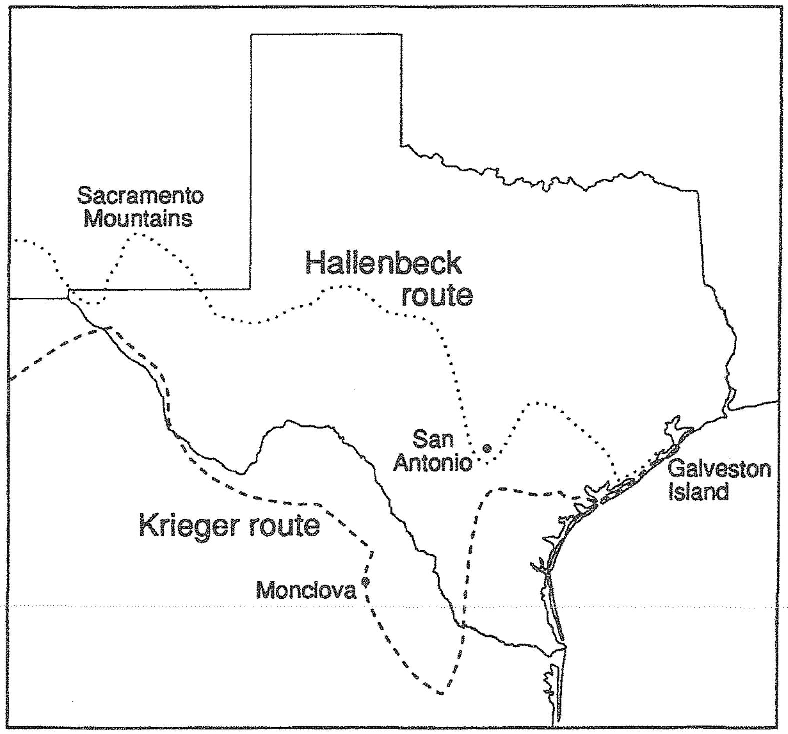


Figure 2. Interpretations of Cabeza de Vaca's Route. Courtesy of the Texas State Historical Association and Donald W. Olson.

Vaca recorded. There are tantalizing material culture details in Cabeza de Vaca's account of the island. For example, Covey (1961:55; see also Favata and Fernandez [1993:55]) notes that an "earthen pot" was one of the items (along with a domestic dog) stolen from a native hut on the island; a recent translation of Cabeza de Vaca's account by Maria Wade (The University of Texas at Austin, Department. of Anthropology) indicates that this "pot" was an olla.

Ricklis' (1994) well-researched study is highly recommended to those who are deeply interested in the earliest part of Cabeza de Vaca's saga in Texas, along and near the Texas coast. My emphasis (see Figures 1-2) will be on his travels across southern Texas and into northeastern Mexico.

distance from the coast, and I will return to it later in this article.

Ricklis' excavations at 41GV66 also produced examples of probable dwellings. For example, Feature 110 was a distinct semi-circular depression, with an arc-like series of postmolds on its south side. Ricklis (1994:6) suggests that the clusters of debris and postmolds found at the site would have represented the types of flimsy mat-covered houses noted by Cabeza de Vaca on the Isla del Malhado, used by the inhabitants in the fall and winter. Krieger (n.d.:47; see also Favata and Fernandez [1993:61]) notes that the Indians of Malhado spent three months on the nearby mainland, staying until the end of April, collecting oysters and "pitched their lodges on oyster heaps." Ricklis found no such dwelling-types in his fieldwork, though perhaps it is possible that portions of oyster-shell clusters that he partially exposed (e.g., Feature 106; see Ricklis [1994:69]) might be floors of small houses associated with the flimsy dwellings described for the island.

Whether these peoples were Karankawa, Akokisa, or some other group, Ricklis' work suggests that they were more complex in term of social organization and belief systems than Cabeza de

## CABEZA DE VACA AS A TRADER

It is during Cabeza de Vaca's presence among the coastal groups that we learn much about material culture, especially the kinds that survive archeologically, and this comes from his role as a trader. This began in 1530 when he lived among the "people of Charruco" in the coastal zone south of Galveston Island. Much has been written about Cabeza de Vaca as a trader (e.g., Corgan 1969; Wade 1996), but here I will focus specifically on the material goods that he exported and imported, and what that tells us archeologically.

Wade (1996 personal communication) in her personal translation of Cabeza de Vaca's account, indicates that the items he took with him from the coast were: pieces of "sea snails" (conch or other gastropods) and their "hearts" (here, he must be referring to the columella of the conch, widely prized as a raw material), and shells to cut a fruit-like bean with which they cure and make bailes and fiestas. This "bean" would not have survived archeologically, although the identity of this vegetal item would be important.

With these goods, Cabeza de Vaca traveled into the interior, apparently crossing territories without conflict. The latter is also of considerable interest, because the region was characterized by continuous inter-group warfare during this time, and most, if not all, groups apparently had well-demarcated territories (cf. Krieger n.d.:47, who notes that the trader [Cabeza de Vaca] could move freely, but not the Indians). Mariah Wade (1998; see Wade, this volume) notes a similar concern with territories among groups in southwest Texas in the 17th century.

It is probable that Cabeza de Vaca's activities were part of a trading system of great time depth in coastal and southern Texas. Indeed, there is ample archeological evidence, on which I have written several times, of pre-Hispanic trade involving these two regions (cf. Hester 1971a, 1971b, 1980, 1995).

Once in the interior, he traded his coastal goods for the following items, again based on Wade's recent translation: "skins," "red dirt with which they grease and paint their faces and hair" [hematite or red ocher], chert [pedernales] points of arrows, hard cane to make arrow shafts [flechas], glue, and "some tassels which they make of skin of deer and dye red."

Cabeza de Vaca's trading endeavors closely match the archeological record of southern Texas, perhaps even that of Central Texas and the lower Pecos. Covey's (1961) suggestions of his incursions going into East Texas and Oklahoma can be discounted. The Texas coast was without chippable stone (chert or "flint") and since Archaic times, there is ample evidence of South and Central Texas cherts being obtained by coastal peoples to make spear and arrow points. This may have even accelerated in Late Prehistoric times, roughly the era of Cabeza de Vaca, when bison hunting became important on the coastal prairies—and thus the need for more chert for arrow points, end scrapers, knives, and perforators (Hester and Parker 1970). Chert of variable quality is available on the lower Nueces and the lower Guadalupe rivers 15-50 miles upstream from the coast (Chandler 1984).

Red ochre or hematite appears in coastal burials (e.g., Hester 1969), as well as in those on the coastal/interior ecotone, such as the Archaic cemetery at Loma Sandia (Taylor and Highley 1995). Skins, arrow shafts, and tassels have left no archeological trace. I am not sure what "glue" the coastal peoples desired from the interior, perhaps sap from mesquite or similar trees which produce resins that make a good mastic; however, the coastal peoples had available, and had used since at least 600-800 B.C., asphaltum that washed up on the beaches, and which could be melted and used as an adhesive.

In the interior, marine shell is present at many sites (cf. Hester 1971a, 1971b, 1980; Black 1986; Highley 1986). Indeed, ornaments of marine shell imported from the Texas coast are found as early as 5800 years ago at the Bering Sink mortuary site in Kerr County (Bement 1994). Marine shell usually occurs as scattered specimens, especially conch shell fragments, conch columella (often made into either tools or disc-shaped beads), and fragments of ribbed cockle shell such as *Dinocardium robustum*. Here again, it is my distinct impression that the very late Late Prehistoric peoples had more of this material, as at the Hinojosa site near Alice (Black 1986) and site 41LK201 on the Frio River west of Three Rivers (Highley 1986). An alternative to trade would be interaction between coastal and interior groups. For instance, Ricklis (1996) has suggested contemporary co-habitation of a coastal margin site, 41RF21, and perhaps during such events, trade would have taken place. And, yet another alternative would have been the seasonal transhumance of coastal groups to the prickly pear fields in the interior, well documented by Cabeza de Vaca. However, given the time depth of such trade in the interior of South, Central, and lower Pecos Texas, I suspect that some other mechanism led to an intensification of exchange in the Late Prehistoric.

## CABEZA DE VACA'S JOURNEY THROUGH THE INTERIOR

Cabeza de Vaca's activities on the margin of the coastal prairies, and then his journey across the interior to the Rio Grande raise several archeological issues. For example, references to subsistence activities are of interest. While living with the Mariames on the lower Guadalupe River (we assume), Cabeza de Vaca and his colleagues were involved in the processing of pecans. This may have involved ground stone manos and metates, or even the use of stone pestles. Alternatively, they may have used wooden mortars and pestles of the sort reported ethnohistorically in Nuevo Leon in the 17th century by Alonso de Leon (Brown 1988; see also Beals 1932), and archeologically, from the lower Pecos area by Collins and Hester (1968) and Prewitt (1981). Cabeza de Vaca noted wooden pestles in use by Indian groups west of present-day Falcon Reservoir (Krieger n.d.:78) In addition, the harvesting and processing of tuna, the fruit of prickly pears, might have involved similar gear, or just an earthen pit.

It is significant that when, in 1532, Cabeza de Vaca and colleagues are involved in the summer harvesting of prickly pear tuna, there is no mention of pottery, which would have been ideal for the storage of beverages made from tuna juices (cf. Krieger 1956:53); indeed, he mentions a "lack of vessels" for the juice from the tunas (Favata and Fernandez [1993:75] also note that these Indians "have no vessels"). Either this is specific only to the group with whom Cabeza de Vaca was associated, his failure to note similar plainware ceramics, or his route across southern Texas was a bit farther south than the "southern route" currently suggests. I can say this with confidence in that the peoples of the southern Texas interior had begun making bone-tempered pottery, including olla forms, as early as A.D. 1200-1300, or perhaps even 200-300 years earlier (cf. Hester 1980:126; Highley 1986). It continued to be manufactured through the Late Prehistoric and during the time the regional Indian groups were residing in the 18th century Spanish missions. Pottery was being made as far south as Alice, and clearly north of a line running from Dimmit County down to Alice and eastward to Baffin Bay. Thus, the map of Cabeza de Vaca's journey might be more accurately drawn as running south of Alice (see Campbell and Campbell 1981:Figure 1)—or his route took a decided southern turn (cf. Chipman 1987:131). I doubt the latter is the case as the Wells and Davenport route discussed by Chipman (1987) would have put the castaways in the South Texas Sand Sheet area, a patch of South Texas that Cabeza de Vaca would have surely remembered! Indeed, if Cabeza de Vaca was among the Avavares, whose territory included the legendary great prickly pear fields, he would then have been in Webb, Duval, and southern Jim Wells counties, south of the pottery-making peoples.

## CABEZA DE VACA'S RECORD OF STONE ARTIFACTS

Cabeza de Vaca also made an interesting record of stone artifacts while among the Avavares, when he was told of the myth of Mala Cosa, the Badthing. Mala Cosa used a "flint knife two palms long and a hand wide" (Covey 1961:90) to inflict wounds on hapless individuals. There is no raw material in southern Texas that would have allowed the Avavares to have even dreamed of a stone tool of that size (the Uvalde and Rio Grande gravels used for points and everyday tools are relatively small cobbles). Additionally, while among the Avavares, another group, the Cutalchiches, were in residence (a village of 50 dwellings, see Krieger n.d.:74). Cabeza de Vaca reports that "they gave us flints up to a palm and a half long, which they use for cutting and which they highly prize." A description of such massive bifaces may reflect what we see archeologically in the region, and that is the presence of large, thin bifaces ("knives," Figure 3) that have been traded into the region from the Edwards Plateau, placed in burials and in non-burial caches (e.g., Hester and Barber 1990; Miller 1993; Hester 1995: Figure 19; Taylor and Highley 1995; Boyd et al. 1997).

## OBSERVATIONS ON SUBSISTENCE AND SETTLEMENT

It should also be noted that this area of Cabeza de Vaca's route, especially Starr, Zapata, and Jim Hogg counties, has a high density of prickly pear, but little in the way of creeks or other surface water (Hester 1981). This area and the area to the east could have been the territories of the Avavares (at least seasonally), and certainly the Arbadaos (Campbell and Campbell 1981), and the dire descriptions of their subsistence, during Cabeza de Vaca's eight months in the monte, would certainly fit with the settlement pattern and low-density resource model that I have put forth for the region (Hester 1981; why Covey [1961:92] equates this locale with the Texas "hill country" is indeed a mystery). Cabeza de Vaca's stay among the Cuchendados (Campbell and Campbell 1981:39) on the Rio Grande demonstrates his adaptation to life in the region (Wade 1996) and his skills at making items of material culture, such as mats, which were greatly prized as house coverings in what appear to have been at least a couple of sizable villages.

Cabeza de Vaca offers other insights into subsistence that have archeological implications. He

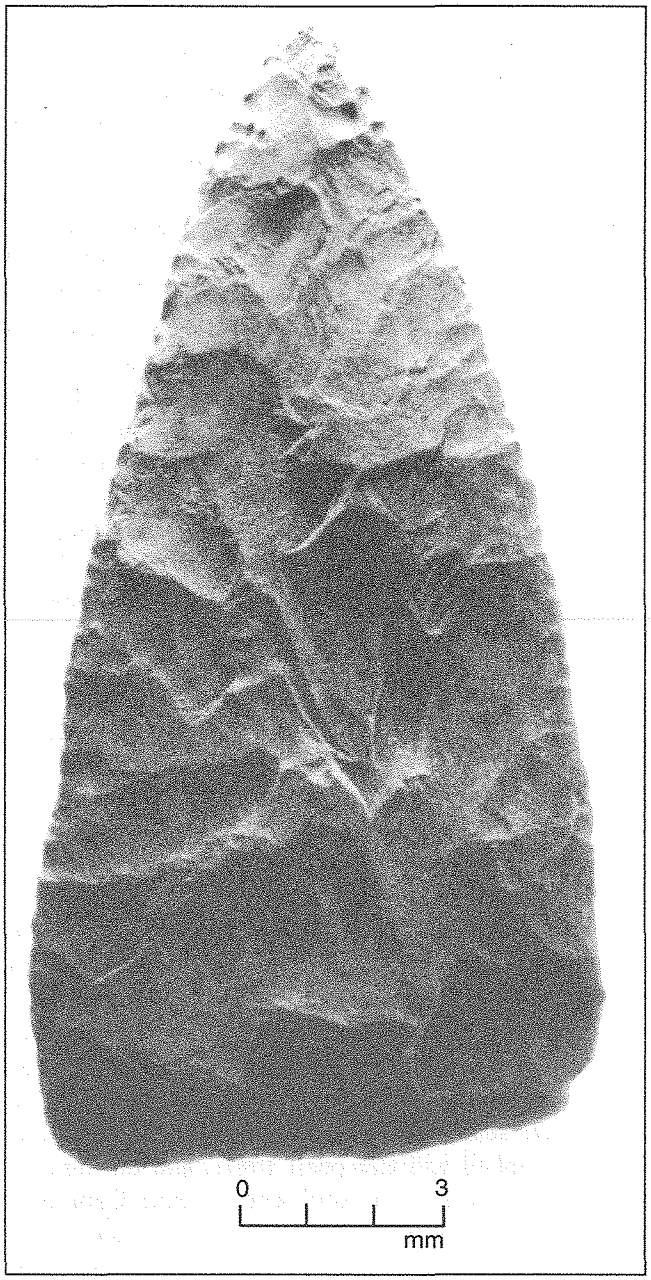


Figure 3. A Large Biface from Atascosa County, Southern Texas. Large bifaces found in south Texas may have well have been the "flints" that Cabeza de Vaca noted among the Avavares and Cutalchiches, and referred to by the Avavares as the weapon of the mythical Mala Cosa. A description of this biface is found in Hester and Barber (1990).

notes bison in the area of the Mariame (which Covey [1961] for some inexplicable reason places in the area of Austin), and clearly there were bison at this period on the coastal prairies (cf. Hester and Parker 1970; Ricklis 1996). He also points to the fact that the Mariame and related groups ate practically everything. This is borne out by the long lists of faunal remains at Late Prehistoric sites in the region (e.g., Hester and Hill 1975; Black 1986, Highley 1986). It is intriguing that he notes the pulverization of bone, to reduce these materials to bone grease to be mixed with other foods. This is a well known practice among southern California Indians (Bean 1972:66). However, faunal remains are so extensive and so well preserved at most Late Prehistoric sites in South Texas that this technology must have been used either with certain species, certain times of the year, or in cases of famine/hunger. Krieger (1956:53) reports that snails (land, or prairie snails; *Rabdotus* sp.) were also eaten, although I cannot locate this reference in the published translations. Campbell (1983) also reports the eating of snails by the Mariame while they were in the tuna fields.

However, the archeological evidence is overwhelming in terms of snail consumption. Along the central and southern coast, on the coastal prairies, and into the interior, Late Prehistoric sites have abundant land snails in the middens. Some archeologists and other scientists attribute their presence to the scavenging activities of land snails, but this is a facile argument that ignores the archeological data, that is to say their association with hearths and food processing areas (cf. Scott 1982; Black 1986; Highley 1986). If the snails got incorporated into the middens as casual scavengers, then they have clearly changed their feeding habits in South Texas since the Late Prehistoric period (Hester 1995)! Snail shells are so common at sites in Starr and Zapata counties, the territory of the Arbadaos (and Cuchendados?) that archeological sites can be easily recognized even during a "windshield survey"—by the glistening white sheen of the mass of snails eroding out of the sites (Nunley and Hester 1975).

Cabeza de Vaca refers to digging of roots; this would have been done with digging sticks of the kind that survive today only in dry caves. He also describes the use of earth ovens for cooking roots. Archeologists working in the region have few examples of such pits, although one recorded in McMullen County (Hester et al.

1975) may be similar. There are, however, a variety of hearths, including charcoal and rock-filled features, that might have served in this fashion (as at Choke Canyon; Scott 1982). While Cabeza de Vaca disparages the Indians' use of fire to burn off the prairies, this was a widespread practice in Texas and the Great Plains. Archeological evidence of such activities is, of course, hard to come by, although McGraw (1983:91) recorded thin lines of charcoal in excavation profiles near Laredo that might reflect such events. Megan Biesele and Steve Barclay (1997 personal communication) report the use of "flash-fires" by the San in Namibia to remove grasses (without damaging fruit-bearing trees), which within a few days are replaced by green shoots attracting kudu to the area (and making the kudu easier to track, with their hoof prints easy to spot in the soot-covered earth).

I have always been bothered by Cabeza de Vaca's descriptions of hunger, famine, and low quantities of food just about everywhere he went (these descriptions have been embellished; cf. Krieger 1956). This simply does not fit with the archeological evidence, in terms of faunal remains (animals, fish, marine or freshwater shell, snails, etc.) that occur in sites in the area where he must have traveled. Perhaps his eight months in the monte in the South Texas interior reflected seasonal variations in food availability as recorded by Alonso de Leon (Brown 1988). Or perhaps he was there in a time of drought; having just been in the area currently suffering from a significant drought, I can imagine the shortage of resources he encountered. Or perhaps his descriptions reflect his bias as a European who had to subsist on unfamiliar and distasteful foods.

The settlement pattern described for the Mariame and associated groups, to be near wood and water, fits what is seen for the placement of prehistoric occupation sites in the region (Cabeza de Vaca later contradicts himself by noting that the Indians "have no familiar places for getting water" [Covey 1961:83]). Perhaps here he referred to groups deeper into South Texas, where creeks and water sources were indeed fewer (the low-density zones described by Hester [1981]). The brevity with which the sites were occupied likely suggests repeated occupations over the years, again fitting with the "settlement zones" seen in the areas of higher density resources in the region (Hester 1981). Some sites were apparently occupied long enough for houses, albeit flimsy ones, to be set up. Archeological evidence for such houses is limited to a few postmolds or trash distribution patterns from a few sites (cf. Black 1986:266).

## CABEZA DE VACA CROSSES THE RIO GRANDE

Cabeza de Vaca's projected entry into Mexico near what is today the Falcon Reservoir district is probably accurate. If the Avavares' homeland was indeed southwest of Alice, in northern Duval County (cf. Krieger n.d.:78), Cabeza de Vaca and his group could have continued southwestward and crossed the Rio Grande in that locale. His party said mountain ranges were off to the west, and Jack T. Hughes notes (1998 personal communication) that Alex Krieger, when visiting Hughes' Falcon excavations in the early 1950s, was amazed at the view of these mountains (the flanks of the Sierra Madre Oriental), looking from the field camp atop a bluff on the north side of the river.

After wading chest-high across the river, the group went to a village of 100 or more "lodges" (Favata and Fernandez 1993:92). That such large villages were in that area is highly likely. The work done by James B. Boyd (Boyd et al. 1997), including the documentation of several cemeteries, appears consistent with significant Late Prehistoric population concentrations (Boyd et al. 1997; Hester 1995). In the large village visited by Cabeza de Vaca were Indians using rattles, fashioned of gourds filled with pebbles. Evidence for such rattles have been found both at Loma Sandia (Taylor and Highley 1995:483-484), in the Falcon Reservoir area, and in ethnohistoric accounts from the lower Rio Grande Valley (Salinas 1990). Regarding the gourds themselves, there has been much debate as to their source, although the native Texas gourd (*Cucurbita texana*) that occurs in Central Texas, along the Guadalupe River, and elsewhere, would have been available, albeit for a fairly small rattle (cf. Heiser 1985:64-65). Additionally, Aveleyra Arroyo de Anda et al. (1956) report a gourd dipper from Cueva la Paila in southwestern Coahuila. This particular gourd is larger and apparently represented a cultivated species; since gourds were domesticated very early in Mesoamerica (Heiser 1985), the specimen seen by

Cabeza de Vaca could have been either of a native Texas species or a gourd/gourd rattle traded into the area, perhaps from the Huasteca.

When Cabeza de Vaca moved west from the Rio Grande, he entered territory that is still very poorly known archeologically—especially in Late Prehistoric times. No major excavations or studies have dealt with this terminal portion of the culture sequence in the region, and those that have, usually involved rockshelters (cf. Hester et al. 1994), a settlement type not described in Cabeza de Vaca's chronicle.

Cabeza de Vaca notes, as he moves away from the Rio Grande, the presence of "corn flour." If this is indeed an accurate reference to maize, it may indicate horticulture in some portion of the northeast Mexico coastal plain. However, less than 150 miles to the south are Huastecan villages (e.g., Wilson and Warren 1975), and cultigens may have been obtained from them. As Cabeza de Vaca moves farther into Coahuila, he also notes "piñon pine," whose nuts were paper-thin. Olson et al. (1997) report the presence of this specific piñon species in the central mountains of Coahuila, "exactly on [the] route as projected by Krieger" (Olson et al. 1997:176, 186). It was also in this area of eastern Coahuila that Cabeza de Vaca carried out his storied surgery, removing a projectile point from a man's chest; earlier studies of Cabeza de Vaca's route place this in areas ranging from West Texas to the Pueblo area in the Southwest (cf. Favata and Fernandez 1993:126). Beyond this area, and still in eastern Coahuila, Cabeza de Vaca describes rabbit-hunting sticks (probably much like those found at Cueva de la Candelaria in southwestern Coahuila [Aveleyra Arroyo de Anda et al. 1956:141, 143, 189], as well as those in the Lower Pecos [Shafer 1986]). He also reports wooden cradle frames (Aveleyra Arroyo de Anda et al. 1956:151-152) and the presence of bison hides. The presence of bison hides in northeastern Mexico likely reflects two phenomena that Wade (1998) has recently reported. Seventeenth century expeditions observed bison in Coahuila, south of the Rio Grande, and also recorded the practice of Indian groups from northeastern Mexico traveling at times north of the Rio Grande to hunt buffalo and then to return to their home territory.

However, there is a much discussed incident involving material culture that I would like to touch upon. This is the "copper" bell or rattle (described as "squat and wide;" M. Wade, 1996 personal communication) given to Dorante "at the base of the mountains" (Covey 1961:110; Ketchum 1988; Epstein 1991). Cabeza de Vaca relates that the gift-givers had obtained the artifact from the "north." This has led many to speculate that it is derived from Casas Grandes, the great trading and craft production center in Chihuahua studied by Di Peso (1974), who notes Casas Grandes trade networks reaching to La Junta de los Rios and other northern Mexico locales. It may have indeed come from there (or from other Southwestern sources; see Vargas 1995), but I suggest an alternate scenario. If the Krieger route is correct (cf. Chipman 1987:143), this event probably took place south of Monterrey. This is only 250 miles from the Pavon site, on the Rio Panuco, in the Huastecan culture area. At this site, Ekholm (1944:478-479) reports and illustrates large copper bells (including one strikingly similar to a specimen from Casas Grandes, see DiPeso [1974:510]), and notes several others, including one in the form of a turtle (the one given Dorante apparently had a "face" or image on it) in the Huasteca. Indeed, Huastecan outposts in the Sierra de Tamaulipas, occupied at the time of Cabeza de Vaca (the Mesoamerican Late Postclassic) were within 150 miles or less. The Huastecans were very active traders, as seen in their interaction with the hunters and gatherers of the Brownsville complex in the Rio Grande delta, where obsidian, pottery, and jade is documented (see Hester [1995] for a detailed review). Further, despite all the ruminations in the various translations, could the "South Sea" and its riches not be the Pacific or the Bay of California, but the Gulf of Mexico with its Huastecan towns and traders?

At the end of the route with which I am concerned in this article, I will close with some observations on the material culture related to the famed "mouse-teeth" bloodletting or scarification event (Covey 1961:113; "rat's teeth," in Krieger [n.d.:109]). It is hard to say where this took place, although Krieger's route suggests it could have been in the Big Bend area (Olson 1997:176), somewhere perhaps about four days west of La Junta de los Rios, or even in the Presidio, Texas area (Butler 1948). Of particular interest here is a cache placed in a basket and covered with matting, excavated at site 41VV171 (Horseshoe Cave) in the 1930s (Figure 4). This has never been fully

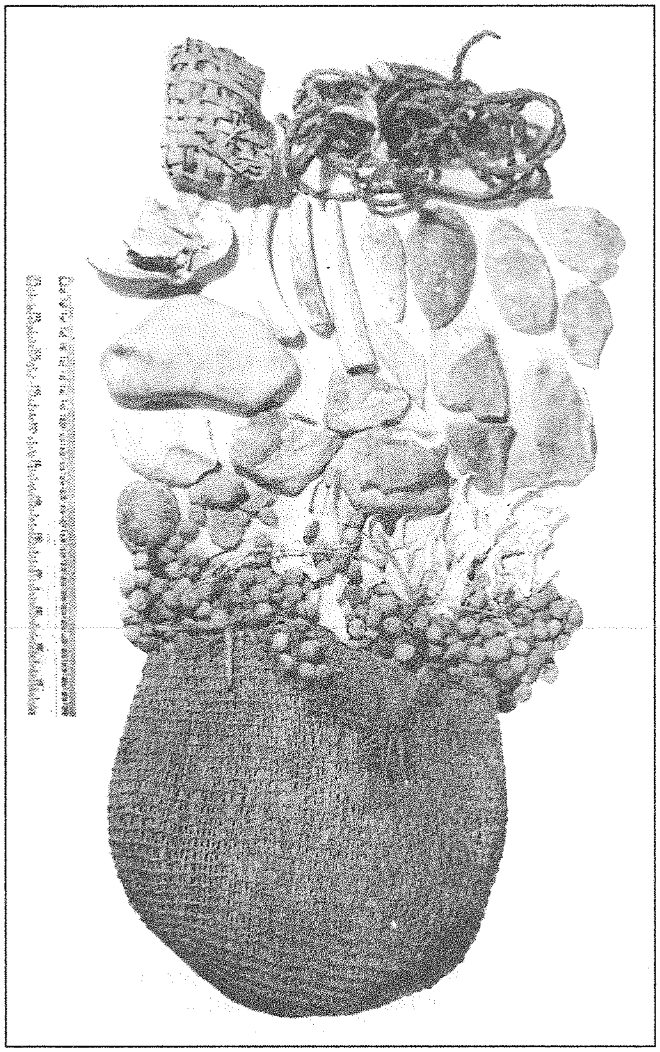

Figure 4. Cache from Horseshoe Cave (41VV171).This cache contained halves of jackrabbit mandibles and other items that have suggested its role as a "shaman's kit" or a "medicine bundle." The rabbit teeth may have been used as scarification or bloodletting tools, of the sort seen by Cabeza de Vaca in western Texas. Photograph courtesy of the Texas Archeological Research Laboratory, The University of Texas at Austin.

published (see Shafer 1986:105; a general description appears in Butler [1948]), although it is sometimes called a "shaman's kit" or a "medicine bundle." Among the contents are mescal beans (hallucinogens?) and buckeyes (for fish poison?) and 11 halves of jackrabbit mandibles. It is not hard to imagine these latter items being used for bloodletting scarification, especially in the scene described by Cabeza de Vaca. While he relates the event as one in which parents are punishing a crying infant, it is possible that he was witnessing a scarification scene. While I am not equating the Val Verde County jackrabbit mandibles with Ricklis' (1994) comb-like apparatus, with rats' teeth mounted in asphaltum (and which he describes as a shaman's bloodletting tool), the Cabeza de Vaca narrative indicates that persons other than shamans may have been involved in bloodletting or scarification.

As we depart the "southern route," as Cabeza de Vaca heads to the Rio Grande in the Junta de los Rios area, he records his interaction with bison hunters, who do their cooking by stone boiling in gourds, and who have acquired cotton blankets. Krieger (n.d.:112) believes these peoples to have been the Jumanos. Hamilton (1999) reports woven cotton, cotton lint, and cotton seeds from Granado Cave (41CU8) in Culberson County. Although this is far to the north of Cabeza de Vaca's route in the Big Bend area, it nonetheless illustrates the presence of these materials in western Texas, doubtless acquired through trade with Southwestern cultures.

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# Unfolding Native American History: The Entrada of Fr. Manuel De La Cruz and the Bosque-Larios Expedition

*Mariah F. Wade*

**ABSTRACT**

In the 1670s Texas did not exist as a colonial province of New Spain. At that time, and later still, the history of Texas was enmeshed with the history of Coahuila as were the lives of many Native American groups. The archival information that pertains to the events before and after the entrada of Fr. Manuel de la Cruz and the Bosque-Larios expedition has been misquoted, poorly researched, and is in some cases unknown. By casting a broad contextual net and doing detailed translations it is possible to obtain information on Native American cultural behavior and the local environment. This article uses archival materials from the 1650s to the 1670s, including the entrada of Fr. Manuel de la Cruz and the Bosque-Larios expedition, to discuss Native requests for settlement, the impact of the work of the Franciscan friars on the Native populations, as well as Native movements, group coalitions, and Native control of land areas and resources. I also provide a list of the Native American groups who inhabited or used the southwest portion of the Texas Edwards Plateau in 1674-1675.

## PREAMBLE

In 1932, Francis Borgia Steck published an article entitled "Forerunners of Captain de Leon's Expedition to Texas, 1670-1675." The article, based on Spanish archival documents, brought to light important events related to the work of the Franciscan friars in Coahuila and Texas in the late 1600s. Although Steck's approach to the archival material is completely understandable, it is unfortunate that Steck did not explore the full potential of this documentation, and, in at least a few important points, his article led to some confusion and misunderstandings.

This article presents most of the documents alluded to or referenced by Steck (1932), and locates the relevant archival repositories. I fully translated all the documents relating to this early period (about 120 pages and 16 different documents). These documents, and others discussed herein, span several years and relate events in the areas of Saltillo, Coahuila, and Texas. I made a conscious effort to retain the tone and language of the documents that were translated. Thus, the majority of the reported events are rendered almost as a direct translation. Due to space constraints, I could not include the Spanish textual version as often as wished. However, in some cases where the information provided by the documents is considered very important, controversial, or was incorrectly reported by Steck (1932), the Spanish quotes have been included. Differences in the spelling of Native names and personal names appear in the original texts. This article also includes archival material heretofore not published except for the author's dissertation (Wade 1998); this material covers the period of 1658 and some of the documents for 1673. This documentation is summarized in the present article to allow for development and analysis of the material that was not fully reported and explored by Steck (1932).

## INTRODUCTION

The Spanish entrada of Fr. Manuel de la Cruz (1674) and the expedition of Bosque-Larios (1675) into the southwest part of the modern territory of Texas provide temporal and spatial windows into the lives of Native groups and the historical events that shaped their lives. The sequence of events that culminated in the Bosque-Larios expedition began to unfold in 1658, and is intrinsically connected with Fr. Manuel's entrada. This article focuses primarily on the events that preceded the Bosque-Larios expedition, and discusses how those events were shaped by the actions of particular Native groups and their spokespersons.

The picture that emerges from the Spanish archival documentation pertaining to this stream of events clearly indicates that the majority of the groups involved had considerable populations, were organized in broad multi-ethnic coalitions, and controlled sophisticated information networks. Some of these groups and their spokespersons were the primary initiators of the movement to establish Native settlements. The evidence also indicates that some Native groups controlled and defended specific geographic areas and the harvesting of resources within those land areas. A reshuffling and bid for control of some of those areas and resources may have been underway at the time of the entradas. This realignment appears to have been a major source of conflict between group coalitions.

Face to face with imminent culture change, brought about by the presence of Europeans, Native American groups on both sides of the Rio Grande were devising ways to incorporate and deflect the potential effects of those changes. In the long run, the events that resulted from these entradas thwarted the Natives' intents, but their actions testify to their insight and enterprising ability within complex political and economical situations.

## THE ENTRADA OF FR. MANUEL DE LA CRUZ AND THE EXPEDITION OF FR. JUAN LARIOS AND LIEUTENANT FERNANDO DEL BOSQUE

The entradas of Fr. Manuel de la Cruz and Bosque-Larios have been portrayed as efforts to Christianize the Native populations and survey the country north of the Rio Grande. There is no question that these were some of the motivations of the colonizers, but the Spanish impetus for those entradas, and the Native motives that fostered those trips, have not been investigated or discussed. The lack of scrutiny of the primary sources has produced, at best, a lopsided view of the events, and at worse, it has presented Native groups as passive subjects in the process of change.

The appointment of Don Antonio Balcarcel de Ribadeneyra y Sottomayor as *Alcalde Mayor* of Coahuila was the catalyst for the Bosque-Larios expedition into modern Texas territory. However, the proximal causes that led to the solo trip of Fr. Manuel de la Cruz and the official entrada of Bosque-Larios were deeply rooted in early Native resettlement attempts. Some of the Native groups and Spanish individuals who played a role in those entradas had been involved in attempts to establish Native pueblos in Coahuila and in colonization efforts before Balcarcel arrived in Coahuila in November 1674.

## PAST EVENTS

### 1658

In March 1658, Miguel de Otalona, War Captain and Judge in Saltillo, heard testimony from army personnel and the citizenry of Saltillo relative to a request made by four Babane and Jumano individuals to establish a pueblo of their own. These individuals had visited Viceroy Duque de Albuquerque (1653-1660) to present their request, and the Viceroy ordered the matter investigated (Otalona 1658).

Testimony of the various witnesses shows that the request made by the Babane and Jumano argued that the *encomenderos* of Saltillo rounded up Natives in Coahuila for their *encomiendas*, imprisoned the children of Native workers to force their parents to remain in the haciendas, and did not pay the Natives for their work. In their request to establish a settlement, these Native Americans begged the Viceroy to provide them with 15 Tlascaltecan families in order that both groups could settle and be Christianized together. Some of the witnesses testified that they had been in the province since 1618. They stated that they had known the Babane and the Jumano for a long time. It appears that these Native groups may have been in the area at least since the 1620s (Morales 1658; Otalona 1658).

Local Spanish officials and *encomenderos* objected vehemently to this petition. Their arguments stated that: (1) these Natives had no pueblo and no Native following since they had always been *encomendados*; (2) the Natives wished to gather in a pueblo only to return to their barbaric customs and be free to commit all sorts of depredations without fear of punishment; (3) the *encomenderos* provided for all the Natives' physical and spiritual needs, which would not be met if they were in a pueblo; (4) if they were allowed to leave Saltillo they would retire to the mountains, where the *encomenderos* could not reach them, and finally (5) if these Natives left, others would follow, and the Province would be ruined, since the *encomenderos* did not have a labor force to work the farms. If that occurred, they would have to abandon the province. The farmers of Saltillo collectively sent a petition to Viceroy Duque de Albuquerque, and the matter was closed (Aguirre et al. 1673a).

## 1673-1674

Fifteen years later the issue resurfaced. In April 1673, Don Marcos, a Juman, appeared before General Echeberz y Subiça in Saltillo to request settlement in a pueblo. Don Marcos was accompanied by his brother, Don Lacaro Agustin, a Juman, and by Don Marcos, a Babane. General Echeberz y Subiça appointed Fr. Juan Larios as interpreter of the proceedings because of his proficiency in the Mexican language (Echeberz y Subiça 1673a). General Echeberz y Subiça told Don Marcos to bring the Natives of his group and following *(nacion y séquito)* to discuss the matter of settlement. Don Marcos replied that there were only three people left of his group. Those who sent him to request a pueblo were the Bobole and their allies (*y otros agregados suios*), who lived in the province of Coahuila and Valley of the Buffalo (Agustin 1673a).

General Echeberz y Subiça convened a meeting of prominent citizens to evaluate the merits of the request and provide information on the character and intentions of the petitioners. Most of the military and church officials who testified stated that they knew Lacaro Agustin and the others, and that it was not a bad idea to establish a pueblo for them in Coahuila. The area needed to be explored and had promising mining possibilities, but it would be essential to place a presidio in the area. They were of the opinion that it would not be easy to sustain a pueblo in Coahuila because of the many rebel and non-Christian peoples that inhabited it, and also because the Natives were not accustomed to labor for their sustenance but survived on what the earth provided. Furthermore, they stated, it would be difficult to control them and prevent their return to a sinful and barbaric way of life (Salaçar 1673).

Nicolas Flores, one of the witnesses, declared that he had known Lacaro Agustin since he was a boy and that Lacaro had been raised in Saltillo. He had no Native following except for his brother, or uncle (Don Marcos), who was also a party to the petition (Flores 1673). Captain Domingo de Menchaca, who had also been in Coahuila before the area was abandoned by the Spaniards, declared that he knew Agustin and the other Natives. He testified that when he was in Coahuila he had seen many *rancherias* of people with the same language and customs (*de la misma lengua y costumbres*) as those who wished to gather in a pueblo (Menchaca 1673).

On June 30, 1673, the petitioners were given to understand that their request was going to be granted. Don Lacaro was ordered to bring before Echeberz y Subiça the Natives who were a part of the request for settlement (Echeberz y Subiça 1673b). Don Lacaro stated that he would get the Bobole and their allies (*agregados*) to come in person and "state their needs as kin that they all were since they understood each other in a mother language and were all natives of the province of Coahuila" (*y juntos pidiriamos do que nos combiese como parientes que somos todos pues nos entendemos en una lengua materna originarios de la dicha probincia de cohaila*) (Aguirre et al. 1673b). Don Lacaro included in the group of petitioners the Bobole, Baias, Contotore, Tetecore, and half of the Momone. Two other very large groups were also joining: the Guequechale and the Tiltic y Maigunm. At this meeting Don Lacaro was accompanied by a Christian Gueiquechali Captain by the name of Don Esteban, two non-Christian Captains, and 28 Bobole and Temmanar individuals (Aguirre et al. 1673b; Agustin 1673b).

Don Lacaro stated that the Bobole had over 300 warriors and that they had been in Coahuila since time immemorial (*desde tiempo ymmemorial*). The Bobole stated that they had lost many people in wars and could not maintain their *rancheria* unless they congregated with other groups. Don Lacaro added that the Bobole had always been loyal to the Spaniards. He mentioned the help given by the Bobole during the battle of Don Fernando de Asco (Azcué) against the Cacaltles and their allies (Echeberz y Subiça 1673b). The intervention of 50 Bobole warriors gave the victory to Azcué and made possible the chastisement of the Tetecore and Contotore. Don Lacaro also mentioned that the other nation who was joining them (Gueiquesale or Catujano?) was from the east and that he did not know the boundaries of their lands (Aguirre et al. 1673b; Menchaca 1673).

After all the witnesses had testified, the consensus was that Don Lacaro Agustin was a savy *ladino* who incited other groups to rebellion, and that he had nothing to do with the help given to Fernando Azcué. General Echeberz y Subiça asked the Town Council (*Cabildo*) for a decision on the affair. After deliberations, the *Cabildo* stated that it was very convenient and useful to establish a pueblo such as the one requested by the Native petitioners, *if* the town had the military force and resources to guarantee its survival. Since that could not be done, and the creation of such a pueblo would strain the town's resources and cause its ruin, the request was denied (Aguirre et al. 1673a, 1673b; Echeberz y Subiça 1673b, 1673c).

In September 1673, Fray Larios traveled to Guadalajara accompanied by 20 Native Americans (Ardenol 1673a). This group of Native Americans came to plead their case for settlement before the *Audiencia de Guadalajara* on behalf of 24 groups. Among the Native visitors were Don Lazaro Agustin, Don Marcos, and a Native named Juan. These Native ambassadors were protesting the offenses committed against them by the *encomenderos*, including the use of military force by the officials in Saltillo to prevent Fr. Larios and the Native groups from moving into Coahuila (Ardenol 1673a:40-42). During their three-month sojourn in Guadalajara, the Native group was housed at the San Francisco Convent where eight Native Americans were publicly and solemnly baptized. The last of the baptismal ceremonies took place on November 27, 1673 (Ardenol 1673a:37-38). The following day Fr. Larios, Fr. Peñasco, Fr. Manuel de la Cruz, and the Native Americans returned to Saltillo. The whole group was escorted with great pomp to the outskirts of Guadalajara by the ecclesiastic authorities, including the Bishop of New Galicia, Don Francisco Verdin y Molina (Ardenol 1673b).

This trip to Guadalajara resulted, in part, from a formal complaint made by Captain Francisco de Barbarigo against the *Alcalde Mayor* of Saltillo, Juan de Maya. In response to the complaint, the *Audiencia de Guadalajara* sent Don Martin Moreno to Saltillo to investigate the charges. Traveling with Don Martin Moreno were Don Antonio Balcarcel and Miguel Thomas de Ascoide (Ardenol 1673a:46). In December 1673, Don Martin Moreno, Miguel Thomas de Ascoide, and Antonio Balcarcel testified to the conflicts they had witnessed in Saltillo and to the tense situation existing between the friars, the Native Americans, the *encomenderos*, and the Saltillo authorities. In his deposition, Balcarcel (Ardenol 1673a:43) attested that he had personally talked with the Native representatives. He stated that all together the 24 nations mustered about 3,700 warriors and about 12,000 people (*y reducido a numero alto ser tres mil y setecientos yndios de armas en que se supone y reconosse este testigo seran mas de dose mill almas*) (Ardenol 1673a:43). Despite these events, in December 1673, the Governor of Saltillo ordered presidial troops to subdue nine rebel Native groups. On December 29th, the troops vanquished the rebels, took their possessions, and reduced the males to slavery (Larios 1674a:136).

In November 1673, when Fr. Larios returned to Saltillo with Fr. Francisco Peñasco and Fr. Manuel de la Cruz, he had obtained official permission to missionize in Coahuila (Ardenol 1673b; Mohedano 1673). It appears that the inquiries ordered by the *Audiencia de Guadalajara* had led to a change of attitudes, and sometime in early 1674 the friars established the first mission settlements in Coahuila. On December 30, 1673, the group of Natives who had pledged peace and were returning from Guadalajara were given 30 *fanegas* (77 bushels) of corn and five heifers (Barbarigo 1674a:102).

In January 1674, Captain Francisco Elizondo was ordered to proceed to Coahuila to establish pueblos for Don Marcos, a Babane, and his allies (Elizondo 1674:65). When Elizondo arrived at Nuestra Señora de Guadalupe (Monclova), 35 leagues (91 miles) from Saltillo, he learned that the friars and the natives were further inland. Elizondo sent a courier to inform Fr. Larios that he would wait four days (until January 23rd or 24th) to meet them and to give official possession of the lands to the Natives (Elizondo 1674:66). By January 24th, since Elizondo had not heard from Fr. Larios, he decided to proceed in search of the friars. He continued northward to Santa Cruz de las Penuelas, located beyond the Nadadores River and halfway between the Nadadores and the Sabinas rivers. After reaching Santa Cruz he traveled about 14 leagues (36.4 miles) northward from Santa Cruz. At this place Captain Elizondo met two Xicocoge who informed him that Don Marcos, his allies, and the friars were on the Sabinas River (Elizondo 1674:67). Elizondo's party traveled to the Sabinas River. On January 26th, he stopped 60 leagues (156 miles) north of Saltillo upon being met by two Natives who were carrying a letter from Fr. Larios. Larios reported that on January 22nd, he had arrived at a *rancheria* of the Bobole, Gueiquechale, Tiltiqui, and Mayhuam and other allied groups. These groups were camped about 10 leagues (26 miles) beyond the Sabinas River toward the Rio Grande because of the smallpox. Since Elizondo's deadline had expired, and Fr. Larios did not wish to leave those who were sick, he promised that as soon as the epidemic subsided he would place them in pueblos and would inform Elizondo (Elizondo 1674:68-69). However, when Fr. Larios learned that Captain Elizondo had not departed for Saltillo, he traveled 4 leagues (10.4 miles) further to San Ildefonso, where he arrived January 23rd (Elizondo 1674:68; Larios 1674b:111).

Captain Elizondo joined Fr. Larios and several Native Captains at San Ildefonso de la Paz, 14 leagues north of the Sabinas River. On January 28th, according to Elizondo, he was visited by the Captains of the Gueiquechale, Bobole, Manos Prietas, Pinanaca, Obaya, Babaymare, Zupulame, Omomone, and Xicocoge. Fr. Larios, on the other hand, states that they were visited by the principal "leaders" of the Gueiquechale, Bobole, Xicocoge, Obaya, Xiupulame, Manos Prietas, Bacorama, Omomone, Baniamamar and *later* by the Mescale, Jumee, Cabeza, Contotor, Tetecora, Bausari, Manos Coloradas, Teimamar, and others (Barbarigo 1674a:112). At least the people from the first set of groups were interviewed through the interpreters Don Marcos and Don Lasaro Agustin, who spoke Castilian, Mexican, and apparently the language of those groups (Elizondo 1674:69). They declared their wish to settle, but they were divided in several groupings at present because of the epidemic and the lack of food. Fr. Larios stated that they lived on mescal, tuna, small nuts and oak acorns, fish, buffalo, and deer. Their dwellings were round huts surrounded by straw and covered with buffalo pelts that had been prepared so as not to let the water penetrate (Barbarigo 1674a:112). Some of their people were on the Rio Grande, 20 leagues (52 miles) from San Ildefonso, hunting and jerking buffalo meat. Many others were in various spots looking for food while several warriors had been left guarding their belongings at the place where they had congregated with Fr. Larios (Elizondo 1674:69-70). The following day (January 29th) Captain Elizondo counted the people: there were 543 adult women and children and 106 warriors. At the Natives' request Fr. Larios baptized 63 Native children.

Captain Elizondo notified Don Marcos and his allies to gather on the Rio Sabinas in order and that he would give them possession of the lands they had selected. Don Marcos made it clear that the number of his people to be settled far exceeded those present. He also stated that he needed more time to gather those who were settled (*com mas gente de la suya de la que esta en aquella parte que la de demas esta fixos y an menester mas tiempo para salir a ella*) (Elizondo 1674:71). After the religious ceremonies Elizondo gave the Native Captains their staffs and admonished them to remain peaceful. He also told them to give of their foods to the friars because the latter had no Spanish foods and were eating mescal (*y acudiessen a su corriente con algun sustento de sus comidas por quanto se allan sin ningun de las de los espanoles comiendo mescale*) (Elizondo 1674:71-72).

Captain Elizondo specified that he had given possession to the Natives of the lands on both sides of the Rio Sabinas for a distance of 10 to 18 leagues (26 to 46.8 miles) (Elizondo 1674:72). On February 1, 1674, Elizondo reported that he had given possession to Don Marcos and his allies of the lands along the course of the Sabinas River above and below a divide between hills that was next to the river, and beyond and northward of the place which they call "where the tetecores were killed" (Elizondo1674:74). The lands extended about 8 leagues north-south from the divide and downstream to a small hill shaped like a hat, which was located at the crossing of the path that led to the San Ildefonso settlement. This pueblo, which was 14 leagues (36.4 miles) south of San Ildefonso, was called Santa Rosa de Santa Maria (Elizondo 1674:74-75). As sign of possession the Natives pulled grass, dug dirt, watered the earth, and marked with stones the square area where the church was to be built.

Captain Elizondo, clearly at the bequest of Fr. Larios, made several recommendations for the success of the enterprise. First, he asked that no Spaniard be allowed to enter that area, particularly those from Saltillo and Nuevo Leon, because the Natives abhorred them due to the punishments and deaths these people had caused the Natives. Second, he asked that no Spaniard be allowed to hunt buffalo in the area. This was a very sensitive issue for the Natives which, among themselves, led them to defend their rights by the force of arms (*por ser materia mui sensible para ellos, y que afuerza de armas defienden de otras naciones*). Third, that no Native be again subjected to *encomienda* since the *encomenderos* had not reduced them but only exploited them (Elizondo 1674:72-73), and fourth, that the missionaries needed help with food, seed, and farming utensils. On March 2, 1674, Fr. Larios sent a letter and several testimonies of their missionary work to the Commissary General in Guadalajara. This letter was hand-delivered by Fr. Peñasco, who traveld to Guadalajara to request help for the new conversions in Coahuila (Larios 1674b).

In a letter dated September 15, 1674, Fr. Larios (Figueroa Torres 1963:67; Larios 1674a:135, 1674c:145) confirmed that between January and February 1674, the friars had established two mission settlements (*poblaciones*): S. Ildefonso de la Paz, located 14 leagues (36.4 miles) north of the Rio Sabinas, 20 leagues (52 miles) south of the Rio Grande and over 70 leagues from Saltillo; and Santa Rosa de Santa Maria, located 80 leagues (208 miles) north of Saltillo and 40 leagues westward of the Rio Grande. The two mission settlements were established principally for the Gueiquezale and the Bobole, but in them were aggregated 32 different Native groups. Twenty-two other groups from Nueva Viscaya and Nueva Galicia had also declared peace and were joining the friars (Larios 1674a:135). At S. Ildefonso there were 512 Gueiquesale and 178 additional individuals, some of which were Bobole, Obayo, Tiltique, Tiltiquimayo, Pinanaca, and Mayhuam, among others (de la Cruz 1674; Steck 1932:6). The smallpox epidemic had led the Gueiquesale, the Bobole, and the Obayo to ask to leave the area. These groups promised to return by the half-moon of March. Fr. Manuel de la Cruz remained at Santa Rosa until March 20, 1674, at which time he was joined by Captain Francisco Barbarigo and Fr. Larios, who arrived from Saltillo with supplies to build the adobe church, the sacristy, and a *zacate* dwelling for the friars (de la Cruz 1674).

The friars stated that the conditions at the mission settlements were very bad: they had little to eat but mescal and roots, and their tattered robes would soon force them to wear buffalo and deer skins (de la Cruz 1674; Steck 1932:16-17). Captain Barbarigo stated that the friars sent him donkeys to be returned with flour and ground corn, but when the Friars ran out of these foods they ate roots of lechugilla, tule, and sotol (Barbarigo 1674b; Figueroa Torres 1963:96). Although it is clear that the conditions could not have been good, especially for the Native Americans deeply affected by smallpox, the friars' reports seem to reflect more their own difficulties than those of the local inhabitants, particularly because the Native groups actually supplied the friars with food (Elizondo 1674:71-72).

When Fr. Larios arrived at Santa Rosa and realized that the Bobole had left the settlement, he asked Fr. Manuel to find them and persuade them to return to the pueblo. On March 22, 1674, Fr. Manuel departed Santa Rosa and traveled 12 leagues (31.2 miles) to an arroyo where the Bobole were camped. Six days later (March 28th?), Fr. Manuel arrived back at Santa Rosa with the Bobole. One day after his arrival, Fr. Larios ordered him to the north side of the Rio Grande to look for the Gueiquesale, and Fr. Manuel left the following day (30th or 31st of March?) (de la Cruz 1674:119-120).

On May 29, 1674, Fr. Manuel wrote a letter describing his trip to the north side of the Rio Grande. The letter makes it clear that he was reluctant to make the trip (de la Cruz 1674). He left with five Bobole and traveled *northward* for four and one-half days and covered about 40 leagues (104 miles) to reach the Rio Grande. The group crossed the Rio Grande in two stages. The crossing was difficult and disturbed the horse or mule Fr. Manuel was riding. After crossing the Rio Grande, Fr. Manuel traveled *eastward for three days* and arrived near a mountain which the Natives called *Dacate*, a word that in Castilian meant noses (*camine al salir del sol dejando de ir acia el norte y a los tres dias llege junto de una sierra q. los yndios llamam dacate q. en nuestro edioma es lo proprio q. narices*) (de la Cruz 1674:120). Near *Dacate* Fr. Manuel was intercepted by a Native who warned him to leave that path because the Patagua-Ocane and Catujane were coming to arrest him and kill his companions. These groups had been told to do so by a devil who appeared to them in visible form (*y me dijo q. dejase aquel camino porq. los yndios Pataguas-ocanes y catujanes abisados de un demonio q. se les aparece en forma* *bisible*). Fr. Manuel *changed course toward the north* and hid in an arroyo for three days surviving on reed roots (*y despidiendose de mi bolbi a caminar acia a el norte y escondido en un aroyo estube tres dias*) (de la Cruz 1674:120). While in hiding he sent one of his Bobole guides to reconnoiter the land, and he returned saying that the Bobole who were missing from Santa Rosa were camped about 6 leagues (15.6 miles) upstream and northward on the same arroyo.

Pleased with the news, Fr. Manuel left his hiding place at about midnight and arrived at the Bobole camp around 9:00 AM. The Bobole informed him that the Gueiquesale "leader" was staying, with all his people, 8 leagues (20.8 miles) *from* the Bobole camp. Fr. Manuel related to the Bobole how he had been warned about the hostile attitude of the Patagua-Ocane and Catujane. The Bobole appeared to be rather astonished. They immediately sent scouts to survey the land and Fr. Manuel sent a Bobole to warn the Gueiquesale "leader" Don Esteban who, upon learning of their plight, left camp with such haste that he reached the Bobole camp before sunset. Don Esteban brought along 98 warriors prepared for war, well supplied with bows and arrows, and displaying body decoration for war. They were wearing only a small piece of deer skin (*gamuca*) over their sexual organs and a hide shield (*adarga de cuero*). Their arms and chests were decorated with streaks of red, yellow, and white. On their heads they had crowns made of mesquite leaves and others of leaves of *estofiate silvestre* (a medicinal herb). Above the floral crowns they wore beautiful feathers. When they arrived at the Bobole camp they sat down and Fr. Manuel embraced Don Esteban, who asked Fr. Manuel why he had come to see them. Fr. Manuel declared that he had come to look for them and find out why the Gueiquesale had not returned to Santa Rosa. Don Esteban declared that his people only wished to be Christians and that was certainly his intent. He stated that as long as Fr. Manuel had come for them they would depart with him (de la Cruz 1674:121).

Meanwhile, the Natives who had gone to patrol the land reported that the enemies were still pursuing Fr. Manuel and that they had 180 warriors. Upon receiving these news they all stood up, got very excited, and told Fr. Manuel to stay in the camp (*rancho*) with the women and children while they proceeded to meet the enemy. Fr. Manuel refused their offer, stating that he would not abandon his brothers. Considering Fr. Manuel's decision as proof of his friendship, they declared that they would rather die than abandon him. Fr. Manuel, Don Esteban, and 147 bowmen left the Bobole camp about 10:00 PM and traveled until they detected the enemy. Then they stopped, and at sunrise they appraised each other's forces. The Gueiquesale and Bobole warriors recognized the superiority in numbers of their adversaries. Fr. Manuel showed them Christ's image (a cross or picture of Christ on the cross) and told them not to worry because God would help them. The last thing the warriors did before battle was to prepare their bows. Then with a horrible noise they attacked the enemy with great valor. Unable to resist, the enemy abandoned the field and hid in the *Sierra Dacate*. The Gueiquesale and the Bobole killed seven men and captured four women and three boys who they did not kill due to Fr. Manuel's intervention. After their victory the Bobole and Gueiquesale showed the surrounding area to Fr. Manuel, telling him the name of the arroyos, mountains, and hills (*y muy alegres me llebaran por toda aquella tierra ensenandomela y diciendome los nombres de los arroyos, sierras y lomas*) (de la Cruz 1674:122). They returned to the Bobole camp and the following day Fr. Manuel left with the Bobole to join with the Gueiquesale *rancheria*. They traveled two days through beautiful prairies (*caminando dos dias por unas ermosas lanadas*) (de la Cruz 1674:122). The prairies they traversed, as well as all the land Fr. Manuel had traveled through after crossing to the north side of the Rio Grande, were covered with countless buffalo, and had many fish, shrimp, plenty of turtles, and all the richness one could ask for (de la Cruz 1674:122).

Fr. Manuel was well received at the Gueiquesale *rancheria*. The Gueiquesale women put on a dance, as was their custom, to express their pleasure at his visit. The following day they all departed. They were 733 people counting children and adults. Fr. Manuel stated that he had spent 21 days north of the Rio Grande. Together they reached the Rio Grande, which they crossed in two stages at a wide and beautiful crossing. The river water reached only the belly of the animal he was riding. This crossing had in the middle of the river a sandy island with two beautiful beaches on both sides of the island. There were rocks but the rocks were not good to make fire (de la Cruz 1674:122).

After crossing the Rio Grande, they traveled for two days and reached an arroyo where 166 Pinanaca and Tiltiq.mayas were camped. They welcomed him and the women prepared a feast (dance?) in his honor. The following day they continued their journey, and traveled seven days through beautiful lands and arroyos until they reached the Nueces River (Mexico). Fr. Manuel explained that the river was so named because all the trees produced large nuts in great quantities. After crossing the Nueces River, they traveled for one day and reached a spring located in a marsh between some hills. Here they found 82 Babusarigame who also received him well. The following day they all departed for Santa Rosa. Both male and female children ran ahead of him gathering small bead-like fruits which grew in the thick bushes. With great joy they brought them to the friar, saying in their language "here father these are for you to eat" (de la Cruz 1674:123). Fr. Manuel accepted them and thanked God for his good fortune. After crossing several beautiful and wide plains and many pleasant arroyos the group reached an arroyo located about 10 leagues (26 miles) from Santa Rosa. The Native travelers were tired and asked to remain there to rest two or three days. Fr. Manuel went ahead to Santa Rosa where he found Fr. Larios and Captain Barbarigo. The day after Fr. Manuel's arrival, they finished erecting an adobe church with a sacristy and a *zacate* dwelling for the friars. On that same day, Fr. Peñasco arrived from Guadalajara having tried, unsuccessfully, to see his Franciscan superiors and obtain support for the mission settlements. Three days after his arrival, Fr. Manuel accompanied Barbarigo to Saltillo to request food donations. Captain Barbarigo, personally aware of the difficulties the friars were experiencing, gave Fr. Manuel flour and corn. After two days in Saltillo, Fr. Manuel returned to the Pueblo with the much needed food supplies (de la Cruz 1674:123).

Fr. Manuel closed his letter with an appeal to his Franciscan superiors for help with supplies as well as a vehement request for action against the *encomenderos* who would not set the Natives free to go settle their lands. Fr. Manuel reported an incident that had just taken place: two male and two female Natives had left the Hacienda de Patos, whose owner was Don Agustin Eceberz y Subica. Upon learning of their departure, Don Agustin sent three people in their pursuit. These individuals hunted down the Natives as if they were runaway slaves (*como se fueran esclavos fugitivos*). Fr. Manuel concluded by saying that if the actions of the *encomenderos* were not curbed all their work among the Native populations would be lost (de la Cruz 1674:124).

In July, Fr. Peñasco wrote to his superiors from Saltillo to relate the events that occurred during May and June. From Fr. Peñasco's letter, it appears he had left Guadalajara on April 10th and arrived at Santa Rosa May 10, 1674 (Barbarigo 1674b:130). Eight days after his arrival at Santa Rosa (May 18th), Fr. Larios sent him to look for the Manos Prietas (Peñasco 1674:127). Fr. Peñasco found them 4 leagues (10.4 miles) north of the Rio Grande and about 50 leagues (130 miles) from Santa Rosa. The Manos Prietas offered him buffalo meat which they possessed in quantity. Fr. Peñasco asked them to move closer to Santa Rosa in order that he could catechize them, and they replied they would do so in another eight days (Peñasco 1674:127).

Meanwhile, the Manos Prietas told Fr. Peñasco about another group, the Giorica, who lived further inland (*mas adentro*) 8 leagues (20.8 miles). Fr. Peñasco dispatched two ambassadors (*dos embaxadores*) to the Giorica to inform them of his presence. The Giorica replied that they did not want to leave their land because they were doing very well and had plenty of food and supplies where they lived (*q. no querian salir a parte alguna por allarse mui bien en aquella tierra, adonde no les faltaba la comida, y sustento necesario*) (Peñasco 1674:127). Undaunted, Fr. Peñasco dispatched another ambassador to explain that he was not trying to persuade them to leave their land but to teach them about God. Fr. Peñasco added that if his words made sense to them they should come and embrace God, otherwise they should stay where they were in peace since God did not force people to serve him. The Giorica treated the second ambassador with more affection than they had the first ones and gave him a Quezale boy who was their prisoner. They also told the ambassador that in two days time they would come to see Fr. Peñasco, which they did (Peñasco 1674:127).

The Manos Prietas, their bodies festively decorated, met the Giorica on the way. Later they held a dance for the Giorica as a sign of peace and exchanged bows and arrows to solidify the peace commitment (*una danza, o baile, q. es señal de paz, y trocaron unos con otros arcos y flechas para maior firmeza de la paz*) (Peñasco 1674:127-128). The following day Fr. Peñasco told them that God and the King wished them to be peaceful and to settle. For that purpose the King would give them corn to plant and oxen to sustain themselves. He stated that the friars were sent by God and the King to teach them the Christian doctrine and to defend them against the Spaniards, who the Natives intensely disliked because of the news they were receiving of the tyrannical behavior suffered by those closer to the Spaniards [*defenderlos de los españoles (aquien tienen notable aborrecimiento, por las noticias que les dan de las tiranias que usan con los de la tierra afuera)*] (Peñasco 1674:127, parenthesis in the original).

Persuaded by Fr. Peñasco's words, about 300 Giorica departed with him and the Manos Prietas for Santa Rosa. About 70 Giorica remained behind to care for their sick people with the understanding that as soon as they recovered they would join their people at Santa Rosa (Peñasco 1674:128). Fr. Peñasco also stated that at Santa Rosa the friars had gathered about 3,200 people who were settled in radii of 2, 3, 5, and 7 leagues (5.2, 7.8, 13, and 18.2 miles). At the time they were sustaining themselves from the large, productive tuna fields in the area, but as Fr. Peñasco pointed out, if the friars did not get food before the tuna supplies ran out, all the natives would leave in search of food. They would then tell the friars they had wronged them by convincing them to gather at Santa Rosa and promising food without delivering (Peñasco 1674:128).

Also in July Captain Barbarigo wrote a letter to the Franciscan Commissary that confirmed the problems facing the fathers at Santa Rosa. Barbarigo, who had returned to Saltillo with Fr. Manuel on May 22, 1674, stated that the friars needed three more religious workers to be able to handle so many people, particularly because they could not remain together due to the lack of food. The friars were obliged to follow the Natives, and they moved every three or four days to look for food. They would set up a *rancheria*, but when there were no more roots to be had hunger forced then to move again. For this reason the friars often stayed apart 20 to 30 leagues (52 to 78 miles). Barbarigo also stated that the *encomenderos* were continuing the practice of enslaving the natives (Barbarigo 1674b:133).

In September 1674, Fr. Larios was planning to establish four other settlements to accommodate the large number of people who had expressed a wish to settle. These settlements were to be located in Mapimi, San Lorenzo, San Pedro, and Cuatro Cienegas. The families who were going to occupy these settlements were to move into those areas by November 1674 (Larios 1674a:138). Given this program, he was understandably desperate for funds, food, and other supplies. Fr. Larios was aware that Don Antonio de Balcarcel had been appointed *Alcalde Mayor* of Coahuila, and it appears Fr. Larios wanted to have these settlements in place before Balcarcel took office.

On October 31, 1674, Fr. Dionisio de San Buenaventura reported to his superiors. He stated that he had arrived at Santa Rosa in early August 1674, accompanied by Fr. Esteban Martinez.When they reached Santa Rosa the place had been abandoned and destroyed. About 600 Natives had moved 15 leagues (39 miles) further inland. The two friars joined them while awaiting Fr. Larios, who had gone to see the Governor of Parral to request the release of the men, women, and children the Governor had imprisoned in December 1673 (de San Buenaventura 1674:141; Larios 1674a, 1674c:143). Fr. Dionisio reported that Balcarcel was to take office in November. The friars were so apprehensive about the Native reaction to this new official entrada in Coahuila that they all gathered in Saltillo to see what developed and also to ask for food donations (*limosna*) (de San Buenaventura 1674:142).

On December 30, 1674, Fr. Larios reported to his Franciscan superiors and provided them with a *Memoria* (Larios 1674d) of the groups who had pledged obedience as of that date. His letter recapitulates some of the events of the year that was about to close. Fr. Larios reported on the unhappy events at Santa Rosa, where only Don Esteban, the Gueiquezal, and Don Marcos, the Babane, had remained. Don Esteban was very sick and it appeared that Don Marcos and some of his people, mostly *ladinos*, had taken all the things from the sacristy and set fire to the *jacale* of the friars (Larios 1674c:144-145).

Fr. Larios went on to explain why Native groups moved so frequently and why the friars were compelled to follow them. He stated that because they were very numerous and lived on the roots gathered and on the animals hunted, in about 15 days they depleted the area where they camped, and were forced to move to other areas. Thus, the friars could not erect permanent buildings and stay with the Native groups in one place. They were like gypsies who did not have permanently located dwellings (*en quince dias atalan la tierra donde se hallan de rayces y luego les es fuerça levantar su rancheria y andarse a otro paraje, y desta suerte no nos es possible hacer mansion en parte alguna con ellos, porque son como gitanos q. no tienen vivienda situada*) (Larios 1674c:144).

In his *Memoria* (Larios 1674d) Fr. Larios listed the coalitions, their "leaders," and the Native member groups of each coalition. The Bobole coalition, under Captain Joan de la Cruz, included the Bobole proper and the Xicocosse, Jumane, Bauane (Babane), Xupulame, Yorica, Xianco cadam, Yergiba, and Bacaranan (Larios 1674d). Although there is no later list for the Bobole coalition, the Bagname, Bibit, Geniocane, Gicocoge, Jumee, and Yorica are mentioned as allies of the Bobole in 1675 (Portillo 1984:106).

The Gueiquesale coalition, under Don Esteban, included the Hueyquetzale proper and the Manos Prietas, Bacoram, Pinanacam, Cacaxte, Coniane, Ovaya, Tetecora, Contotore, Tocaymamare, Saesser, Teneymamar, Codam (Oodam?), Guiguigoa, Eguapit, Tocamomom, Huhuygam, Doaquioydacam, Cocuytzam, Aquita doydacam, Babury, Dedepo, Soromet, and Teymamare (Larios 1674c).

The third coalition was under Don Fabian and included the Mayo, Babusarigame, Bamarimamare, Cabezas, Bauiasmamare, Colorado, Pies de Venado, Igo quib, and Toque (Larios 1674d). The elements of this coalition also acknowledged the authority of Don Esteban. The fourth and last coalition group was under the influence of Captain Miguel, a Catujano, and included the Catujano proper, the Bahanero, Chacahuale, Toarma, Masiabe, Madmeda, Mabibit, Milihae, Ape, Paçhaque, Tilyhay, Xumez, Garafe, and Mexcale (Larios 1674d).

Fr. Larios' lists, as published by Alessio Robles (1938:232, 242) and Griffen (1969:88), differ from the original in that some Native names are shown with a different spelling and the Xumez are omitted from the Catujano list. From the events of 1658 and 1673, it is clear that these groups stated their allegiance to Fr. Larios and had established these coalitions sometime before the arrival of Balcarcel.

On November 23, 1674, Don Antonio Balcarcel arrived at Monclova. On November 28th, Fr. Larios and Fr. Manuel went in search of the Bobole and their allies at the Sabinas River. Fr. Larios stated that in February he would be traveling north of the Rio Grande to visit Don Esteban, who was there with all his people. He was also sending another friar to the Catujano, not only to continue to catechize them, but also to make arrangements for Balcarel's trip to the north side of the Rio Grande to survey the land and count the Natives (Larios 1674c:149).

As soon as Balcarcel took possession of Monclova, he received a series of Native ambassadorial delegations who came to pledge obedience and declare their intent to be peaceful and settle in pueblos. Fr. Larios' lists include groups that did not appear before Balcarcel to pay homage, and were not included in the lists given by Juan de la Cruz, Don Esteban, or Captain Miguel. Don Fabian does not appear as the spokesman for a coalition in the later lists. Don Esteban came in the name of his group and as representative of the following groups: Manos Prietas, Bocora, Siaexer, Pinanaca, Escabaca, Cacaste, Cocobipta, Cocomaque, Oodame, Contotore, Colorado, Babiamare, and Taimamare (Portillo 1984:69). Captain Miguel, a Christian Catujano, appeared on behalf of his group and as representative of his allies the Tilijae, Ape, Jumee, Pachuque, and Toamare (Portillo 1984:72). Later, Captain Miguel brought before Balcarcel the captains of the Bajare, Pachaque, and Jumee (Portillo 1984:80-83).

On January 18th, Balcarcel welcomed Francisco, a Bagname, who was accompanied by 18 warriors, three women, *Mapo*, a Bagname Captain, and *Yosame carboan*, a Siano Captain (Portillo 1984:73-75). On January 26, 1675, Balcarcel received the visit of Pablo, a Manos Prietas, who was accompanied by eight individuals of his group, the Gueiquesale, BapacoraPinanaca (Bacopora and Pinanaca), and Espopolame (Portillo 1984:73-75). On April 22, 1675, Balcarcel received Don Salvador, a Bobosarigame, who came accompanied by Don Bernabé, a Contotore, and by Don Esteban, who was, by then, called *Capitan Grande* by the other Natives (Portillo 1984:80-83).

This series of ambassadorial delegations provides some information about Native power relationships and the various coalitions and their member-groups. The order of appearance before Balcarcel is the following: the Gueiquesale and their allies; the Catujano and their allies; the Contotore; the Bagname and the Siano; and the Manos Prietas, who came as allies of the Gueiquesale and with two groups allied with the Gueiquesale (the Bacora and Pinanaca). The Manos Prietas also brought along the Espopolame, not mentioned in the coalition list of Don Esteban but recorded as Xupulame, a member of the Bobole coalition, in December 1674. The Manos Prietas had alliances, or friendship ties, with groups belonging to the Gueiquesale and the Bobole macro-spheres of influence. This indicates a primary alliance (micro-social) with the Xupulame (and probably other groups), and an alliance with the Bobole at a macro-social level. The Manos Prietas alliance with the Gueiquesale may have also been a primary alliance. The same holds true for the alliance between the Bacora and Pinanaca (micro-social) and the alliance between the Bacora, the Pinanaca, and the Gueiquesale (macro-social). These alliances were, quite possibly, restricted to certain spheres of social and economic interaction.

The next round of ambassadorial delegations started with the Catujano and their allies, the Bobosarigame (who came accompanied by Don Esteban and Don Bernabé, a Contotore), followed once again by the Catujano and their allies. Don Bernabé appeared to be an adjunct to Don Esteban, a Gueiquesale. The Bobosarigame, who in December 1674 appeared within the following of Don Fabian, accepted Don Esteban's authority quite likely via the Contotore. This implies a closer relationship (micro-social) with the Contotore. In their visits to Balcarcel, the Catujano representatives were never accompanied by the Gueiquesale or the Bobole. This confirms their independence, as a coalition, from the other two coalitions.

The Catujano brought before Balcarcel the Captains of the Ape, Tilijae, Bajare, Jumee, and Pachaque. Only the representative of the Toamare, stated as a Catujano ally in January, did not come before Balcarcel. The Bagname and the Siano asked to be settled with the Bobole. They do not appear to have considered the Gueiquesale their friends or to have had an alliance with them. Their relationship to the Catujano, *if* there was one, could have been via their connection to the Bobole. Being inhabitants of the *Dacate* area, as they stated, they were probably being squeezed by the peoples of Don Esteban's coalition, as indicated by the statements made by the peoples encountered by Bosque while on the north side of the Rio Grande. Some of the Catujano groups (Ape, Jumee, and Bibit or Mabibit) seem to have had a closer relationship with the Bobole, likely via the Yorica. This series of interlocking ties within micro- or macro-coalitions reflects the particular and timely concerns of each group.

The process of aggregation through coalitions and alliances is well noted among the Prehispanic Tlascaltecans (Corona 1988:66-69). Although in the Tlascaltecan case Corona refers to "clans" and "tribes," he points out that the political structure was organized around an individual who was viewed as the supreme expression of the community and was the eldest or the strongest in political and military terms. This individual would establish close relations with other "chiefs" of the same ethnic group or, alternatively, establish alliances to achieve a broad coalition to defend the ethnic and territorial viability of the group (Corona 1988:68).

Similar processes were at work in Pre-contact California. Discussing issues of multi-lingualism, Silver and Miller (1997:212-215) state:

> [T]ribelets were strongly connected with each other by both formal and informal interlocking links, and stable trade and military alliances often involved communities that were members of various language groups. Alliance structures occurred throughout the precontact California area from west to east and from north to south. In addition, there were communities that served as cross-tribelet interface centers, sometimes involving several hundred to several thousand people in intense sociopolitical and economic interaction (Silver and Miller 1997:214).

Unfortunately, these authors provide only general sources (Silver and Miller 1997:223) to substantiate these comments, making it difficult to compare specific groups and cases.

In April 1675, Don Esteban reported having problems with the Ervipiame (Yrvipias) because they had killed five people belonging to the Gueiquesale coalition. In retaliation for that attack, the Gueiquesale attacked the Ervipiame and killed their Captain and eight of his people. The sequence of conflicts between the Gueiquesale (and their allies) with the Ervipiame shows a continuation of a problem that already existed the year before, when Fr. Manuel witnessed a battle between these groups (Portillo 1984:75, 80-81; Wade 1998:50-51). Whatever the problems at issue, they had not been resolved. If the Ervipiame were trying to infringe on the territory held by the Gueiquesale and their allies, they had not yet succeeded. If, on the other hand, the situation was reversed, the Gueiquesale had not succeeded in displacing the Ervipiame. It appears, however, that the Gueiquesale were getting the upper hand. Regardless of the final outcome of the conflict, smaller and weaker groups in the area would have to ally themselves with one of these parties.

It is logical to think that the number of warriors was a very important consideration for Native groups and that having 100 warriors or more was necessary to muster control. It is possible that the threshold was regarded as controlling 100 bowmen. Thus, some battles were waged to reduce the size of the opposing warrior group, because warriors were not easily replaced. Likewise, coalitions were necessary to provide warriors and maintain a balance of power.

On April 25, 1675, the Parochial Church of Nuestra Señora de Guadalupe was officially opened. The following day Balcarcel founded the Native pueblo of S. Miguel de Luna. The pueblo leadership was given to the Bobole and the Gicocoge, even though other groups, including the Ape and the Gueiquesale, were congregated there (Portillo 1984:84-87). On April 29, 1675, Captain Pablo, a Manos Prietas, arrived to settle at S. Miguel de Luna with 232 of his people. He informed Balcarcel that he had left behind, ready to depart, all the people who wanted to be settled. The number of people was so great that they extended from Monclova to both the south and the north banks of the Rio Grande (Portillo 1984:88). Balcarcel must have been petrified. S. Miguel de Luna was already overflowing, and even charismatic leaders like Juan de la Cruz and Don Esteban were hard pressed to maintain peace. The alliance between the Bobole, the Gueiquesale, and the Spaniards held the balance of power and was key to the peace that kept other groups at bay. On the other hand, many Spaniards, fearful of the presence of so many Native Americans, had fled the area (Portillo 1984:132). Balcarcel readily recognized the potential for conflict if all these peoples were allowed to stay at S. Miguel de Luna.

On April 30th, Balcarcel ordered Alferez Fernando del Bosque and Fr. Juan Larios to travel from the Rio de Nadadores to the *Sierra Dacate* and other areas that might be convenient to visit. They were to take possession of the lands, record information on the environment, and count the peoples they encountered. They were to inform the Native Americans that the Spanish would establish pueblos for them and would supply ministers to teach them the Christian doctrine. In fact, however, their primary objective was to stem the flow of Native groups into the Monclova area by promising them the establishment of pueblos in their own lands (Portillo 1984:88-89).

## THE BOSQUE-LARIOS EXPEDITION

The expedition of Fernando del Bosque and Fr. Larios (Portillo 1984:90-107; Wade 1998:63-106) to the north side of the Rio Grande was fairly uneventful. The group left Monclova and traveled to the Rio Grande, which they crossed near modern Normandy, Texas (Figure 1). Soon after the crossing, probably at Las Moras Creek (day 14), they encountered 54 Yorica and Jeapa warriors who had been buffalo hunting. These individuals complained to Bosque about their difficulties in traversing the land, visiting their kinfolk, and acquiring resources. They also reported their conflicts with the Ocane, the Pataguaque, and the Ervipiame. The Yorica and Jeapa offered to guide the expeditionary group to the peoples who lived in the *Sierra Dacate and Yacatsol*. Meanwhile they sent emissaries to their people, the Mabibit (or Bibit) and the Jumee, to join them along the way to greet the Spaniards. On May 14th, probably between Las Moras Creek and Cow Creek, the Bosque-Larios party met the Mabibit and the Jumee, who reiterated the same complaints made by the Yorica and Jeapa. These people were separated from their kin due to internecine strife between Native groups. Such a pattern of forced geographical division of ethnic groups in the Edwards Plateau occurred prior to the southward moves of the Apache. The statements of the Mabibit, Jeapa, Jumee, and Yorica constitute good evidence that the same or related Native groups lived in different areas, either by choice or as a result of local conflicts.

While at this camp, Bosque and Larios received the visit of six captains of the Pinanaca, Xaeser, Teneimamar, and possibly the Cocoma. They had come to reaffirm the allegiance given to the King of Spain, in their name, by Don Esteban. They were

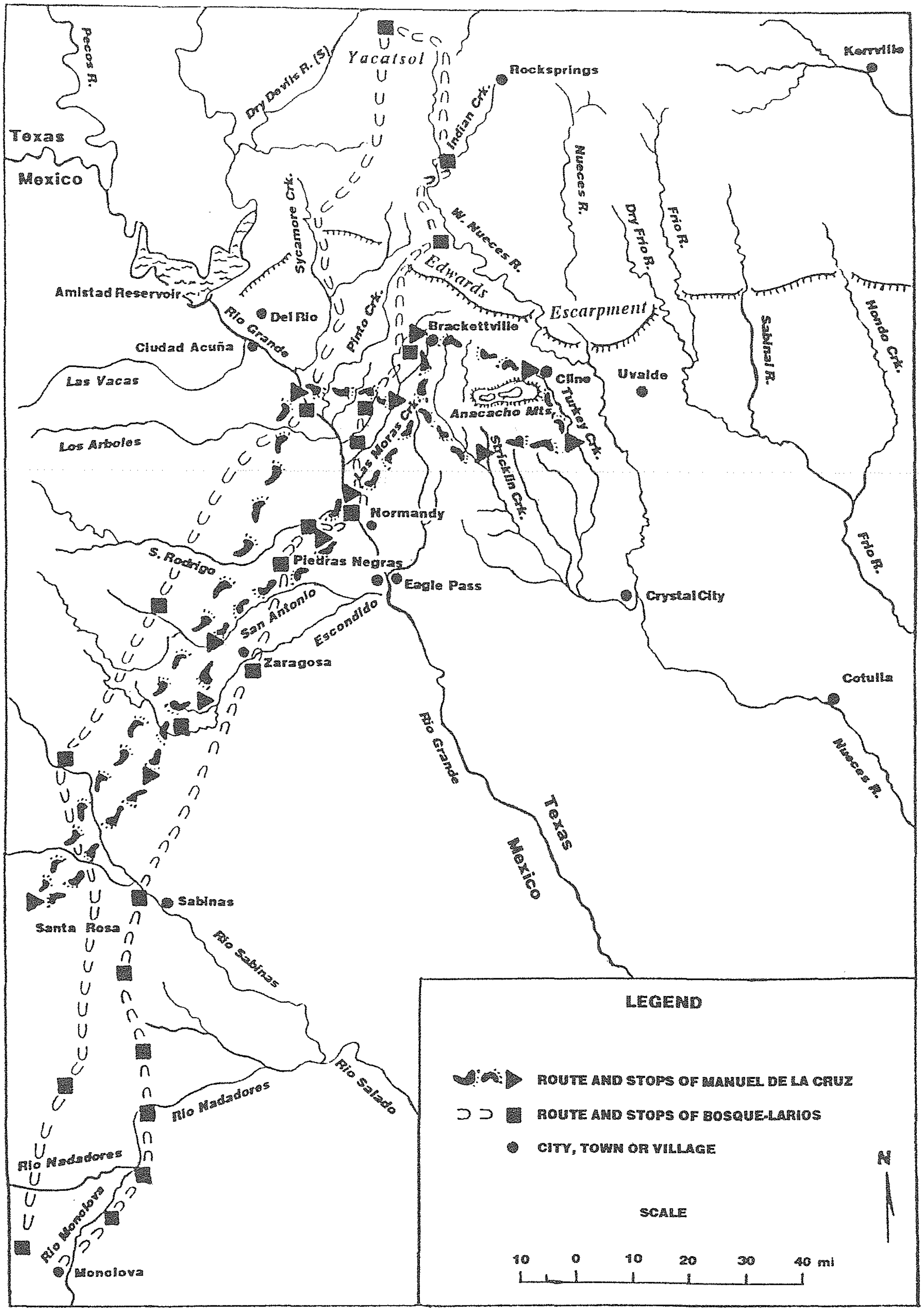


Figure 1. Routes of the trips of Bosque-Larios and Fr. Manuel de La Cruz to the north side of the Rio Grande.

waiting to become Christians and be settled in a pueblo (Bolton 1916:300-301; Portillo 1984:97-98). The visit of the Pinanaca, Xaeser, and Teneimamar captains confirms the connections between the following of Don Esteban on the west and those on the east (i.e., the north bank of the Rio Grande). All these groups were included in the coalition of Don Esteban. None of these groups complained about the difficulties of traveling through the area or having access to the buffalo herds. Their silence over these difficulties appears to be confirmation of their control over the area as members of the Gueiquesale coalition. This control would justify the problems of the Yorica, Bibit, Jeapa, and Jumee to travel through the area, since these groups were members of the Bobole and the Catujano-Tilijae coalitions.

The following day, probably on Elm Creek, the Spaniards were visited by the captains of the Xoman, Tereodan, Teaname, and Teimamar, together with their people (Bolton 1916:300-301; Portillo 1984:98). They too declared their wish to be Christians and settle in pueblos. This decision was being taken for the future welfare of their children and grand-children. Bosque ordered them to be peaceful and to avoid the conflicts that led them to kill each other. The people of these groups made an offering (*lismona*) of a piece of animal fat (*sebo*), a piece of rendered fat (*manteca*), as well as skins or pelts of animals that they used to make clothing, or used as cover for themselves, or to sleep on (Portillo 1984:98-99). When the Spaniards counted the Natives they found over 1,300 people.

On May 18th, the party reached a small stream that the Natives called *Dacate*. It appears that the native word *Dacate* denoted the southwest edge of the Edwards Plateau. On the southwest bank of the West Nueces River, Bosque received the visit of a Geniocane Captain who stated that he could not travel further south because of their enemies, but that his people would be waiting for the Spaniards northward. The Geniocane could not travel to the area of *Dacate,* the southern edge of the Edwards Plateau. The control of the boundaries of that physiographic feature prevented the Geniocane from reaching the buffalo hunting grounds on the plains to the south.

The Bagname captains Francisco and *Mapo*, as well as the Siano (Sana) Captain *Yosame carboan*, who visited Balcarcel at Monclova, declared that they came from a mountain range (*sierra*) which in their language was called *Dacate.* These groups were not mentioned among the following of Don Esteban (Portillo 1984:74-73). Presumably the Bagname and the Siano were in the same situation as the Geniocane, sandwiched between the friends of the Gueiquesale and other enemies further to the north on the plains forming the top of the Edwards Plateau.

On May 20th, the Bosque-Larios party reached the *rancheria* of the Geniocane, probably in the valley of Indian Creek (see Figure 1). Unlike other groups met before, it is apparent that Fr. Larios was not acquainted with the Geniocane since he did not accede to their request for baptism. However, he promised to visit them frequently and teach them the doctrine in order that they could be baptized (Wade 1998:94-95).

On May 25th, Bosque traveled northward, probably to the headwaters of the more southerly Dry Devils River. This spot was near or at the locality mentioned by the Native Americans as *Yacatsol* because of the small mountains with tall protrusions like nipples described by Bosque (Lino Canedo 1968:8; Molina 1977:30; Wade 1998:97-98). He was accompanied by the captains of the Xoman, Tereodan, Teaname, and Teimamar. He ordered them to remain peaceful in their lands. Bosque stated that these groups belonged to the following of Don Esteban.

The Bosque-Larios party returned to Monclova. North of the Rio Grande between Sycamore Creek and Pinto Creek (see Figure 1), Bosque met the Bobole, who were hunting buffalo. During the return trip Bosque found several other Native groups between the south bank of the Rio Grande and Monclova. Bosque arrived at Monclova and wrote a report and recommendations to Balcarcel based on his observations and impressions. Bosque stated (Portillo 1984:105-107) that he had traveled the land north-south and east-west and realized that it was divided into three major coalitions, or three divisions (*sequitos o parcialidades de jente*), each with a great number of people. The most bellicose, but the least numerous, was the following of Don Esteban, consisting of all the peoples that had been counted, except the Yorica, Jumee, Vivit (Bibit), and Geniocane, since those groups belonged to the followings of the Bobole and the Catujano-Tilijae. These groups had many conflicts among themselves. They killed each other, ate each other, and kidnapped each other's children, as they themselves stated. At the time of the report several groups were at war. The following of Don Esteban was at war with the Geniocane and their allies; the Yorica, Jumee, and Vivit were at war with the Arame and the Ocane and those of their following; and the Bobole were at war with the Yurbipiame. Bosque declared that the various groups wanted to be Christians and to settle in pueblos, but they wished to get individual economic and spiritual help and did not want to be placed together in a pueblo because this would result in conflicts. He thought the best solution would be to create three main pueblos for the three coalitions, whereby they would recognize each other but would remain independent. Apart from all this, Bosque stated that missionaries would also have to be provided because the Native Americans requested them. The groups did not want to share the friars but wished to be ministered to individually. Besides, the Native peoples spoke different languages, were very numerous, and their settlements were located at great distances. For the time being, at least four missionaries were needed for each chain of settlements, and if the King wished to accept their request and place them in pueblos, it would be necessary to provide seed, oxen, and Tlascaltecan families to help with the settlement (Portillo 1984:105-107).

## AFTERMATH

On June 30th, Balcarcel and Fr. Larios presided over the religious ceremonies at S. Miguel de Luna. By July 3, 1675, Balcarcel realized that there were too many conflicts and too many people at S. Miguel de Luna. He ordered the Ape, the Bobosarigame, the Catujano, and the Manos Prietas to leave the pueblo for their own lands. He promised them religious and material support (Portillo 1984:127-128). On July 5th, Larios traveled to Guadalajara to ask for help for the new conversions in Coahuila. Fr. Larios also stated that he was in possession of the Baptism, Marriage, and Burial books that pertained to the three *parcialidades*: Boboles, Huiquesales, and Catuxames and all their allies (Larios 1675). On July 6, 1675, Balcarcel (Portillo 1984:129-136; Wade 1998:405-408) wrote a very eloquent and unusual letter to the *Audiencia de Guadalajara*. In it he recommended the establishment of several pueblos, made suggestions for their organization, recognized the shortcomings of S. Miguel de Luna, the inadequacy of the resources available, and the failure of promises made to the Natives.

On October 26, 1675, Balcarcel was visited by Captain Christobal, a Catujano representative of the following nations: Ocane, Maquimixe, Mancequan, Papuliquier, Paponaca, Pahaque, Patoloque, Mesquite, Pataquaque, Canoome, Pausale, Pamafeo, Papanaque, Chanoada, Panaque, Tochi, and Michi. The Catujano Captain estimated the total population of these groups to be over 2,000 people. Christobal declared that they wished to settle in pueblos and become Christians. Balcarcel told them to return to their lands and stated that he would inform the King of their wishes (Portillo 1984:139). On November 17, 1675, Balcarcel welcomed Juan de la Cruz and Don Esteban, who came to see him on behalf of their people and the other groups staying at S. Miguel de Luna. These Native "leaders" were preoccupied with the continuous conflicts and the poor conditions in the pueblo, as well as the misunderstandings that resulted from the different languages and the actions of manipulative interpreters (Portillo 1984:140).

On November 20, 1675, Balcarcel stated his intention to visit the surrounding area, assess its problems, and attempt to keep the peace. He informed Juan de la Cruz and Don Esteban of his intentions. It is not certain that this trip was ever undertaken. On the same date, he counted the people in the town of Monclova and stated that there were eight Spaniards and 232 Natives. The rest of the people had left to hunt and eat buffalo. Thus, most of the people at Monclova were on their winter buffalo hunt on the north side of the Rio Grande. By the end of 1676, Balcarcel had left Monclova and was living in Saltillo (Portillo 1984:142).

In January 1676, the Bishop of Guadalajara, D. Manuel de Santa Cruz y Sahagún, placed Fr. Peñasco in charge of the pueblo of Santa Rosa (40 leagues from Monclova); Fr. Esteban Martínez in charge of the pueblo de Baluartes (20 leagues from Monclova); Fr. Dionisio de Buenaventura in charge of the pueblo of Quatro Sienegas (16 leagues from Monclova); and Fr. Manuel de la Cruz at the Head Mission in Monclova (*Cavesera de Coahuila*). These were all Native pueblos (Figueroa Torres 1963:128-129). Fr. Larios died September 7, 1676 (Figueroa Torres 1963:133). In 1681, Fr. Peñasco was still working in the area, and during the same year Fernando del Bosque was appointed *Alcalde Mayor* and *Capitan de Guerra* of Coahuila (Marques de la Laguna 1681).

## ANALYSIS

### Requests for settlement

The events that began to unfold in 1658 and continued through 1675 make it abundantly clear that certain Native groups and particular individuals took the initiative to promote the idea of autonomous and multi-ethnic settlements in order to escape the actions of *encomenderos* and counteract the population erosion being experienced by certain ethnic groups. The active intervention of Don Lazaro Agustin and Don Marcos, as well as the statements of the Bobole mentioned earlier, are clear evidence of those concerns. The political and economic influence of the *encomenderos* nullified the Natives' demands for settlement until the intervention of the friars and some influential civilians took up the Natives' cause. The advocacy of the Natives' requests came with a price: Christianization practices and the reoccupation of Monclova by Europeans. This, as usual, would prove a mixed blessing.

### The Franciscan friars, the Natives, and the Settlement project

With the concerted intervention of Fr. Larios and the ecclesiastic and civil authorities of Guadalajara, the establishment of several Native settlements was attempted in 1674. In their conversion zeal the friars tried to bring into the settlements not only Native groups who actually had asked for them, but also other groups who apparently expressed no desire to move out of their lands. The case of the Yorica illustrates this, since the Yorica specifically stated they did not wish to move, were content in the lands they occupied, and had plenty of resources.

Despite the Yorica's early refusal, Fr. Peñasco offered them, in the name of God and King, corn to plant and cattle to eat. This offer led the Yorica to move from the north side of the Rio Grande to the south side in May 1674. One year later, in May 1675, when the Yorica and their allies, the Jeapa, Jumee, and Mabibit, were encountered by Bosque, they complained about the difficulty to travel freely, obtain food resources, and visit their kin. It appears that the move they made in 1674 cut them off from their kin and produced loss of territory and resources. The case of the Yorica is probably not unique.

Thus, it seems that while some Native groups needed to move and coalesce with other groups to maintain their ethnic viability and escape the *encomenderos*, other groups were enticed to move off their lands by well-intentioned but unrealistic promises. It is clear that the first set of groups was comprised of Natives who were in close contact with the European population south and west of the Rio Grande. The latter set of groups was located primarily north of the Rio Grande.

The confines of this article do not permit a full discussion of the settlement problem. However, it should be noted that the settlement movement of 1674 and 1675 was greatly based on both mutual equivocations and unreasonable expectations on the part of the Native groups and the friars. The friars were befuddled by the intrinsic logic behind the pattern of resource acquisition practiced by the Native groups, but they could not supply them with enough food to prevent their frequent moves. On the other hand, the Natives felt betrayed when they were promised food resources that were not delivered. When that happened and the local resources became exhausted, they were forced to move. This issue was only partly solved when the mission became synonymous with a set of permanent buildings inside which the Natives were confined.

### The entrada of Fr. Manuel de la Cruz

The route and events of Fr. Manuel's trip to Texas have been improperly understood partly because they were reported without adequate context, and in some cases, erroneously. As previously noted, it is necessary to review the events of 1658 and 1673 to understand why Fr. Manuel was ordered to travel north of the Rio Grande.

When Steck (1932) reported on Fr. Manuel's trip, he omitted some important information included in the letter and mislead researchers by indicating that Fr. Manuel traveled in a "northerly direction" (Steck 1932:10) before and *after* he crossed the Rio Grande to the north side. Steck also stated that Fr. Manuel covered "approximately six leagues a day" (Steck 1932:10), and that Fr. Manuel "disregarded the Indian's warning" (Steck 1932:10) to change course. All these statements are incorrect. The letter referenced by Steck (1932:10) has the same date and addressee as the one I translated, and most of the information reported by Steck (1932) is indeed mentioned in the letter. It seems that both Steck (1932) and I saw and used the same archival document. However, it is possible that Steck saw an incomplete or faulty transcript of the letter. Nonetheless, researchers who used this material were mislead just as I was while preparing my dissertation (Wade 1998). When I finally located these documents and translated them, the discrepancies became apparent.

Fr. Manuel's route as presented in this paper (see Figure 1) is not without problems. Fr. Manuel crossed the Rio Grande and traveled eastward for three days. Late on the third day, near a sierra called *Dacate*, he was intercepted by a Native who warned him not to continue eastward because of the danger of being captured by hostile Native warriors. Fr. Manuel turned northward and hid in an arroyo until his scouts reported that the Bobole were upstream on that same arroyo. He traveled to the Bobole camp and was soon joined by the Gueiquesale warriors. Together they traveled to the site of the battle, which was near the Bobole camp, and the Bobole and Gueiquesale defeated the enemy. Sometime after the battle, Fr. Manuel traveled two days across beautiful prairies to reach the Gueiquesale *rancheria*, and the following day he, the Bobole, and the Gueiquesale started their return to Santa Rosa.

The information provided by Fr. Manuel is not adequate to accurately trace his route north of the Rio Grande; thus, several alternate scenarios could be proposed. The one offered here seems to accommodate all the available evidence in a reasonable manner (see Figure 1). Fr. Manuel crossed the Rio Grande about 15 miles downriver from Ciudad Acuña and somewhere between the mouth of Sycamore Creek and Pinto Creek. He traveled three days in an east-southeast direction. On the first night Fr. Manuel stopped on Las Moras Creek, about 13 miles downstream from Brackettville. On the second night, he stopped at a pond on Stricklin Creek about 2.5 miles south of the north line of Maverick County. On the third night Fr. Manuel hid on Turkey Creek, about one mile south of the north line of Maverick County, and about two miles north of the eastward path he had been following. He proceeded 15.5 miles upstream on Turkey Creek to the Bobole camp, which was located one and a half miles northwest of the modern village of Cline. The battle took place 5 to 10 miles east-northeast of the Bobole camp, near the confluence of the Nueces and West Nueces rivers. Fr. Manuel probably spent a few days near the Bobole camp and was shown a large area of the Edwards Plateau Escarpment, the rivers, and Anacacho Mountain. Fr. Manuel, the Bobole, and the Gueiquesale warriors traveled 20.8 miles west-northwest to the Gueiquesale *rancheria* located near the modern town of Brackettville. From there, Fr. Manuel and the people of both Native groups returned to the Rio Grande, which they crossed about three miles downstream from the place where Fr. Manuel had originally crossed, and near the same crossing used by the Bosque-Larios party on their outbound trip.

## Populations, Groups, and Coalitions

It has been frequently assumed that the groups who inhabited the southern and western portions of the Edwards Plateau had small populations. The documents do not bear out that notion. Although it is often impossible to disentangle individual group numbers from totals, or determine the extent of temporary and local patterns of fusion and fission, some numbers should be noted. The smallest stated *individual* group population belongs to the Geniocane, with 188 people (including 75 warriors), while the largest, 512 people, belongs to the Gueiquesale. However, these numbers are misleading since the *combined* population of the Jumee and Mabibit was only 105 people, and the *combined* population of the Xoman, Tereodam, Teaname, and Teimamar was over 1,300 people, or an average of 325 people per group. The last four groups mustered 425 warriors, or an average of 106 warriors per group. The preferred number of warriors for a group, or coalition of groups, appears to have been 100 or more bowmen (Wade 1998:89). Balcarcel's remark that 24 Native groups mustered 3,700 warriors (about 154 per group) appears to confirm that assumption.

According to the archival documents discussed in this article, the groups that inhabited or used the southwest portion of the Edwards Plateau in 1673-1675 were: Ape (Jeapa), Bagname, Bibit (Mabibit), Bobole, Cacaxtle, Catujano, Ervipiame, Geniocane, Gueiquesale, Jumee, Manos Prietas, Ocane, Patagua and or Pataguaque, Pinanaca, Saesse, Siano, Teaname, Teimamar, Teneimamar, Tereodam, Xoman, and Yorica.

Most of these groups were members of coalitions. These coalitions can be grouped into two basic types: macro-social coalitions and micro-social coalitions. The macro-social coalitions, such as the coalitions headed by the Gueiquesale, the Bobole, and the Catujano-Tilijae, incorporated many groups and reflected their broad concerns. These macro-social coalitions were agglutinated by means of interlocking micro-social coalitions. These micro-coalitions probably reflected kin ties or concerns particular to a small number of groups. The size and life-span of a specific coalition quite likely reflected the type and duration of defensive, economic, and political endeavors.

### "Territories"

It appears that some group coalitions controlled and defended specific land areas and the resources in those areas. The evidence is still sketchy but statements by Balcarcel (Wade 1998:405-408), Fr. Larios and Bosque, together with the approximate location of the camps of the Bobole, Gueiquesale, Yorica and others, give weight to this interpretation. Those "territories" seemed to have been composed of slices of land, oriented north-south, and bordered by main water courses, such as the Pecos and the Nueces rivers. A north-south environmental cline provided access to a variety of resources, particularly prickly-pear fields and buffalo herds immediately north and south of the Edwards Escarpment.

The remarks made by various Native leaders during the period of 1674-1675 indicate intensive group agglutination but also great tension. The location of the camps of several groups near the margins or immediately below the Edwards Escarpment, and the conflicts reported both by Fr. Manuel and the Bosque-Larios expedition, point to the need to control the Edwards Escarpment and the access to the plains immediately to the south. Further research may invalidate or validate this interpretation.

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# Mission Dolores Revisited

*Shawn B. Carlson and James E. Corbin*


## ABSTRACT

Mission Dolores, one of the earliest established and longest occupied missions in Texas has been the subject of numerous archeological investigations over the years. Now, that information has been synthesized and incorporated into exhibits at a newly erected on-site visitor's center. A collection of documents, copied from repositories throughout the United States, Mexico, and Spain, supplements the archeological facilities, promoting the center as a Spanish colonial research facility.


## RECENT DEVELOPMENT OF THE MISSION SITE

Development of Mission Dolores de los Ais has been a dream of San Augustinians for years. Recently, those dreams have come to fruition with the completion of a plan designed to preserve, protect, interpret, and develop the archeological site that lies on the outskirts of their town (Freeman and Kenmotsu 1993). A newly erected visitor's and interpretive center graces the site perimeter and trails meander through the site proper. Exhibits within the center focus upon integration of the site's archeology and history as it pertains to: (1) the Native American culture that preceded establishment of the mission, (2) the period during which Mission Dolores de los Ais was actively occupied, and (3) the post-mission period settlement.

Archeological data for exhibits comes from excavations that have taken place through the years (Corbin et al. 1980, 1990; Carlson and Quinn 1996). It is hoped that ongoing excavations directed at specific research issues will regularly provide new data and serve as a "living" exhibit. The archeological laboratory housed within the new interpretive center provides the space and equipment necessary to carry out these investigations.

Adjacent to the archeological laboratory is the archival research library. A collection of newly acquired Spanish documents is housed in this library, which will serve both as a repository for the documents and a reading room for researchers (Benavides 1998).

Funding for programs at the visitor's center will come from fees charged at a new recreational vehicle park adjacent to the site that includes vehicular camp sites, tent camp sites, and group shelters. Other sources of revenue include fees from the visitor's center and taxes generated from tourist expenditures.

Interpretation of Mission Dolores is now being achieved through museum exhibits and tours of the site. Long-term plans call for reconstruction of the mission and construction of an Indian farmstead that will reflect the life of the missionaries and the Ais Indians.

## A RECAP OF THE MISSION'S HISTORY

During the 18th century, the mission of Dolores de los Ais was one of many isolated posts on the Texas frontier. Its first location was occupied for only two years (1717-1719) before the threat of French encroachment forced its abandonment (Chipman 1992:111-119). The second location of Dolores, only one-quarter league distant from the first, operated for 51 years but was never particularly successful (Forrestal 1935). Situated halfway down an upland outlier, Mission Dolores was erected in a small open prairie, surrounded by forest, and overlooked Ayish Bayou to the west (Figure 1). A nearby creek supplied water for drinking and for an adjacent fruit and vegetable garden. Although a large, level tract, suitable for cultivated fields was

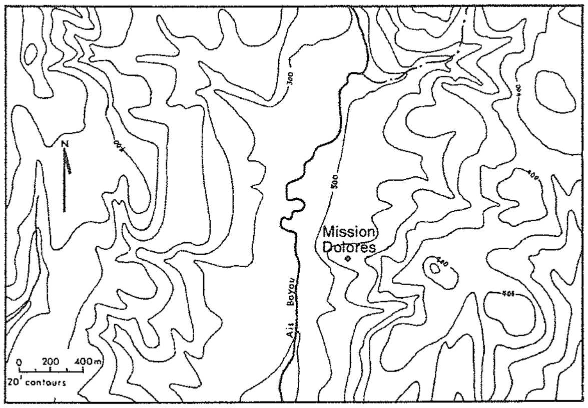



Figure 1. Topographic Location of Mission Dolores.

close by, these fields could not be irrigated because of the steep creek banks.

The geographic location of Mission Dolores matches those of other mission sites (Corbin n.d.:6-7). Clearly established in a defensive position, the location was less suitable for agriculture and may have actually repelled the Ais, who were accomplished agriculturalists. Although located centrally to attract the greatest number of Indians, the eight Ais settlements (*rancherias*) within two leagues of Mission Dolores had little use for the struggling mission.

To date, no documentary information exists regarding the actual arrangement or construction techniques used in the buildings at Mission Dolores de los Ais. They may have been similar to those at Mission San Miguel de Linares established approximately 30 leagues to the east during late 1716. A 1767 map of Mission San Miguel de Linares (and Presidio Los Adaes) drawn by Joseph Urrutia shows two buildings within the stockaded mission compound (Avery 1997:66). Coincidentally, two diaries describing Mission Dolores mention only two buildings. These are the 1721-1722 diaries of Don Juan Antonio de la Peña describing the establishment of Mission Dolores and the 1767-1768 diary of Fray Gaspar de Solís during his inspection of the missions (Forrestal 1931, 1935). The structures mentioned in both diaries are (1) the mission, and (2) the dwelling for the padres. It is likely that other structures were built through time and archeological evidence supports an argument for multiple structures (Corbin et al. 1980, 1990). However, the low number of soldiers assigned to guard the mission and the inability of the missionaries to attract Indian converts suggests that additional buildings may have been unnecessary.

In 1727, the only priest at Mission Dolores—Fray Pedro Munoz—described the church as beautifully furnished and decorated with "the required colors to celebrate the holy Sacrifice of the Mass and to administer the holy Sacraments" (Munoz 1727). Later, in 1767, Solís described the mission as a wooden structure kept neat and clean with well-kept vestments, sacred vessels, and silver utensils (Kress 1931). The dwelling quarters were large and made of wood.

Between 1736 and 1748 there is little information about the mission, although we do know that during the year 1744 only two priests with a guard of two soldiers inhabited the mission (Magnaghi 1984:175). No Indians were in the mission, apparently due to the lack of funds to support it.

By 1754, these conditions had not changed and recommendations were made to transfer the Ais mission to the coast to serve the Karankawan Indians instead. This proposal was successfully defeated and the mission remained occupied (Nunley 1975:32).

In 1767, an inspection was made of the missions by the Marquis de Rubí. His engineer and diarist, Nicolás de la Fora, described Mission Dolores de los Ais as "...useless as the preceding one [Guadalupe de Nacogdoches]..." (Kinnaird 1958:166).

Only a few years later, in 1772, the governor of Coahuila authorized the closing of the East Texas missions (Bolton 1970:377-446). The few settlers at Los Adaes and Los Ais were forced to abandon their homes and move to San Antonio. Subsequently, they established a new settlement in 1774 on the Trinity River called Bucareli. Bucareli was abandoned in 1779 and its inhabitants moved to Nacogdoches.

## PAST ARCHEOLOGICAL INVESTIGATIONS AT MISSION DOLORES

The site of Mission Dolores de los Ais lay neglected from the time of its abandonment in 1773 until the early 1960s when archeologists first became interested in it. Local residents were well aware of the general site area and referred to it as "Mission Hill." But, the exact location of the mission compound was not known and no steps had ever been taken to recover physical information about the mission. It was not until 1972 and 1973, when Dr. Kathleen Gilmore (1980), of the University of North Texas in Denton, tried her hand at finding the elusive mission, that any real effort was placed in recovering the remains of the mission.

Dr. Gilmore (1980) and her team of students dug nine trenches across the top of Mission Hill. These trenches exposed 23 different disturbances in the soil and a variety of Spanish colonial artifacts. The disturbances included man-made intrusions such as postholes, trash pits, building foundations, etc. Because so much activity had taken place on Mission Hill over the years, these disturbances could not be definitely associated with the mission.

This was not the end of archeological investigations at the site, however. In 1976, 1977, and 1978, Dr. James E. Corbin of Stephen F. Austin State University in Nacogdoches conducted archeological field schools immediately south of Mission Hill (Corbin et al. 1980) (Figure 2). He proved that a part of the mission was probably on Mission Hill, but about one-third of it lay to the south across State Highway 147. His excavations identified 24 m of the southeastern perimeter wall of the mission complex. The orientation of this wall was identical to those found at Mission Rosario (Gilmore 1974) and Mission San Xavier (Gilmore 1969). Also found were a small 1.2 x 2.0 m structure aligned with the *palisado* wall and a 4 x 7 m structure, probably *bousillage*, that formed the southwest corner of the compound. Four trash pits, and possibly part of the 18th century El Camino Real, were uncovered as well (Figure 3).

In 1984, Dr. Corbin returned to the site, again excavating on the south side of State Highway 147 (Corbin et al. 1990). This time he found further evidence of structures or internal walls, more of the perimeter wall, and two large pits (Figure 4a-b). Posthole alignments were found that represented at least five structures. Corbin's excavations resulted in the recovery of thousands of Spanish colonial, French, and aboriginal artifacts.

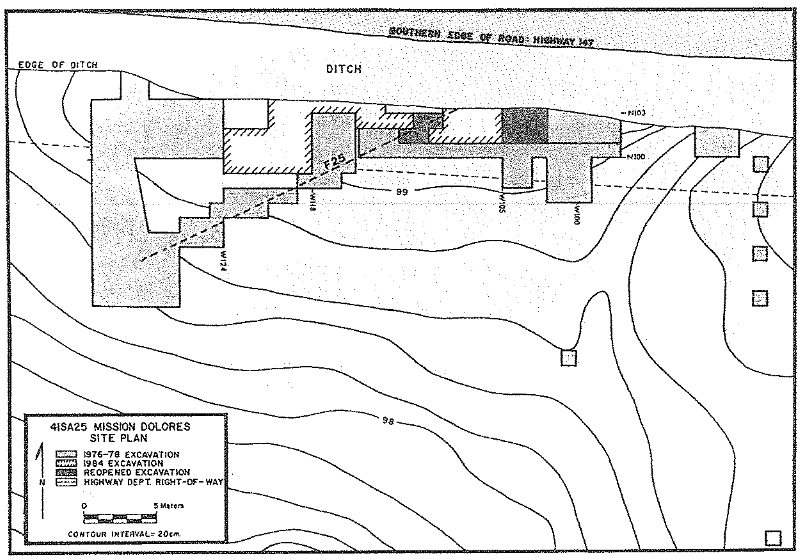



Figure 2. Plan of Excavations, 1976-1978 and 1984 Investigations.

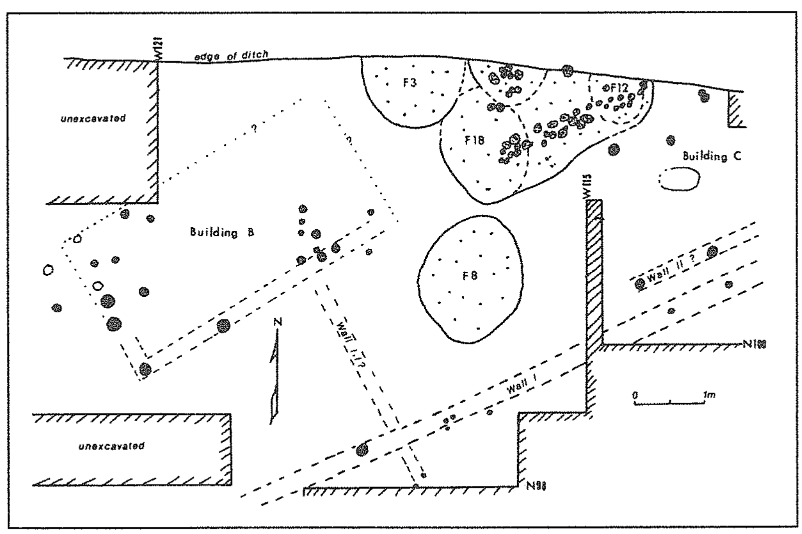
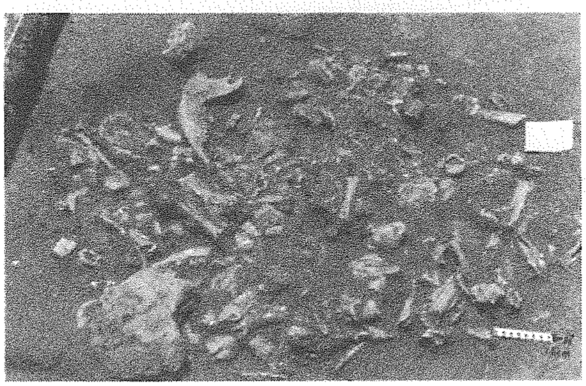



Figure 3. Plan View showing relationship of Features 3, 8, 12, and 18 to Buildings and Walls.

a



b

Figure 4. Feature 8 Pit: a, excavations in progress; b, rocks and faunal debris in feature.

Most recently, excavations were conducted in 1995 and 1996 by Dr. Shawn Bonath Carlson of Historic Sites Research in College Station (Carlson and Quinn 1996). Carlson's excavations focused on the periphery of the mission compound where plans were being made to construct a visitor's center and parking lot complex. Anticipating Indian campsites associated with the mission, Carlson and her team were dismayed to find logging activities had obliterated any evidence of 18th century debris around the mission.

## THE ARCHEOLOGICAL EVIDENCE

Thousands of artifacts, variously attributed to Ais, Mexicans, or Europeans, have been recovered from Mission Dolores over the years. Of particular interest is the ceramic assemblage. Despite the fact that there was never a resident population of Ais documented at the mission (cf. Winthuysen 1744), 96 percent of the ceramics were aboriginal (Carlson 1994:179). Corbin (n.d.:9) attributes this presence to the use of aboriginal wares by the soldiers and the priests. The remainder of the collection included European wares (2 percent), Mexican majolica (1 percent), and Chinese wares (1 percent).

The non-aboriginal wares were somewhat difficult to obtain (Carlson 1994). Chinese porcelains (Figure 5), which were used in small quantities at most of the missions, were shipped once a year from the Philippines, across the Pacific Ocean, to Acapulco. They were carefully packed on mule trains that journeyed more than 1000 miles north through Mexico to the Texas hinterlands. The safe arrival of these delicate wares to the Spanish missions seems remarkable today.

European wares, like English and German salt-glazed stoneware or Dutch and English delft, arrived at the port of Vera Cruz on the east coast of Mexico and, like the porcelain, were transported

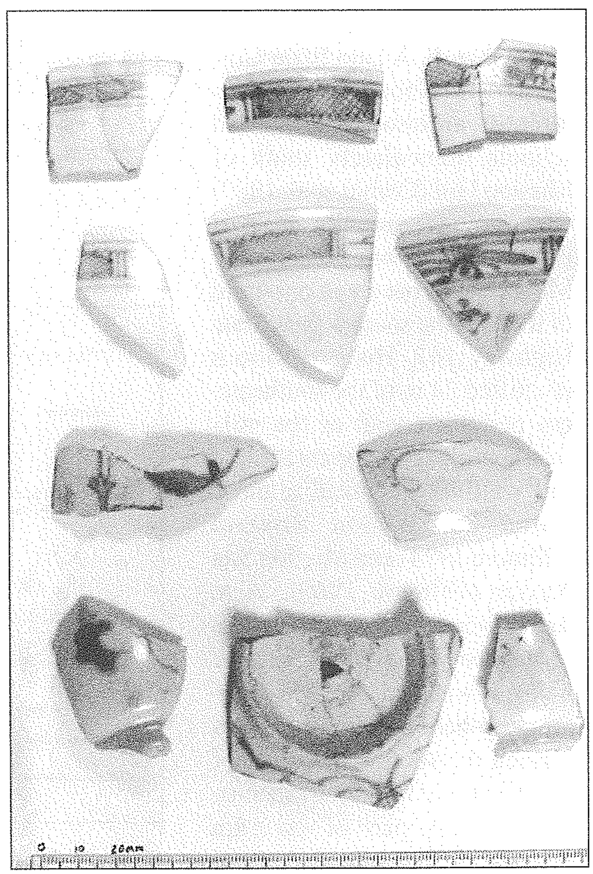


Figure 5. Chinese Porcelain from Mission Dolores.

to Texas by mule train. French faience (Figure 6) probably came through the port of New Orleans (Walthall 1991:99). Also, a large variety of hand-decorated vessels, both lead-glazed and tin-glazed (majolica), were made throughout central Mexico during the 18th century, and these were commonly used as well (Figure 7). While it is unlikely that Indians were eating from Chinese, European, or Mexican wares, it is believed that all occupants or visitors to the mission were using the easily obtainable and coarsely-made Indian vessels for eating, cooking, and storing food. These low-fired earthenware vessels comprised the major part of the ceramic assemblage recovered archeologically from Mission Dolores de los Ais (Corbin et al. 1980, 1990).

Besides ceramics, some glassware was also found at Mission Dolores. Most of the glass vessels were fragments of dark olive green hand-blown wine bottles (Corbin et al. 1980, 1990). Typically, these bottles are irregularly shaped and exhibit many bubbles as a by-product of blowing glass. Pontil scars are found on the bottle bases and the finishes have simple fire-polished rims. Applied strips of glass provided added strength to the rim and made it easier to seal these bottles (Figure 8e-i).

Other glass artifacts included trade beads (Corbin et al. 1980, 1990). These were found in a variety of shapes and colors (see Figure 8a-c). The basic shapes were tubular or round, with the tubular shape being achieved through blowing and pulling of molten glass. Round beads were shaped by winding small strands of molten glass around a thin metal rod.

Metal artifacts were widely varied with nails being the most abundant ferrous materials recovered (Corbin et al. 1980, 1990). The nails associated with Mission Dolores were all hand-forged and appeared square in cross-section (Figure 9a-e). In addition, knife parts, bridle parts (Figure 9f-i), spur parts (Figure 9j), a key, bullet worms, hasps, gun parts (Figure 10e-f), kettle fragments, wire

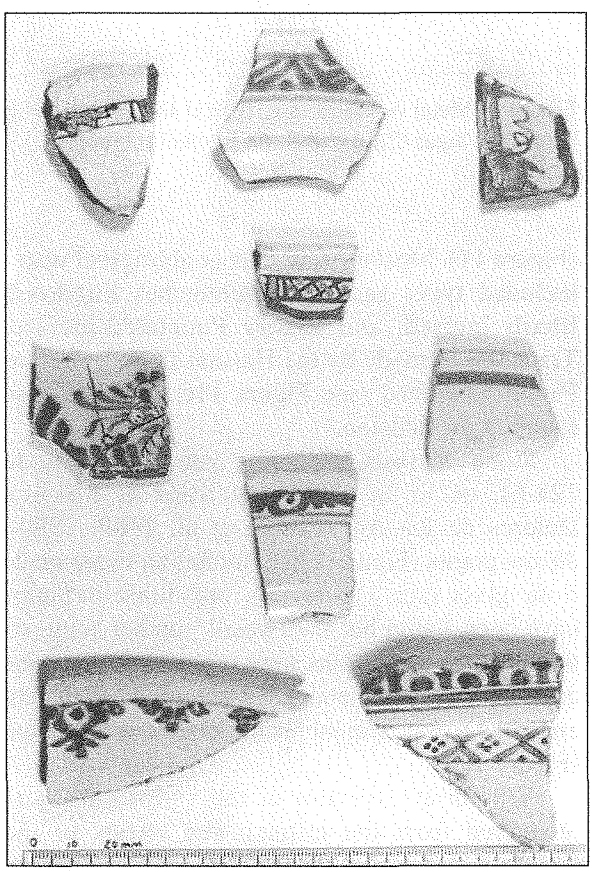


Figure 6. French Faience from Mission Dolores.

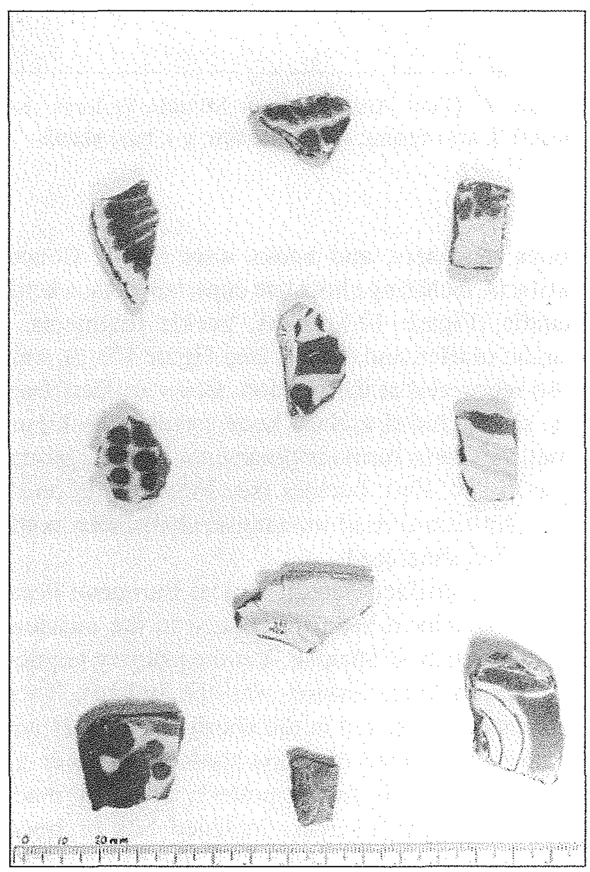


Figure 7. Mexican Majolica from Mission Dolores.

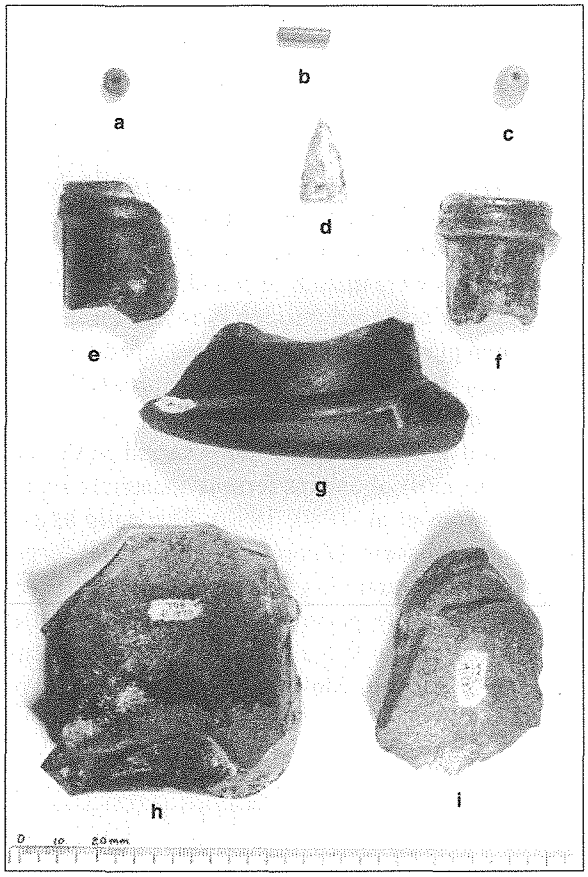



Figure 8. Glass Artifacts from Mission Dolores: a-c, beads; d, arrowpoint; e-f, bottle lips; g-i, base sherds.

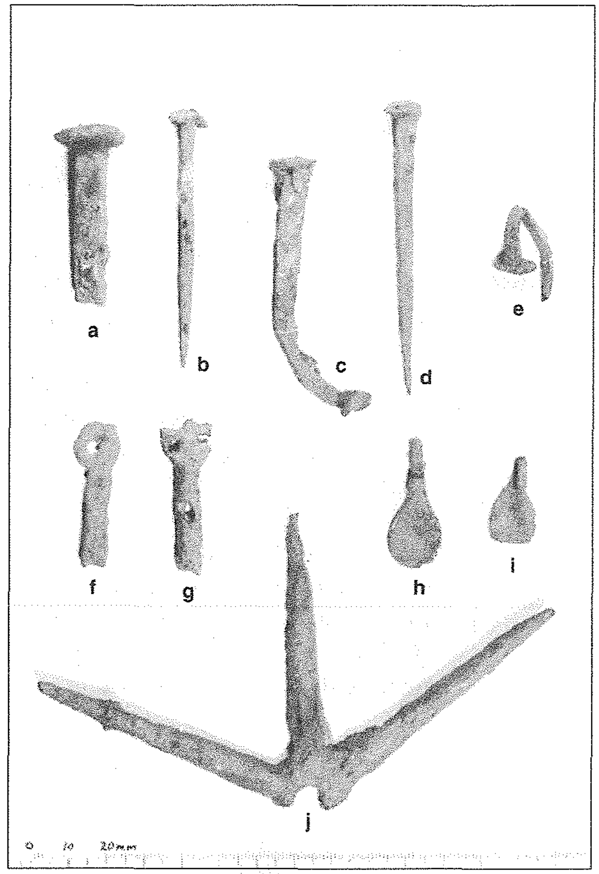



Figure 9. Metal Artifacts: a-e, typical forged nails; f-g, higas; h-i, higas (?), spoon form; j, rowel fragment.

loops, fasteners, and hooks were found. Copper artifacts, including chocolate cups, bail ears, a kettle handle (Figure 10i), rivets, buckle fragments, a candle snuffer, and tinklers (see Figure 10b-c), were also recovered at the mission. Brass artifacts from the site included a clasp knife handle (see Figure 10a), gun parts, furniture ornaments, buttons, spoons (see Figure 10g), buckles (see Figure 10d), and a tack. Artifacts of lead were musket balls, shot, bottle seals, and sheet lead.

These artifacts are all typical European items that would have been introduced to the missions by the French or Spanish. Yet the primary population around the mission was the Indians. Their presence is reflected in the aboriginal pottery and a limited number of stone tools (Corbin et al. 1980, 1990). The Indian pottery, probably made from local clay sources, included bits of bone, shell, and grog as temper. Also, the vessels were decorated with engraving, incising, and punctating (Figure 11). Most typically, these aboriginal wares included types such as Natchitoches Engraved, Ebarb Incised, and Emory Punctated-Incised. Trade wares made by the Hasinai Caddo, such as Patton Engraved (see Figure 11c, g), were also found at the mission.

Stone artifacts, including gun flints (Figure 12a-h), occur in small quantities at Mission Dolores de los Ais (Corbin et al. 1980, 1990). Arrow points (Figure 12i-j), including those made from glass (see Figure 8d), and lithic debitage have been found but their small number suggests that perhaps the Indians were replacing their stone tools with ones of metal manufacture. Also present are stone metate fragments imported from Mexico (Figure 12l).

This brief overview of the various artifacts recovered from the mission site attests to the presence of the friars, the soldiers, and the Indians throughout the 18th century at Mission Dolores

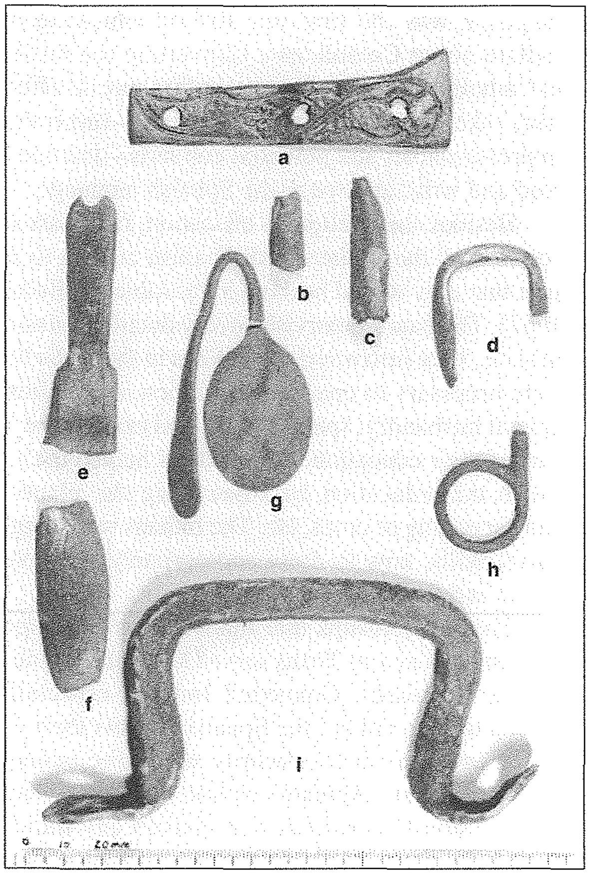



Figure 10. Other Metal Artifacts from Mission Dolores.

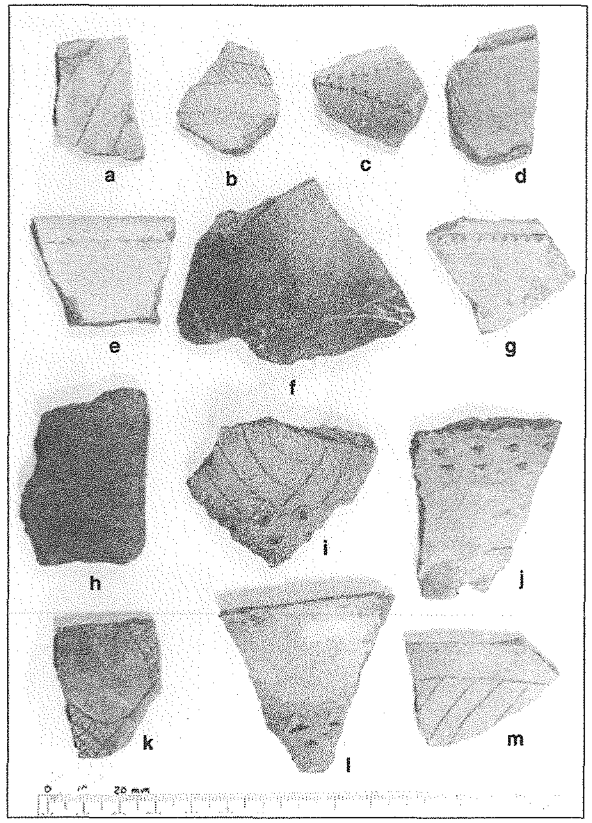



Figure 11. Indian Pottery from Mission Dolores: a-d, f-g, k, engraved; e, plain rim; h, m, incised; i, incised-punctated; j, l, punctated.

de los Ais. The quantity of artifacts found, the diversity of artifacts recovered, and their location on the site all give us information about the mission occupants that cannot be found in the written records.

## THE MISSION INHABITANTS

The mission inhabitants included the priests, the soldiers, and, occasionally, the native Ais. Soldiers at Mission Dolores de los Ais were few. A minimum of two were required at every mission and they were supplied by the nearest presidio. The soldiers at Dolores came from nearby Presidio Los Adaes and, ostensibly, protected the friars. They also helped in running the mission. When the Marquis de Rubí inspected the mission in 1767, he noted that the two soldiers—with their families—plus two priests and a layman were the only residents at Dolores (Kinnaird 1958).

The Ais Indians, a tribe of the Caddo, only visited the mission when it was to their advantage (Hatcher 1927; Hughes 1974). Already successful agriculturalists, the Indians did not need the missionaries. They lived in dispersed permanent settlements that were self-sufficient, and they only came to the mission to trade for European items that they wanted; some became baptized before their deaths. The Ais primarily cultivated corn and beans and supplemented their meals with deer and an occasional bison. They lived in dome-shaped, thatched houses with several generations of family. Their clothing was made of carefully dressed deer skins or buffalo hide. Men wore little clothing during warm weather and leggings and shirts when it was colder. The women, however, were usually covered from head to toe with ankle-length skirts and

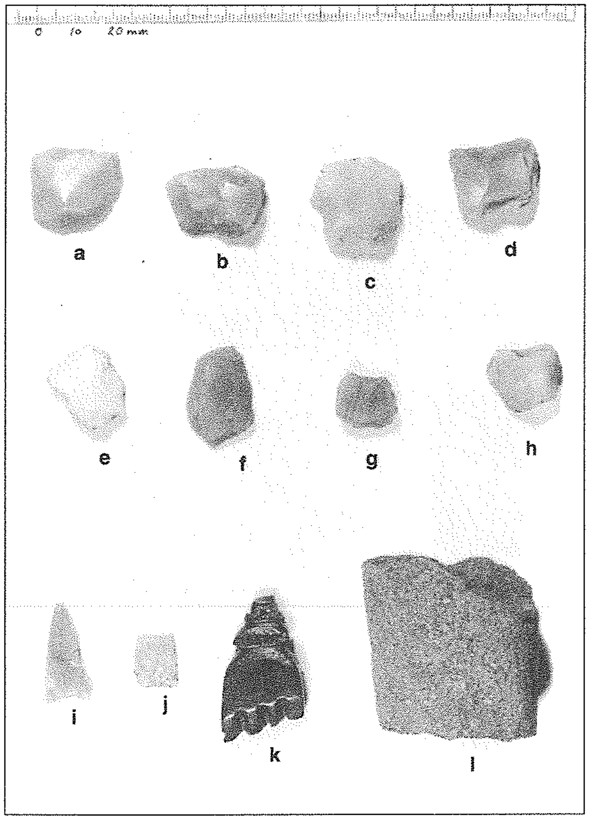



Figure 12. Stone Artifacts from Mission Dolores: a-h, gun flints; i-j, arrow points; k, higa; l, metate leg fragment.

waist-length shirts. All clothing was decorated with fringes, beads, feathers, etc. The men wore their hair long, as did the women.

Between sunrise and sunset, the friars sought to educate the Indians. At Mission Dolores, the friars were forced to travel to the *rancherias* because the Indians would not come to the mission (Kress 1931). However, the large quantity of ceramics recovered from archeological excavations suggests that Indians *did* come to the mission despite documents that show otherwise (Corbin et al. 1980, 1990). It is likely that the Ais chose to come and go as they pleased, never committing themselves to mission life or Christianity. It is also possible that other Indian groups sought refuge at the mission. During the times that the Ais, or other tribes, were present at Mission Dolores, daily activities were probably much like those at other missions. The friars devoted themselves to teaching the Indians Castillian Spanish and, in turn, learned the native language (Bolton 1962). Although communication was important, the friars believed that language was the first step toward educating the Indians about Catholicism. Converting the Indians to Catholicism was so important that special efforts were taken to insure that the children—vulnerable, impressionable, and potential converts—learned to read and write and speak the Spanish language.

Besides their religious education, the friars indoctrinated the Indians with Spanish culture to insure that they would become loyal subjects (Bolton 1962). The friars supervised every detail of mission life, i.e., they instructed the Indians in the skills that were necessary to operate the mission. Agriculture, animal husbandry, special skills, and crafts were all part of their education. The soldiers helped the friars in this education by supervising the planting and harvesting of crops, etc. The Indians were taught social skills, how to dress appropriately, and even music and the arts.

The relationships that missionaries developed with Indians across Texas served to create alliances for the Spaniards. Converted Indians, especially, tended to help defend the Spanish against their enemies and provided a security net at the isolated frontier outposts. Although various documents show that Mission Dolores failed to convert any Indians during the years in which it was in operation, their presence at the mission is known through the archeological record. Their interaction with the Spanish missionaries had effects about which modern researchers can only speculate.

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# The Marqués De Aguayo's Report to the King Regarding His Expedition to Restore and Establish Missions and Presidios in Texas, 1720-1722

*Translated and Edited by David McDonald, Kay Hindes, and Kathleen Gilmore*

The following transcription and translation is the official report made by the Marqués de San Miguel de Aguayo to the King of Spain of his tour of inspection of the northern frontier of New Spain from 1720-1722. This expedition "so solidified the Spanish claim to Texas that it was never again challenged by the French" (Newton 1996:71). Presented here for the first time, in his own words, is Aguayo's brief account of his expedition. We believe the document will serve as an important source of primary archival research to not only archeologists and historians working in the Spanish Colonial period, but to other disciplines as well.

Prior to the publication of this document no translated version of Aguayo's account of his expedition has been available to researchers. Foster (1995:145) correctly notes that no record of a diary account written by Aguayo has been found to date, but although certainly not as detailed as a daily log (or *derrotero*), the following report contributes to our knowledge and understanding of the expedition. Aguayo himself notes that a record exists of the expedition's route "which I have sent to be printed in Mexico" (Aguayo 1722). It is not clear if this statement indicates that Aguayo maintained his own daily log, or perhaps was referring to the one kept by Father Juan Antonio de la Peña (Forrestal 1935). The possibility that such a document may exist is important and exciting.

Although earlier historians (Buckley 1911; Castañeda 1936-1958; Hackett 1945), as well as more recent ones (Chipman 1992), obviously had access to the untranslated document or a similar one, apparently no translation was ever published of this particular account. Chipman (1992) references an additional report sent to the Viceroy by Aguayo, and while this document contains much of the same information as the report to the King, the following account is more inclusive. Archeologists and historians have relied primarily on the much more extensive and detailed account of the expedition recorded and written by Father Peña (Forrestal 1935).

The Aguayo account is presented here with minimal annotation. We acknowledge this could be considered a flaw of this article, but believe that in the interest of making the data available we are justified in doing so. Also, as noted above, a number of historians have previously presented richly annotated accounts and narratives of the expedition and we direct the interested reader to these additional published sources.

Located in the archival collections at the Old Spanish Missions Historical Research Library, Our Lady of the Lake University, in San Antonio, Texas, this document is one of two that Aguayo wrote to the Viceroy and the King detailing his expedition. The document was located by Research Historian Kay Hindes in 1997 while undertaking primary research regarding the first site of the Mission Nuestra Señora Espiritu Santo de Zuñiga, founded on Garcitas Creek in present day Victoria County. The mission was originally established in 1721, but not formally dedicated by Aguayo until 1722. The site of this mission has not been found to date, despite extensive field surveys and archival research. Hindes contacted two of her colleagues to assist in the verification, analysis, and translation of the document: David McDonald, an experienced translator of Spanish Colonial documents, and Dr. Kathleen Gilmore, historical archeologist. McDonald verified the document and produced a scholarly transcription and translation. Dr. Gilmore provided expertise concerning the veracity of the document, and provided funding for the translation.

This account currently is a part of the research studies associated with the site of 41VT4, La Salle's Fort St. Louis located on Garcitas Creek in present-day Victoria County. The document, found prior to the beginning of contracted research for this ongoing project, is direct confirmation and validation of Father Peña's account that the Spanish Presidio del Loreto, present by at least 1721, and formerly established by Aguayo in 1722, was built directly at the place where the French fort had been located as per the direct orders of the King. Additionally, we believe the document serves to clarify and elucidate a number of other areas for archeologists and historians interested in the Spanish Colonial period. We are grateful to Dr. James E. Bruseth and Mike Davis of the Archeology Division, Texas Historical Commission, and to Dr. Timothy K. Perttula, Texas Archeological Society Publications Editor, for their cooperation in the timely publication of this significant document.

Written in his own words, and read as such, we are able to begin to understand that a man of such importance as the Marqués de Aguayo needed and desired to undertake and perform a deed of great importance. By doing so, he was "responsible for the beginnings of colonization in Texas" (Newton 1996:71), and established his place firmly in our history.

## THE MARQUÉS DE AGUAYO'S REPORT TO THE KING REGARDING HIS EXPEDITION TO RESTORE AND ESTABLISH MISSIONS AND PRESIDIOS IN TEXAS, 1720-1722

*The Marqués de San Miguel de Aguayo, Captain General of the Military Arms of Your Majesty on the frontiers of New Spain, reports to Your Majesty that he has secured your beautiful province of the Texas Indians, the New Kingdom of the Philippines, by having established a presidio at the Bahia of Espiritu Santo, another presidio in the center of Texas, and another on the frontier near Natchitoches. Along with these fortifications, including the presidio of San Antonio (which was untenable), he also established nine missions and placed seventy Indian nations under the obedience of Your Majesty across this province, which extends two hundred fifty leagues in length and eighty in breadth.*[1]

//1 My good fortune to serve Your Majesty with the general command of these frontiers of New Spain reached its zenith with the honor that your royal generosity conferred upon me, by the dispatch you signed in Aranjuez on May 26, 1721. Thus with the knowledge that you had entrusted to my modest abilities the restoration of Texas, or New Philippines, the arms of Your Majesty have prevailed and with little more than a feint your legitimate domain was restored.

Misfortunes and various acts of war exiled Your Majesty's pleasing dominion of Texas (which borders on the confines of Coahuila), except for the Presidio of San Antonio. It would appear that all the denizens of Hell conspired to maintain this tyrannical empire by which barbarism was prolonged, resulting in the abominable scorn by which the Catholic religion was profaned by the barbarous, idolatrous Indians. It conspired to abolish the six missions by fomenting their diabolical astuteness, and by delaying my expedition by imposing the obstacle of severe storms.

During all of 1720, my departure from this province of Coahuila, or New Extremadura, was delayed by a great drought that caused the loss of 3,500 horses. The replacement of them, and all the military and food supplies, could not be achieved until the beginning of October. This is the time of copious rains of the Fall season, and I decided that I could not begin the march until the middle of November. The rivers flooded out of their banks with such forceful risings that they greatly hindered me in crossing with the six-hundred troops[2] plus twenty horses, six hundred steers, nine-hundred sheep, and eight-hundred mules for the baggage and food supplies. This is in addition to what was stored at the Presidios at San Juan Bautista and San Antonio. I was detained only by Rio Sabinas and the Rio del Norte (commonly called Rio Grande), which flows through this province [of Coahuila]. I remained at its banks until March 20, 1721, until its currents subsided and because of bad weather of the season that produced ice, snow, and rain. Flooding slowed the fifty swimmers whom I directed to cross using rafts made of wooden beams, barrels and rushes. I had no other way to cross the Rio del Norte. It was done with such effort and risk that some loads were lost, and two soldiers were endangered. From there, daily marches had to be adjusted because of the intense heat. All of the other sixteen rivers I found to be fordable //3 except the Trinity and the Neches, which flows by the site where the first mission was built. I spent nearly a month in crossing them. While we were there [at the Neches], the Comander of Texas, Monsieur St. Denis, came with a guard party and asked me to negotiate concerning the interests of the two crowns. His said that he knew Your Majesty had agreed to truces with France in Europe and that adherence to them should be observed in these lands. To that I responded according to the orders of Your Majesty which I now carried that authorized only defensive warfare, once that province was recovered. I said that it would be advisable for him to depart, to retreat immediately with all his people to Nachitoches,[3] the terminus prescribed my orders.

With his capitulation, he delivered to me the entire province. Continuing my march I re-established all the missions. I went among the Indians—as many as sixty nations in the remainder of this province—flattering them and providing gifts so that they would willingly render obedience to Your Majesty. I gave them to understand that Your Majesty would admit them under your royal patrimony; that you wished for them the greatest good: that they would come to know the True God, and that in return they were to congregate in the missions. They showed me that they would comply by planting crops, especially at Mission Concepcion //4 of Our Lady. It is in the center of the land of the Texas Indians, where I found many Caddodacho, Bidays, Yogdocas, and other nations that the Comandant St. Denis had recently convened. His intent (according to what I learned from the Texas Indians) was to take over the Bahía del Espiritu Santo and then to proceed to invade San Antonio (I had already been at La Bahía for four months, providing it with a presidio and forty soldiers).

These storm clouds faded like smoke with the arrival of Your Majesty's arms. And having reestablished the five missions (building again the churches and residences of the priests) I built a presidio in the center for their protection, designing the fortification to correspond to the twenty-five men planned for it. I continued my journey to Los Adaes, where I arrived on August 29. There, the comandante of Nachitos, Monsieur Rererenau, wanted to hinder our occupation of that place with chicanery. He said that he had no order from Mobile that would allow me to fortify and take possession of that area, and thus I would have to halt. But when I responded that I carried orders to the contrary that I was bound to execute at any cost, he yielded his position, capitulating like Comandant St. Denis—he whom we had running truces. Having reconnoitered all that frontier, I established the sixth mission and constructed a Presidio of one hundred men at the place that I found to be most advantageous for all. It is seven leagues from Nachitoches and a little more than a half league from a large lake, through which the Rio de Cadodachos passes and forms the Island of Nachitos. The presidio was completed in the form of a hexagon, that I sketched, removing from it three bastions so as to provide the mounting that it had to have for the six campaign artillery pieces that I brought.

I began my return on November 17. From the first steps, the returning was more troublesome than the coming because of the terrible weather. Rain, snow, and ice broke an infinite number of trees and uprooted them from the weight of the ice. So many horses, mules, and oxen died that, from the [land of the] Texas, almost all the people traveled on foot, the hardship being such that even officials marched in the same manner. I also made some marches on foot in order to share in the fatigue. Because of the shortage of mules and the slowness of the marches, my greatest concern was to zelously watch to see if the food supplies were faltering. But this did not happen, although we reached San Antonio with but 100 of the 800 mules and 50 of the 2,000 horses.

We had to leave behind, halfway along the road, about 150 loads and almost all the soldiers' saddles—to be watched over by guards. Nevertheless, I had the good fortune of not endangering a single soldier. Upon arrival in San Antonio, I recognized, as has been said, that the Presidio was vulnerable to any attack by Indians because it was completely indefensible. I surveyed and caused to begin construction of a fortification with four baluartes proportioned for a company of 54 soldiers.

I sent for replacements of mules and horses, and with those that I could gather, I went to La Bahía in order to strengthen that presidio with fifty soldiers and to set up the fortification at the place where Monsieur La Salle had his fort. As Your Majesty ordered, thus have I executed; for the location is still known of the holes where they burned the powder and buried the artillery. I found pieces of muskets and other iron pieces during the digging of the foundations, which I recorded in the sketch which, along with those of the other presidios, I am remitting to Your Majesty. Also included is the chart of the bay that I had sounded and the sand bar that was well reconnoitered. The bay will be secure as if locked with a key if a small fortress is built and equipped with artillery at the Cape of Nuestra Señora de Buena Fortuna.[4] There are two springs of sweet water there, but they can not 6// support more than twenty-five soldiers. When families come, a town could be established closer to the sea on the banks of the Guadalupe River. The route to Veracruz was determined, the coast being observed with a sloop rented at my expense for 305 pesos, in order to bring to La Bahía the supplies that came in my care. I have requested payment of 1,300 pesos from Your Majesty. Having supplied the captain of the presidio, provided for the fortification of that port, and increased his staff by fifty men, I returned to San Antonio in accord with my orders. Supplied with fresh horses, I continued the return march [to Coahuila] in order to reduce the license [term of service] for the rest of the troops, which I effected in this capital[5] on the 31st of the past month.

The result of my expedition is in accord with most recent orders of Your Majesty: a barricade has been formed by the presidios that I constructed in that province, equiping it as bastion for the Kingdoms of New Spain. The missions have been increased, as the Catholic zeal of Your Majesty desires. In addition to the six missions that I restablished among the Texas Indians, there is now one in La Bahía and two in San Antonio, including the mission that was already there before my expedition, 7// and many Indians were left congregated in them, as is demonstrated by the testimonies of the foundings which I am remitting to Your Majesty.

For the progress, establishment, and maintenance of this province, as well as to save Your Majesty many expenditures by not having to maintain so many soldiers or presidios, it is indispensable to settle it with two-hundred families of Spaniards from Galicia, the Canary Islands, or Havana. For these are people better equipped to work in this climate. Also needed are another two hundred families from Gran Tlaxcala which, by way of Veracruz, could arrive at La Bahía for a modest cost. The Tlaxcalans have proven themselves in all parts of the colony, and since they are very devoted to the Divine Cult their example would serve as a great stimulus to [reduce] that interminable gentilism. The two hundred families could be distributed among La Bahía, San Antonio, the missions of Adaes and the Texas Indians. Another town of Spaniards and Tlaxcalans could be founded half-way along the road at either of the two points of Anguila or Nuestra Senora de Buena Vista, for the one hundred seventy-two leagues between San Antonio and the first mission of Texas[6] are unpopulated. Without these families //8 it will be difficult if not impossible to maintain that province— which should be for Your Majesty one of the best in America because of the great fertility and amenities of the land (which is specifically expressed in the record of the expedition's route, which I have sent to be printed in Mexico). The province is suitable of all types of crops and livestock and is lacking in nothing but agriculture and a populace who, as they explore the land, will solicit the richest mining claims so they can be worked for the pleasure of Your Majesty. [In turn], Your Majesty could employ your treasures to rescue the innumerable souls who live in the unhappy captivity of idolatry, whose voracious flames are being vanquished by the ocean within the immense sea of grace of Holy Baptism that is frequently administered.

I have desired in this enterprise to discharge my obligation and my love for the royal service of Your Majesty, in which I hope the little I have done may supplement the great desire I have had for its completion. If Your Majesty provides, bequeathing for my service, I will obtain the greatest prize to which I have aspired. Even though my broken health persists—which began upon leaving San Antonio—I take [pride][7] in having employed that also in the service of Your Majesty. Having concluded with the recovery//9 of that province, insofar that it was made my responsibility, I left those provinces and obtained permission to retire to my home, which I did this week. Nevertheless, I would still go forth to whatever part of the world that Your Majesty may order. As long as I have breath, I will not lack the will to employ my life in the service of Your Majesty. May God watch over the Catholic and Royal Person of Your Majesty for the many years that Christianity has need of you. Coahuila, June 13, 1722

[signed] El Marq.s de S.n Miguel
de Aguaio [rubric]

## END NOTES

[1]Or 657 miles by 210 miles, at 2.63 miles per league (based on the standard that one linear league = 5,000 *varas*, at 33.33 inches/vara).

[2]Six hundred troops. The text says "arreglados," which means orderly, arranged, etc. Although it does not specifically mean troops, that is what is implied here.

[3]Nachitos.

[4]Possibly near present Port O'Conner.

[5]Saltillo, May 31, 1722.

[6]San Francisco de los Tejas, founded 1690.

[7]"saco avsuras (absuras?)." The spelling of this is unclear, but the context requires a word such as "pride" or "satisfaction."

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# Bronze Cannons and Ardent Spirits at La Bahía

*Curtis Tunnell*


## ABSTRACT

A cache of copper and iron artifacts excavated near Mission Espiritu Santo at Goliad in 1930 are described and related to Spanish documents of the period. Two bronze cannons and a large copper still in the cache add significantly to our knowledge of Spanish colonial material culture in Texas.


## INTRODUCTION

La Bahía, Spanish for "The Bay," was a term originally applied to the Spanish Presidio Nuestra Señora de Loreto located on the site of La Salle's Fort Saint Louis at the head of Lavaca Bay. After subsequent relocations, the Presidio and Mission Nuestra Señora del Espíritu Santo de Zuñiga were established on the San Antonio River near Goliad, Texas, in 1749 (Roell 1996:1180). A settlement known as La Bahía grew up around the presídio and mission. In this paper, the term La Bahía refers to the entire complex of presídio, mission, and townsite.

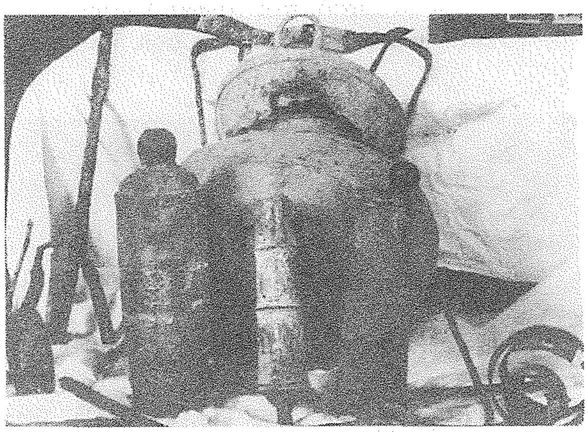

Figure 1. Parts of Two Bronze Cannons, Large Copper Pot, and other Items Excavated near Mission Espiritu Santo in September 1930, by Gus Leeder, Harley Johnson, and Sam Johnson. Special Collections, Victoria College.

## BRONZE CANNONS

The two bronze cannons from La Bahía first came to my attention about 1970, when the Texas Parks and Wildlife Department was installing interpretive exhibits at Goliad State Park. Virtually no provenience information was available on the cannons at that time, but it was assumed that they had been found at that site because of the notation "Site Find" on the catalog card. After the Texas Historical Commission began working on La Salle's ship La Belle in 1997, several people told us that we should examine the old "French Cannon" at Goliad State Park. There were some recent news articles that mentioned a French cannon at Goliad that may have been brought over by La Salle. On a trip to the coast, I stopped by Goliad and asked if they had a French cannon. The park attendant said that indeed they had a French gun and took me to an exhibit case. There was one of the Spanish bronze cannons that I remembered from years back. The elaborate dedication plaque on the cannon is a bit obscure (Figure 1), but the gun is obviously Spanish in origin. This cannon is illustrated and properly attributed as being of Spanish origin in *The Presídio La Bahía del Espíritu Santo de Zuñiga* (O'Connor 1966:54).

Adding to the confusion over the identity of these guns was an article in the *Goliad Advance Guard*, dated October 27, 1930, which quotes Yoakum (1855:22):

> Beaujeau sailed on the 12th of March, 1685, thus leaving La Salle with eight

> cannons, and not a single ball. These pieces of artillery were afterwards transported to La Bahía (now Goliad), and used by the Spaniards till 1812...where as late as 1838, they were seen, with the impression of Louis XIV upon them.

We now know that this statement is not true, because the eight La Salle cannons were excavated in September 1997 by the Texas Historical Commission at Fort Saint Louis on Garcitas Creek where they were buried by Don Alonzo De León in 1689 (Tunnell 1998). In the book *Prairiedom: Rambles and Scrambles in Texas or New Estremadura* (Suthron 1845:140) it is said: "Goliad was first settled in 1662 [sic] by M. La Salle, a Frenchman. Some of his descendants, it is said, now live here, and there are French cannon here which they brought, with the impression of Louis XIV, on them." Again, this statement is so patently permeated with errors that it is meaningless, but it nevertheless has contributed to the myth of French cannons at Goliad.

## FINDING OF THE BRONZE GUNS

It all started with an article in *Popular Mechanics* magazine in early 1930, describing how to build a metal detecting device. August Leeder of Center Point, Texas, was mechanically inclined and decided to try his hand at making one of the contraptions. Harley Johnson was born and raised in Goliad, but was working at a hospital in Kerrville when he met Gus Leeder. Harley's older brother, Sam Johnson, was still living on the farm at Goliad and had long dreamed of finding buried treasures around the old Spanish mission and Presídio (La Bahía) on the San Antonio River.

One conversation led to another, and in September 1930, Gus and Harley arrived at the Johnson farm in Goliad with the "electrical-magnetic" machine which Gus had built. Well, it did not take long for them to strike paydirt. On about the 10th of September, they made a big hit down by the river near the old mission (Nuestra Señora del Espíritu Santo de Zuñiga, third location). After digging down a few feet, they were flabbergasted to find a large bronze cannon, which had been cut through the middle into two pieces (Figure 2). The cannon was some five feet long, with a bore diameter of three and one-eighth inches, and with one trunion missing. The cannon had an eroded Spanish coat of arms and some other markings. Along with the cannon, they found two large copper vessels and many other artifacts (see Figure 1). Partially filling-in the hole and taking their treasures home, they began to worry about reporting the find.

Judge Fowler of the Fannin Battlefield Commission and County Judge J. A. White of Goliad already had gotten news of the treasure seeker's activities. Being avid history buffs, they wasted no time in going out to the Johnson farm where they found the cannon in the front yard, covered with a cottonsack. On September 13th, the Johnsons and Leeder brought the cannon to Judge White's office (see Figure 2), and surrendered it when they were assured that they were not giving up any "finders rights" which they might have. The receipt which they received, on Judge White's stationery and dated September 13, 1930 (Goliad County Library, Judge White collection), reads in part:

> This is to certify that August Leeder, Harley Johnson, and Sam Johnson, have

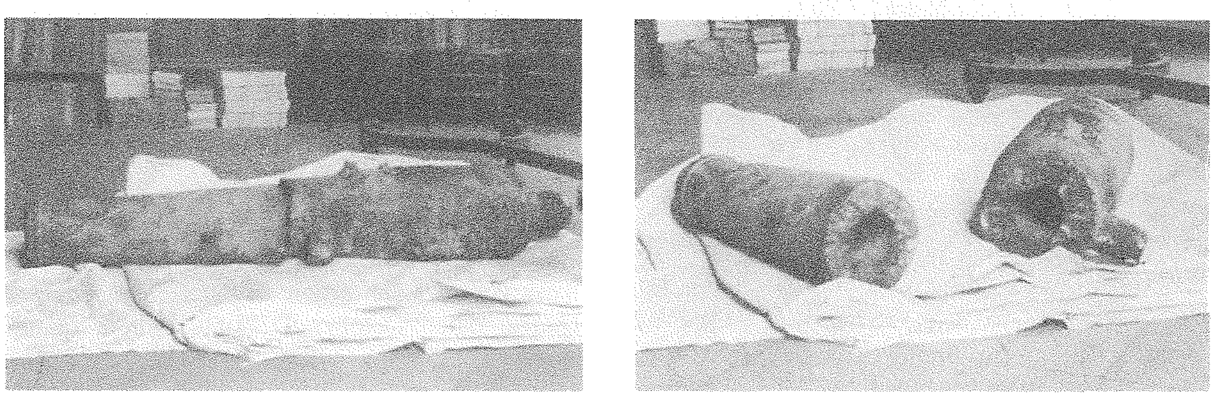

Figure 2. Spanish Bronze Cannon GOSP-419 as found in 1930. Special Collections, Victoria College.

> this day brought to my office an ancient cannon which the parties state they found near La Bahía Mission on the San Antonio River, the cannon being dug out of the ground. This cannon has been left with me by the parties above mentioned with the understanding on their part that they do not relinquish or abandon any legal rights they may have as finders of the cannon. They state they recognize State ownership in the cannon and only ask to be protected in so far as their rights as finders obtain (Goliad County Library, Judge White collection).

The document is signed by Judge White, Leeder, and the two Johnsons. Judge White explained to them: "That a river's bend was state property and that property could not be legally claimed by a finder if the finder knew it's rightful owner" (*Goliad Advance Guard*, September 25, 1930).

Now that an understanding had been reached, Leeder and the Johnsons carried out more digging in the "treasure hole." Judge White described their metal detector as a wire-covered frame attached to a battery and earphones. The frame was carried on the operator's shoulders and a buzzing noise was heard. The judge tried the instrument and said it worked perfectly (*Goliad Advance Guard*, September 25, 1930). Soon they had found the breech half of another bronze Spanish cannon with elaborate decoration. Excitement filled the air. The finders invited Governor Dan Moody to come to Goliad and receive the cannons. He declined and urged them to keep the whole matter quiet. Ms. Clara Driscoll was also invited, but had other travel plans. Lawyers were consulted. Local newspapers carried stories of the finds. A state-wide tour of the cannons was discussed. By September 19th, Judge White had both halves of both cannons in his office, and the public was invited to view them. An article in the *Houston Chronicle* dated September 19, 1930, says in part:

> The second cannon unearthed near La Bahía Mission within a week was delivered to County Judge J. A. White by Sam Johnson, one of the finders of the first cannon, which was located with the aid of an electrical instrument. Both were found at the same spot. The success with which the ancient guns were discovered by use of an electrical instrument probably will cause extensive employment of such devices in similar searches. [The beginning of an era!]

The smaller bronze cannon, also in two pieces, was ornately decorated with a crest, obscure writings, and decorations, which resembled fleur-de-lis (see discussion below). This cannon was about four feet long, with a one and 3/4-inch bore and both trunions intact. Almost immediately, people and the press began to speculate that this cannon might be of French origin, and may have even come over with La Salle. Locally, this has been known as a "French cannon" to the present day.

In May 1931, Senator J. W. Stevenson of Victoria asked the Legislature to appropriate $3,000, "an exorbitant sum," to settle with the cannon finders. In a letter to Judge White, dated May 14, 1931 (Goliad County Library, Judge White collection), Senator Stevenson says: "There are two or three men who are claiming ownership of the cannon taken out of the grounds of La Bahía Mission. I do not think these claimants have any valid claim on these relics. However, I am willing to make a fair settlement with them if my associates in the Legislature will agree" (Goliad County Library, Judge White collection). Alas, no record has been found that the Senator was successful in getting his legislative colleagues to appropriate money for cannons in what must have been a very tight-money session.

The two halves of both cannons were soldered back together, and after a time in Judge White's office, they were put on permanent exhibit in Goliad State Park. In fact, the cannons and other artifacts recovered in 1930 were instrumental in getting public support for creation of the park by the Legislature in March 1931.

In a letter from Judge White to a Mr. McVea in Houston, he says in part: "The parties who found them [the cannons] were searching for money, and did their work at night. They surrendered the cannon and pots to me as county judge. We feel that the cannon should eventually be placed in the Goliad State Park for permanent exhibit." And so it has been for over 60 years.

Leopold Morris of the *Victoria Advocate* made a serious attempt to identify the markings on the two cannons. A letter to Morris from O. J. Gatchell of the Ordinance Department dated October 7, 1930

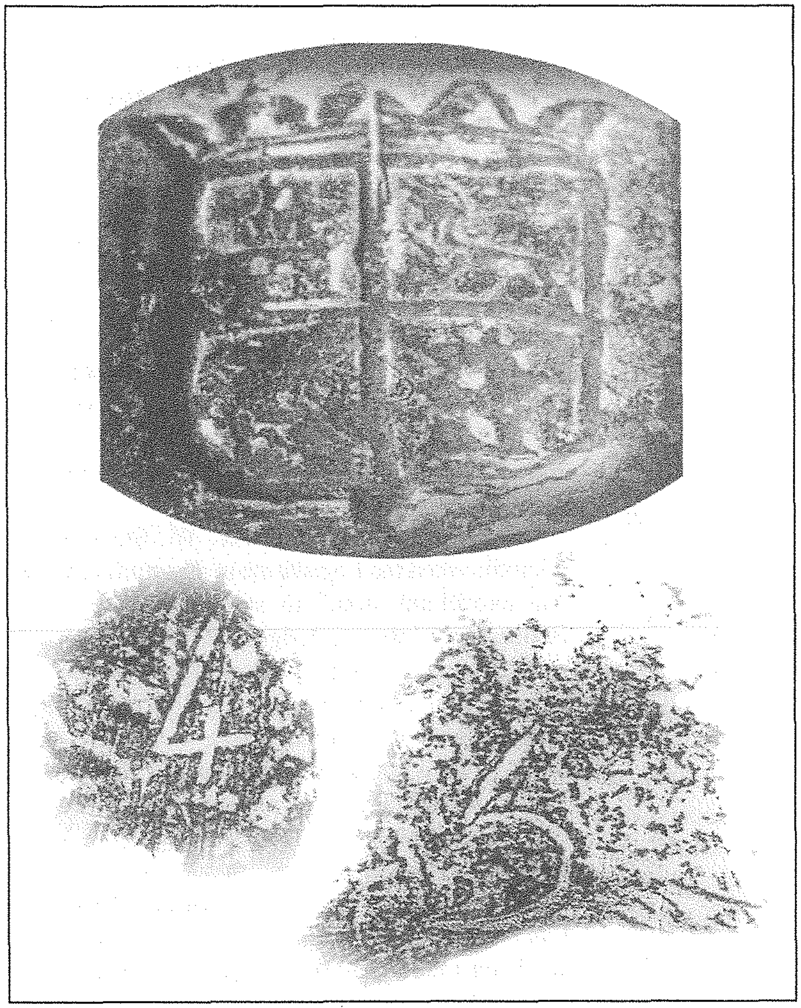

Figure 3. Spanish Bronze Cannon GOSP-419, Crest and Poundage Marks.

states in part: "It would be impossible to determine the age of the old cannon found near Goliad, Texas. It is most likely a Spanish gun. The copy of the coat of arms [Figure 3] is too indistinct to be identified." So on October 13, 1930, Morris wrote Judge White: "Please be so kind as to send me three wax impressions of the coat-of-arms of each of the two cannons. Will send them to Washington, Mexico City and Madrid for possible identification." Roscoe Martin of the University of Texas in Austin, wrote Judge White on December 6, 1930: "I am writing with reference to the impressions which you gave me when I was in Goliad two or three weeks ago of the coats of arms on the old cannon in your office. I have turned our impressions over to the Librarian here and he has two or three people searching for a record of them in various books of our library." Unfortunately, no identifications of the markings on the two cannons were forthcoming from the many sources consulted.

## DESCRIPTION OF THE LARGER CANNON (CATALOG NUMBER GOSP-419)

The first cannon found by Leeder and the Johnsons is of cast brass or bronze. It had been cut through immediately in front of the trunions (see Figure 2), and one trunion and both lifting handles had been removed. Deeply impressed hammer blows occur on both sides of the cut which severed the cannon before it was buried. The gun is relatively devoid of decoration except for a badly eroded crest immediately toward the breech from the lifting handles (see Figure 3). The touchhole has been spiked. The figure "4" was chisel-cut into the top of the gun near the muzzle, and a "5" appears between the breech and the crest (see Figure 3). There is a distinct reinforce at the breech, and the knob of the cascabel is large and spherical (Figure 4).

Careful scrutiny under strong light, revealed that this cannon was pieced together from three fragments of similar-size cannons. The breech piece is about one-fourth of the cannon length and contains the "5" mark. The midsection is about one-half of the cannon length and contains the raised crest. The muzzle piece is about one-fourth of the length and contains the "4" mark. The seams where the three fragments were attached are straight, thin, smooth, and almost invisible. Probably, salvaged fragments of guns which had exploded or cracked, were joined in a foundry to form this "Frankenstein" cannon. It is likely that the "4" indicates a fragment of a four-pounder cannon and the "5" a five-pounder piece. In the bore, an iron pipe was driven through the length of the cannon except for the forward 10 centimeters. This probably strengthened this pieced-together cannon for firing and assured that the bore was a consistent diameter

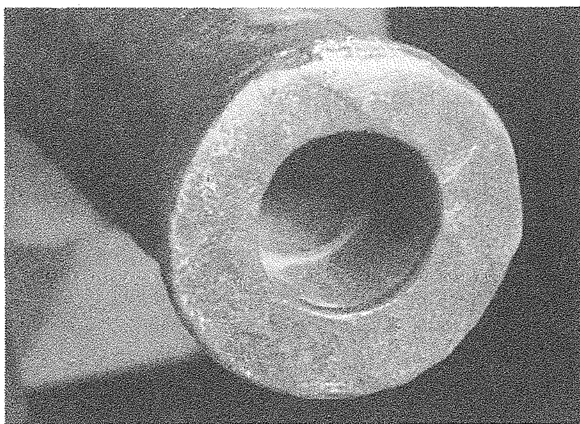

Figure 4. Spanish Bronze Cannon GOSP-419.

throughout the length. The chisel-cut through the cannon at the time of burial, was crudely soldered together at the time it was recovered in 1930. Dimensions of this cannon appear in Figure 5. At the time of documentation, this cannon was mounted on a crudely wrought wooden carriage and rested atop a mock bastion in the exhibit hall of Goliad State Park; consequently, its weight could not be determined.

## DESCRIPTION OF THE SMALLER CANNON (CATALOG NUMBER GOSP-148)

The Texas Parks and Wildlife staff graciously removed the smaller cannon from an exhibit case where it had rested for 25 years, in order to make it available for study by this researcher. This brass or bronze gun weighs no more than about 100 pounds and is cylindrical in shape (Figure 6). This small ornate cannon likely was a presentation piece used more for saluting, signaling, and ceremonial purposes than for defense. It saw heavy use through many years of service. The bore of the gun shows a myriad of linear striations running lengthwise where cannonballs and perhaps chain, nails, stones, and other things were fired through it. The touchhole is eroded into a broad pit and has been spiked.

This gun is richly ornamented with both molded and chased decorations. The muzzle face is decorated with a molded floral motif, and there is a bevel down to the bore (Figure 7). A series of six raised rings or reinforcements divide the barrel into segments, with the first rings being at the muzzle and the sixth set at the breech (see Figure 6). Between the fourth and the fifth rings is a raised crest with chased burgees or pennants on either side (Figure 8), and small impressed stamps of a lion passant and crest with the name "JURADO." Jurado is a common name in southern Spain, and almost certainly identifies the maker of this cannon.

Toward the breech from the third and fifth rings are chased designs resembling fleur-de-lis, which have probably led to this cannon being wrongly attributed for decades to the French (see Figure 7). Philip V ruled Spain between 1700 and 1746, and he was a grandson of Louis XIV and

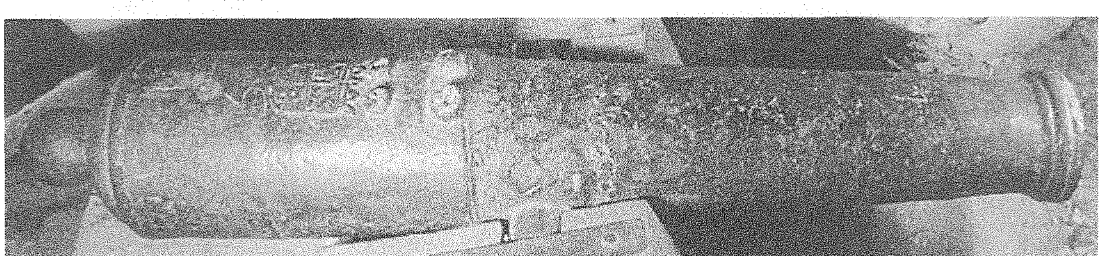

Figure 5. Spanish Bronze Cannon GOSP-419. Overall length=1210 mm; Breech to muzzle length=1065 mm; Breech to trunion length=465 mm; Muzzle to repaired break=530 mm; Trunion length=75 mm; Trunion diameters=68 mm; Cascabel knob diameter=100 mm; Diameter at breech=220 mm; Diameter at trunions=195 mm; Diameter at muzzle=160 mm; Bore diameter at muzzle=78 mm; Breech to touch hole=100 mm; Breech to seam in tube=170 mm; Muzzle to seam in tube=250 mm; Muzzle to "4"=180 mm; Muzzle to "5"=160 mm.

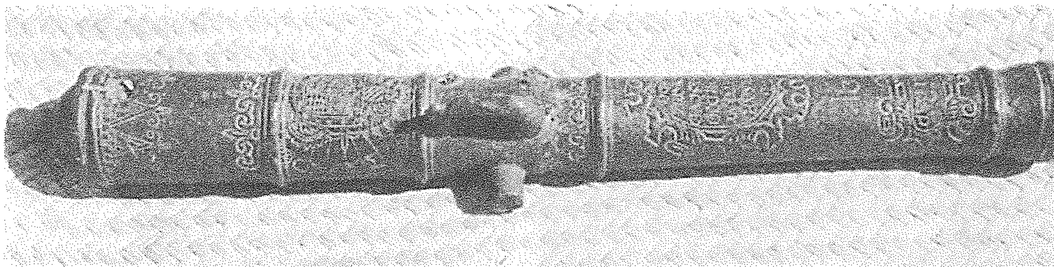

Figure 6. Spanish Bronze Cannon GOSP-418. Found at Espiritu Santo in 1930. Overall length=1042 mm; Breech to muzzle length=962 mm; Breech to trunion length=415 mm; Muzzle to repaired break=500 mm; Trunions face to face=166 mm; Trunion diameters=39 and 40 mm; Cascabel knob diameter=40 mm; Diameter at breech=122 mm; Diameter at trunions=96 mm; Diameter at muzzle=101 mm; Bore diameter at muzzle=46 mm; Breech to touch hole=48 mm; Muzzle face to first rings=63 mm; First to second rings=372 mm; Second to third rings=165 mm; Third to fourth rings=136 mm; Fourth to fifth rings=165 mm.

Figure 7. Spanish Bronze Cannon GOSP-148.

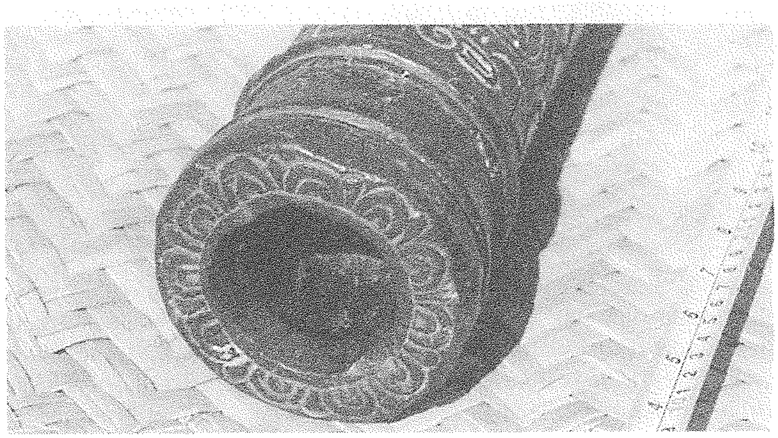


Figure 8. Spanish Bronze Cannon GOSP-148. Crest, chased flags, and stamped mark.

born at Versailles. A Fleur-de-lis design could well have been used in Spain during his reign.

Between the second and third rings is a cartouche with "San Juan Bautista" and a "91" (see Figure 7). Below the "91" is a chased medallion with obscure wording which says: "DEL SARGENTO MAYÓR DON JUAN ESCUDERO Y ARN EDO." The letters are all run together and complicated by use of small subletters, double letters, and backward "N's," as if done by someone of limited literacy (Figure 9). This panel may well attribute this ceremonial cannon to the person who had it commissioned.

Like the larger cannon, this small one was cut into two pieces immediately on the muzzle side of the trunions at the time of its burial. After its recovery in 1930, it was soldered back together rather crudely, with the joint being incompletely closed on the bottom side of the cannon. The modern solder protrudes about 1 cm into the bore.

One of the lifting handles is missing from the top of the cannon and the one remaining probably represents a jumping dolphin, but it is very crudely executed. The rings on the bottom side of the gun are heavily worn, as if the gun was often dragged-around on this face. On either side of the breech end of the gun are many fine chisel marks and scratches in a random pattern, covering an area some 80 mm in diameter. There is a prominent bulge at the base of the breech, and the cascabel is long and narrow with a small knob on the end. Dimensions of this cannon appear in Figure 6.

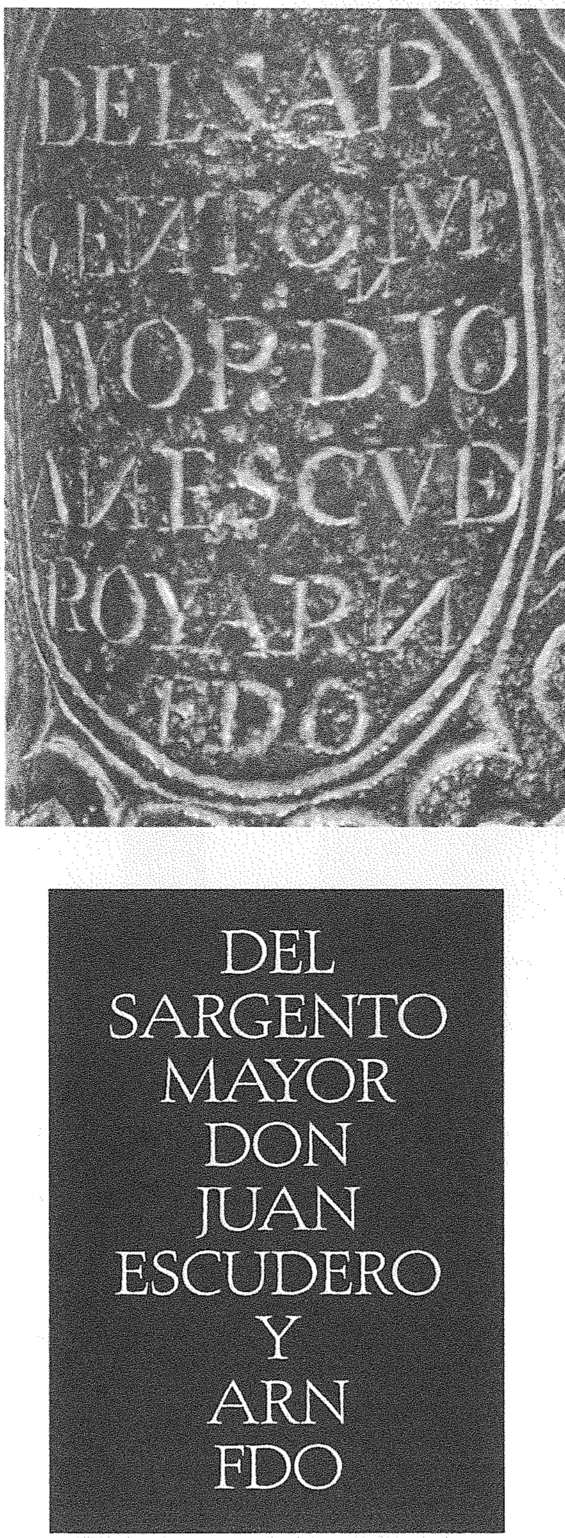


Figure 9. Presentation Plaque on Spanish Bronze Cannon GOSP-148.

## IDENTIFICATION OF THE CRESTS

Considerable effort has been expended in attempting to identify the coats-of-arms on the two bronze cannons from La Bahía, and has met with some success. The heavily eroded crest on the larger cannon, GOSP-419, has not been identified with certainty, but Dr. John de Bry of the Center for Historical Archaeology in Florida feels that it is "clearly Spanish" and probably is a device awarded after a naval battle to the first seaman or officer to board an enemy ship.

Dr. de Bry, working with Michel Paret, an archivist in Seville, was successful in finding the crest-of-arms from the small cannon (GOSP-148), in a listing of 13,000 coats-of-arms. It belongs to the family Arnuero, from a place name Muruelo, jurisdiction of Villa de Santoño, in the province of Santandér. The owner of the crest appears to be José Prado Guenes Arneuro y de la Sota, who received the Order of Alcantara, as shown in the crest, in the year 1737. This may indicate that the cannon was cast soon after that date.

## CONCLUSIONS CONCERNING THE CANNONS

The two bronze cannons from La Bahía add significantly to our inventory of Spanish Colonial material culture in Texas. We may never know for sure if the guns were cast in Mexico or in Spain. In any case, the two cannons must have been of considerable value at this remote outpost, where they had been brought across many rivers by oxcart or pack animals. They appear to have been used for decades.

It is said that gunners liked bronze guns because they would bulge before they cracked, and crack before they burst. Iron guns, on the other hand, would sometimes explode disastrously without warning. Another advantage of these small guns was their relatively light weight, as they could be easily maneuvered by two or three men. Four and six-pounder iron guns, like the French cannons found at Fort Saint Louis (Tunnell 1998:40), weigh-in at 800 to 1000 pounds and are much more difficult to handle.

These small bronze cannons were probably used more often for ceremonial occasions than for defense or offense. Such guns serve well for celebrating weddings, funerals, patriotic holidays, and saluting the arrival of dignitaries. Also, the noise and fire that issued from these cannons were very effective in intimidating Native Americans who were unaccustomed to such firepower.

Soon after Presídio La Bahía and Mission Espíritu Santo were moved to the San Antonio River in 1749, on the recommendation of José de Escandon, the well-armed garrison had six eight-pounder cannons (Roell 1996:1068). It is not specified if these large guns were iron or bronze, but at that date they were likely iron. There is no mention of the two small bronze guns being at the settlement in 1750. Governor Martos y Navarrete (1762) inspected the Presídio in 1762 and mentioned six eight-pounder cannons made of iron and two swivel guns, but makes no mention of the two small bronze cannons.

Captain Juan Cortés, who commanded the Presídio in 1795, reported that there were eight serviceable cannons at La Bahía of twelve and sixteen caliber, with gunners ladles, wool swabs, waddings, and powder scoops (Cortés 1796). However, he said that because they lacked experienced people to serve these guns, he had no faith in the utility of this artillery should it need to be used. "I have no confidence in the troop in charge of the cannons...because the Presídio is laid out without any order in the town's center, the cannons would destroy the larger part of the houses if served with ball and shot" (Cortés 1796).

Upon returning from a trip to Nacogdoches, Captain Cortés recovered two bronze cannons that had been abandoned by Don António Gil Ybarbo at the old townsite of Pilár de Bucareli on the Trinity River (Castañeda 1942:180). Gil Ybarbo had transported four bronze and two iron cannons from Presídio Los Adaes to Bucareli when it was established back in 1774 (Castañeda 1939:315). Captain Cortés said in a January 16, 1796 letter to Governor Munoz:

> As for the cannons at Nacogdoches, I can only say that I saw them resting on the earth without carriages, supported only by logs. In just such a condition did I find the bronze guns I observed on the Trinity River, where they were abandoned by Don António Gil Ybarbo (the ones Your Honor ordered brought hither) (Cortés 1796).

Then, in May 1795, Ensign Cadena brought back to La Bahía a bronze swivel gun from the Trinity River crossing where Bucareli had once stood (Cortés 1795). This put at least three old bronze cannons of unspecified poundage at La Bahía in 1795.

Since Mission Espíritu Santo had only two small cracked bells, Captain Cortés requested that the governor send a master craftsman to melt-down the bronze cannons found at old Bucareli and cast substantial bells for the church, but permission was denied by the governor. In 1797, the mission was still requesting new bells, and eventually was granted bells from one of the San Antonio missions that had been secularized (Castañeda 1942:180). A former presidial commander at La Bahía left a long outstanding debt of 400 pesos due Mission Espíritu Santo. One wonders if two of the old bronze cannons may have been given by Captain Cortés, to the Mission as potential bell metal, in payment of this debt.

It seems likely that the two bronze cannons excavated near Mission Espíritu Santo in 1930, were at Presídio Los Adaes, then were moved to Pilár de Bucareli by Gil Ibarbo in 1774, were abandoned on this site from 1779 until 1795, when they were transported to La Bahía. Captain Cortés obviously thought little of the guns and proposed that they be melted to make bells for the mission. The final question is when and by whom the guns were destroyed and buried beside the San Antonio River.

The following hypotheses concerning the cannons are proposed:

1. That the two bronze cannons excavated near Mission Espíritu Santo in 1930, began their Texas odyssey at Presídio San Juan Bautista on the Río Grande in the early 18th century;

2. That at some later date they were moved to Presídio Los Adaes which confronted the French at Natchitoches;

3. That they were transported in 1774, along with two other bronze guns and two of iron, by Don António Gil Ybarbo to the new village of Pilár de Bucareli on the Trinity River;

4. That when Bucareli was abandoned after a

disastrous flood in 1779, the bronze cannons lay hidden and ignored beside the Trinity River for the next 16 years;

5. That in 1795, Captain Cortés found and recovered the old bronze cannons and transported them to Presídio La Bahía on the San Antonio River;

6. That since the Presídio had much larger and more serviceable guns, Cortés asked permission to have the old bronze guns made into bells, but permission was denied;

7. That to settle a long overdue debt of 400 pesos by previous commander Manuel Espadas, Captain Cortés cut the two least serviceable bronze guns (excluding the bronze swivel) into pieces and gave them to Mission Espíritu Santo as potential bell metal, at the time of his retirement in 1797;

8. That when secularization finally came to the dilapidated and mostly deserted Mission Espíritu Santo in 1830, the priest had the parishioners bury the old cannon fragments, a huge copper pot (see below), and other items not worth transporting to San Antonio, and of no use to the few remaining families; and

9. That the old bronze cannon fragments faded from the memory of local families and lay in their pit beside the San Antonio River until found by Gus Leeder's metal detector in September 1930.

In 1846, the City of Goliad reserved the old Mission grounds and 20 acres of land to serve as the site for county or college buildings. The City and County of Goliad transferred this site to the State on March 24, 1931, for use as a historic park.

## COPPER STILL OR PERÓL

Spanish documents, so rich in detail on many subjects, remain largely silent concerning the availability and use of alcoholic beverages on the Texas frontier. Most would agree that ardent spirits must have been required to relieve some of the misery and pain in this dangerous and remote outpost of New Spain. A spectacular artifact in the museum at Goliad State Park may reveal that distilled spirits were indeed available to the soldiers, settlers, and clerics of La Bahía.

Using a home-made metal detector, Gus Leeder, Harley Johnson, and Sam Johnson located and excavated a giant copper vessel (GOSP-421) along with two destroyed bronze cannons in 1930 (Figure 10; see also Figure 1). Quite a variety of artifacts were found by the treasure hunters in a pit near Mission Espíritu Santo, and due to the efforts of County Judge J. A. White, the cannons and large spherical copper vessel were preserved in the newly created state park.

Although I saw the large copper vessel in 1970, it meant nothing to me at the time. But while studying primitive distilleries (*viñatas*) in the Chihuahuan desert around La Junta in the mid-1980s, I saw a number of large spherical copper vessels used in the distilling of sotól liquor. When I again saw the vessel in the museum at Goliad State Park, in 1998, I recognized it immediately as a "peról" for distilling liquor.

## DESCRIPTION OF THE PERÓL

This beautiful example of Spanish Colonial craftsmanship is almost identical in size and conformation to the recent peróls around La Junta

Figure 10. Copper peról excavated near Mission Espiritu Santo in 1930.

(Figure 11), but it is more ornate in execution. The peról is made from three pieces of hammered copper, put together with elaborate riveted joins (Figure 12), forming a spherical vessel 256 cm in circumference around the middle and 70 cm deep from lip to bottom. The vertical neck of the vessel is 26 cm in diameter and 5.5 to 6.0 cm in height, ending in a rolled lip. Just below the bottom join is a drainage hole 10 cm in diameter with a riveted reinforcing band around the circumference. This drain facilitated the removal of water and dregs from the peról between distillations. The bottom of the peról is somewhat flattened.

The copper sheets from which the peról is formed are a uniform thickness of about 0.3-0.5 mm. The joins were formed by overlapping the sheets by 3.7-4.0 cm. The upper sheet and lower sheet both overlap the central body sheet. Heavy rivets are spaced evenly at 4.5 cm intervals along both joins. The rivets protrude about 5 mm on the outside and are surrounded by a hexagonal pattern of four rows of chisel marks (see Figure 12). On the inside of the vessel, the rivets are hammered flush with the surface. A chased mark along the back edge of the join completes the design.

The peról has extensive damage, including missing fragments on the backside, and these may have occurred during its burial and excavation. Riveted repairs to some of these breaks were made in the 1930s.

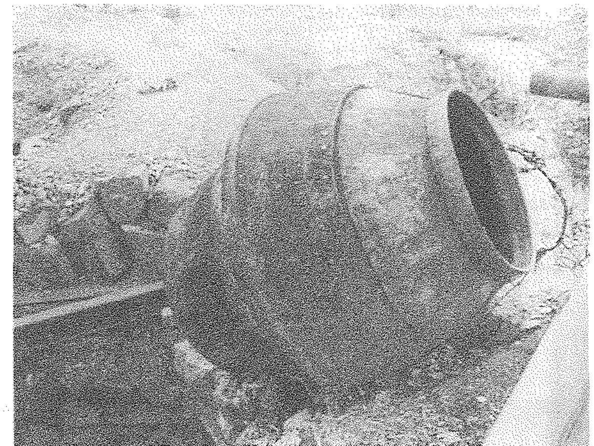

Figure 11. Copper perol at Vinata Las Perlas, Chihuahua.

Figure 12. Riveted Join on Copper Perol GOSP-421.

## PRODUCTION OF DISTILLED ALCOHOL

Sources of sugars for distillation during the colonial period at La Bahía could have included grains, sugar cane, and agaves. Since grain and sugar cane would have been in demand as food, agaves may have been a more likely source of liquors. Knowledge of preparing alcoholic beverages from agaves was probably brought from Mexico by many of the settlers. Agaves still abound around La Bahía today.

Many kinds of agaves, yuccas, and sotóls have hearts rich in starch and sugars. Mature plants are pried out of the ground with an iron bar and the leaves chopped off with a machete. The hearts (*piñas*) are baked in an earth oven, chopped into pieces, and fermented in wooden vats in the ground (Tunnell and Madrid 1988:154).

After several days of fermenting, the juice (*caldo*) is placed in a spherical copper peról of about 400-600 liters capacity and boiled over a hot fire (Figure 13). A section of hollow log (*pipote*) is sealed on top of the peról with mash and catches the steam. A tube (*serpentina*) of copper or cane carries the steam through a cooling vat and liquor drips from the end of the tube. The product of the first distillation is called "vino" and contains impurities which can cause headache and hangover. After draining and cleaning of the peról, a second distillation of the vino produces a much finer and stronger liquor. Fragments of green glass bottles are found on most Spanish sites in Texas, and liquor could have been kept in these or even in glazed clay bottles and pitchers.

Liquor not only served as an intoxicating beverage on this remote frontier, but it was also an important medication for many illnesses. Efficacy of the alcohol as medication was likely enhanced by the addition of various herbs (Tunnell and Madrid 1988:159). In 1768, Fray José de Solís reported that excellent peaches and figs were harvested in large quantities by the neophytes at Mission Espíritu Santo (Castañeda 1939:32). Soaking

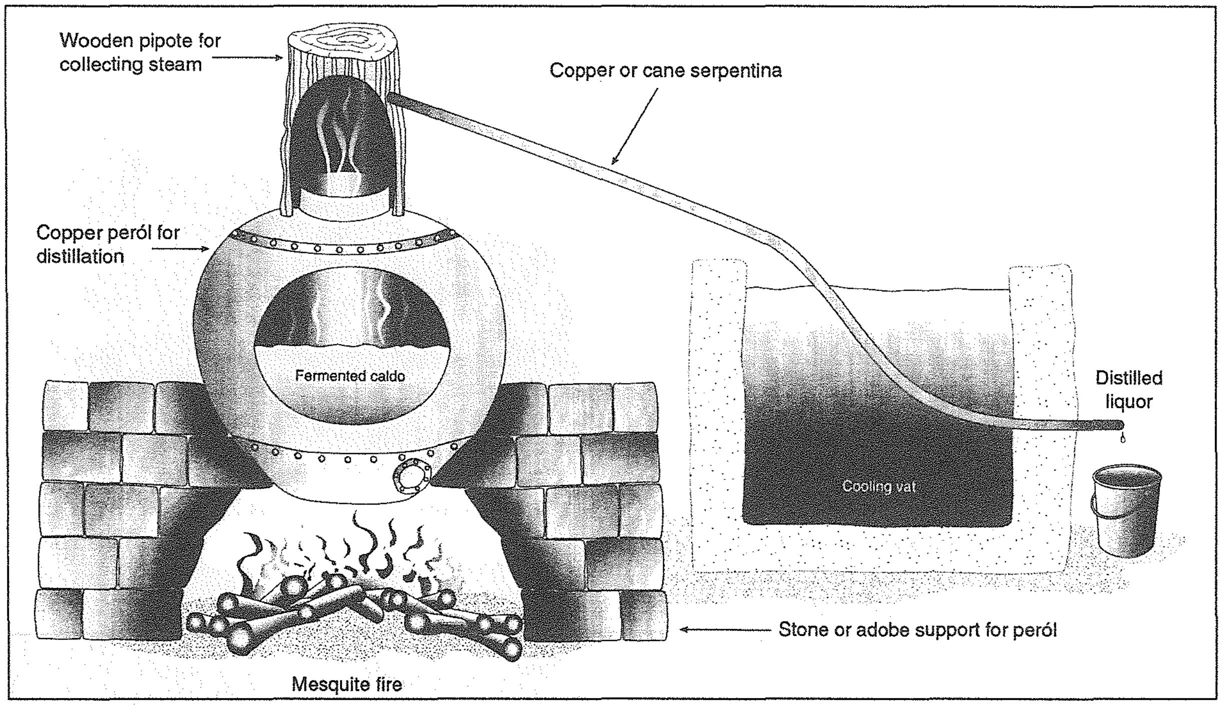


Figure 13. Use of copper peról for distillation of ardent spirits.

of these fruits in the distilled liquor could produce good quality brandy.

Hypotheses concerning the peról:

1. That since the peról was found buried near Mission Espíritu Santo, the chore of making alcohol at La Bahía may have fallen to the neophytes;

2. That the sale of alcohol as a beverage and medication to the presidial troops and villagers across the river, would have provided some income for the church. Lt. Hardy (1977), traveling in the Chihuahuan desert in 1825, said that two small stills brought a profit of thirty dollars a day throughout the year;

3. That an overdue debt of 400 pesos owed to the church by presidial Commander Manuel Espadas, was settled by Captain Cortés in 1797 (Castañeda 1942:180). Perhaps this was a bill for liquor rations secured from the mission; and

4. That when the mission was finally secularized in 1830, the departing priest had the parishioners bury the old peról and fragments of two bronze cannons which had been intended as bell metal, between the mission and the river.

## ACKNOWLEDGEMENTS

This little research project was assisted by many kind friends. Luis Cazarez Rueda, Park Ranger at Goliad State Park, helped with documentation of the cannons. Patsy Light and Anne Bode suggested research avenues. Sharon Barnes with special Collections at Victoria College helped find historical photographs. Elaine Noland and Ellen Cunningham assisted with the Judge White Collection in the Goliad County Library. Doris Freer of the Goliad County Historical Commission assisted with local history. Newton Warzecha, Director of Presídio La Bahía, provided access to collections. Dr. John de Bry of the Center for Historical Archaeology in Melbourne Beach, Florida, and Archivist Michel Paret of Seville, Spain, worked valiantly to identify the coats-of-arms on the two cannons. Marlene Casarez edited the manuscript. Dr. Lee Johnson and Gabriela Fuentes translated Spanish documents. Roland Pantermuehl prepared the final illustrations. Ben Hydrick prepared a careful pattern of one cannon in

the late 1960s, which will be used to cast a replica of the gun.

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# An Overview of Test Excavations and Documentary Research at 41VT10, the Tonkawa Bank Site, Victoria City Park, Victoria, Texas

*V. Kay Hindes, Anne A. Fox, and E. H. Schmiedlin*

ABSTRACT

This article presents historical, archival, and artifactual evidence supporting the belief that the Tonkawa Bank site (41VT10), located in the Victoria City Park, Victoria, Texas, is the *second* location of the Mission Espíritu Santo de Zuñiga. This mission, originally founded in 1721 on Garcitas Creek in current-day Jackson County, was relocated to the Guadalupe River sometime prior to 1725. The site, listed on the National Register of Historic Places in 1981, is significant from a local, areal, regional, and state-wide perspective.

## INTRODUCTION

Site 41VT10, known as the Tonkawa Bank site, is currently recognized as a *visita* of the Mission Espíritu Santo de Zuñiga. Located within the Victoria City Park, the site, listed on the National Register of Historic Places in 1981, also is a Recorded Texas Historic Landmark. The site consists of both a prehistoric and historical component. The historical component consists of the stone foundation footings of a two-room rectangular structure, measuring ca. 25 x 40 feet on the exterior (Figures 1 and 2). The footings are constructed of stream-rolled chert gravels, caliche/

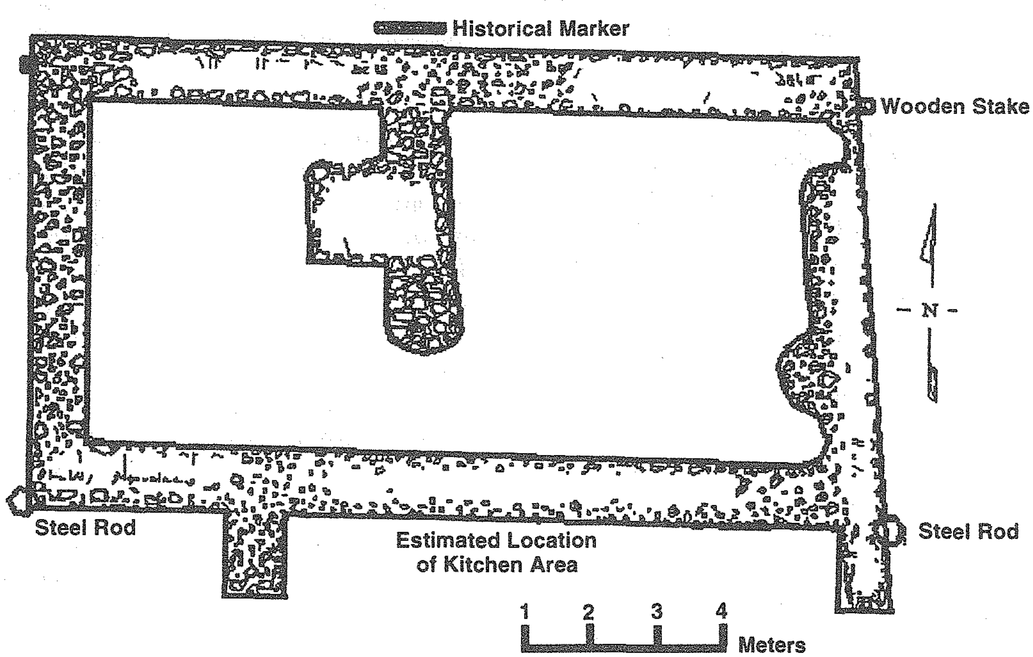


Figure 1. Scaled drawing of building foundations (adapted from 1980 National Register Nomination).

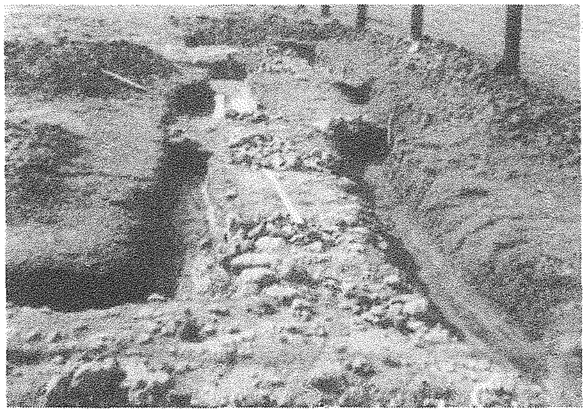

Figure 2. Stone foundations, ca. 1968. Photograph courtesy of Victoria College.

sandstone cobbles and mortar, with an original width of one *vara* (33.3 inches). Surface artifacts on the site cover an area approximately 240 x 300 feet, with concentrations of artifacts located well to the south of the existing foundations.

Archival research (Hindes 1995:8-9, 28) and archeological field work indicates that the site more accurately may be the second location (see Hester 1995:6, Endnote 1) of the Mission Espíritu Santo de Zuñiga, moved from its first location on Garcitas Creek in ca. 1725. This mission and its corresponding Presidio Nuestra Señora del Loreto were originally founded by the Spanish on Garcitas Creek in 1721, although not officially dedicated by Aguayo until 1722 (Patron 1722). The Presidio Nuestra Señora del Loreto was established on the site of La Salle's Ft. St. Louis (Gilmore 1973).

The documentary data regarding an additional location for the Mission Espíritu Santo de Zuñiga was uncovered during historical and archival research conducted in 1994-1995 (Hindes 1994). This research was begun prior to field surveys initiated in 1994 and currently ongoing to locate the first site of the mission. Although the later locations of the mission (as well as the Presidio Nuestra Señora del Loreto) were not of primary interest during the original studies, a review of all aspects of mission development and history was necessary to understand the mission's founding.

## PREVIOUS INVESTIGATIONS

The site was a Tonkawa Indian site when Martín de León founded Victoria in 1824 (Jarratt 1932:3). As early as 1883, John Linn, who settled in Victoria in 1829, noted:

> The Toncahuas were located at or near Victoria, their field being above the site of the present town. They had a church, which was erected on what is now known as "the Toncahua Bank," the foundation of which is still visible, as it was built of masonry (Linn 1883:333-334).

Linn's information regarding the site may have come from a Tonkawa Indian named "Joe" who lived in Victoria during the time that Linn also resided there (Linn 1883:333-334). According to Linn, the Tonkawa manufactured blankets, cultivated corn and vegetables, and owned cattle and horses (Linn 1883:333-334). However, only a remnant of the tribe was left as of the early to mid-19th century (Linn 1883:333-334).

The first mission on Garcitas Creek had been founded primarily for the Cocos, Curacames, and Cujames (Karankawa) Indians (Patron 1722). The relocated mission was established for the Aranama (Almazan 1726; Bustillo 1726), who had petitioned Governor Alarcón for a mission as early as 1718 (Celiz 1935:67). However, by the early to mid-19th century, at which time Linn had settled in the Victoria area, the Tonkawa resided here.

John Jarratt first became aware of the archeological aspects of the site in 1922 when he discovered a human arm bone partly exposed in an area of a mott of trees located on the southern portions of the site (the prehistoric component), as well as chert flakes, shell, and animal bone (Jarratt 1932:1). These deposits had been exposed by soil borrowing activities conducted by "Doc Hiller," the owner of "Hiller's Mott," as the site was then known. The stone ruins were found on top of the thick mesquite and huisache brush-covered ridge (Figure 3) (Jarratt 1932:2). In 1930-1931, Jarratt investigated the "Indian Village" (or burial ground) located ca. 1000 feet south of the stone ruins (Jarratt 1966b:1). He additionally placed a "test hole two feet deep by two feet wide...300 feet from the river and on top of the hill" (Jarratt 1932:3). At this location, Jarratt found a "volcanic rock matate [sic] of Mexican origin" (Jarratt 1932:3). The 1930 excavations revealed the following regarding the historical component:

Figure 3. Site 41VT10 prior to bulldozing by city.

> Much pottery and various types of flint implements such as manos, points, scrapers, grinders, etc. were found—much of it on the surface among the brush that covered the whole ridge at that time. Here also Spanish artifacts are much in evidence in the form of broken metates and manos of Mal-pie and volcanic materials, and Majolica pottery potsherds.
>
> Tests...on the ridge showed kitchen midden from 8 to 12 inches deep and saturated through with all sorts of potsherds, Indian and Spanish, flint, dart and arrow points, bones, burned rocks, and in some places charcoal to a depth of 2 feet (Jarratt 1966a:4-5).

Jarratt forwarded artifacts, notes, and drawings to the Smithsonian Institution, and on April 24, 1931, Dr. Frank M. Setzler of the Smithsonian traveled to Victoria (Jarratt 1932:11). Both the south slope (and Indian burial ground area), as well as the north slope (in the area of the stone ruins), were inspected (Jarratt 1932:11).

J. E. Pearce of the University of Texas at Austin visited the site in early 1932 (Jarratt 1932:12). Pearce, later that same year, sent A. M. Woolsey of the University of Texas at Austin and some students to conduct investigations at the Tonkawa Bank site as well as at other sites in the Victoria area (Jarratt 1932:12). Woolsey worked two days at the prehistoric component (Woolsey n.d.; Jarratt 1966b). He did not investigate the historical component at the site (Jarratt 1932:12).

In 1965, Jarratt, with a small number of volunteers including George Hobbs, a 15-year-old high school student, returned to the Tonkawa Bank site, this time concentrating his efforts at the stone ruins (Figure 4a-b). He excavated and mapped what remained of the ruins on the site, which he had observed there originally in 1922, before the City of Victoria bulldozed about two feet off the top of the ridge in 1958. Jarratt maintained that the walls had been standing three feet high as late as 1922 (Jarratt 1966a:6). He found a two-room stone building partially surrounded by a stone wall on the north, east, and south. Artifacts he recovered included majolica and Indian pottery sherds as well as other Spanish artifacts. Mr. Des Hiller, who as a boy played around the old foundations, stated that:

> ...the large door to the building faced west or toward the river.../and the walls/ ...were about 5 feet high in places, and had a lot of Windows or what could of been windows, they were very small and looked more like slots left in the wall for some reason... (Jarratt 1966c:6-7).

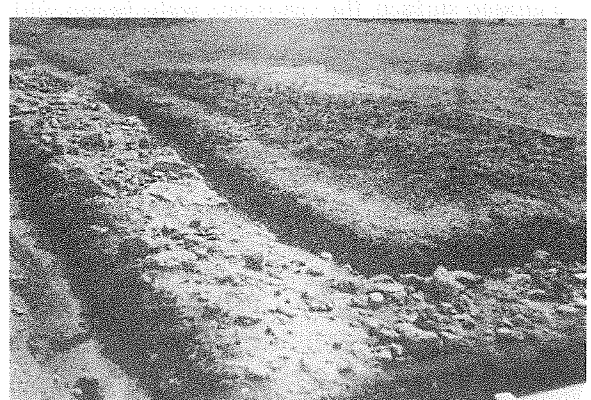

Figure 4a. Exposed stone foundations, 1968.

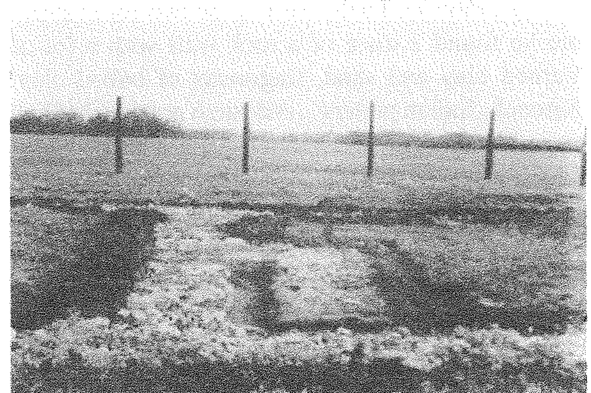

Figure 4b. Exposed stone foundations, 1968.

These openings were probably *troneras* (gunports) commonly found in early structures on the sides of the doors and windows for defensive purposes (Graham 1994:26). Because of the threat of Indian attack, the earliest structures had few if any windows (Juárez 1976:21).

By 1965, the stone ruins were about six inches below the surface (Jarratt 1966b:7-9). The foundations, "made of limestone or sandstone rock, were two feet in width" (Jarratt 1966b:7-9). Jarratt reported that a layer of yellow sand had been placed in a prepared trench that was then filled with river gravel and rock and cemented into a solid mass. The stone ruins measured 40 feet on the north side, 42 feet on the south side, and 25 feet in width. The west end on the south side had an extension of two feet. The main door was located in the west elevation. The building was divided into two rooms by a partition wall, also two feet in width, with a fire place in the front room. Buttresses were noted at each corner (Jarratt 1966b:7-9).

The layer of sand was ca. three inches in depth and placed directly on clay (Jarratt 1966c:6). Once these foundations reached what Jarratt considered the ground surface, the sandstone walls began with "some gravel being used as filling, with the exception of the corners and where the buttress/es/ were located..." (Jarratt 1966c:6). The floor was made of a limestone-caliche while the walls were plastered (Jarratt 1966a:6).

Jarratt also found "the outline traces of other old foundations" near where he encountered three historic burials (Jarratt 1966c:5). Additionally, Jarratt found evidence of a third room attached to the southeast corner of the two-room structure that he believed may have served as a kitchen. Indian pottery, majolica, burned rock, fragments of an old iron pot, animal bones, and shells were found here (Jarratt 1966c:7). To the west of the two-room structure he found a trace of a rock wall with a lot of "burned clay and sand, fragments of baked clay, charcoal...Indian pottery...and some pottery that had been glazed...clam and mussel, shell, and flint chipping..." (Jarratt 1966c:8).

In September 1965, Jarratt located three burials ca. 60 feet south of the stone ruins (Jarratt 1966b:3), or 36 feet southeast from the old foundation wall (Jarratt 1966c:5). All three burials had been exposed by heavy equipment being driven over the area in wet weather (Jarratt 1966a:7), and were "badly crushed and broken" (Jarratt 1966c:7). Burial No. 1 was "exposed so much that it was taken up" (Jarratt 1966b:3):

> The skull was all broken and crushed as /were/ the other bones of the skeleton, however, a complete Jaw bone with the teeth still intact was in good condition, the burial was all removed as to [sic] much of it was showing above ground, I did not want anyone digging around the area and find/ing/ the other graves, these I want to excavate with an Anthropologist present when they are taken up...In the grave excavated, was found with the skeleton were scraps of old Iron so badly rusted away that nothing could be made of it, also found was a fragment of Braid made of Copper Silver and Brass thread (This I identified as Spanish by comparison with similar braid found at the Espíritu Santo Mission site and at La Bahía at Goliad), and could be off of a Spanish Priest Vestments or from a Spanish Officers Coat of the Early 18th Century. A peace [sic] of lead was also found at this burial, as was a small fragment of Majolica ware...My opinion of this grave yard is that it is Spanish, as the burials face East, and are straight burials, where as the burials that I found in 1930 in the Indian burying ground South of this location /were/ all flexed or bundle burials (Jarratt 1966c:8).

Police Capt. Kenneth Rosenquest, another policeman, and Mr. Herman Fishbeck witnessed the excavation (Jarratt 1966b:3).

On November 24 and December 28, 1965, Jarratt also reported finding "some human bones (ribs) south of rock wall...The remains of an Iron pot 8 in. down...the bones and the pot /were/ left over night inside a fence, but /were/ stolen during the night" (Jarratt 1966b:10). It is not clear if these remains were from the same original three individuals or different burials.

On May 27, 1966, Jarratt began the excavation of the second burial at the site. This burial, fully extended with the hands folded across the breast, faced east (Jarratt 1966b:20-21). Two amber glass beads and approximately three pink "chalk" beads were found near the neck. Based on the presence of fragments of nails and "rusty streaks," Jarratt believed the body to have been placed in a coffin about two-and-one-half or three feet deep (Jarratt 1966b:20-21). Since evidence of a "fire pit" and Indian ceramic sherds were encountered 12 inches below the burials, Jarratt believed that the burials had been placed within/over an Indian occupation level (Jarratt 1966a:7).

In the spring of 1978, E. H. Schmiedlin excavated a row of 11 auger tests across the site. He recovered additional artifacts similar to those found by Jarratt and the tests suggested that the site continued to the south of the ruins.

At the request of Jack Murphy, Director of Parks and Recreation for the City of Victoria, archeologists from the Center for Archaeological Research at The University of Texas at San Antonio (CAR-UTSA) monitored test trenching at the park site in November 1978 (Fox 1979). The purpose of the project was to determine the extent of the site so that future park development in the form of a rose garden to the west of the site would be sure not to disturb it. Two narrow perpendicular trenches were machine-excavated across the area directly south of the ruins, as suggested by the results of Schmiedlin's auger tests. All artifacts brought up in the backdirt of the machine were flagged and mapped in place. The resulting site map depicts the extent of the site (Figure 5). This estimate was reached by mapping the extent of the artifact scatter recorded by these two efforts, in relation to the overall map of the site. Artifacts were concentrated near the crossing of the two trenches, and gradually diminished toward the west, south, and east.

In May 1989, at the request of Parks and Recreation Director Paul Locher, Dan Potter from the CAR-UTSA conducted a survey and shovel testing of the area directly to the east of the colonial site. The area had been the location of the Jaycee Hall and parking lot. The hall had been removed down to the concrete slab, and the area was slated to become a children's playground. Potter found no evidence of archeological sites of any kind within the survey area, which approached to within 25 m of the estimated eastern edge of the colonial site.

In September 1996, limited testing and mapping operations were conducted at the Tonkawa Bank site by the authors under Antiquities Permit No. 1733 issued to Dr. Thomas R. Hester. These investigations extended the testing to the east and south in order to positively confirm the limits of the

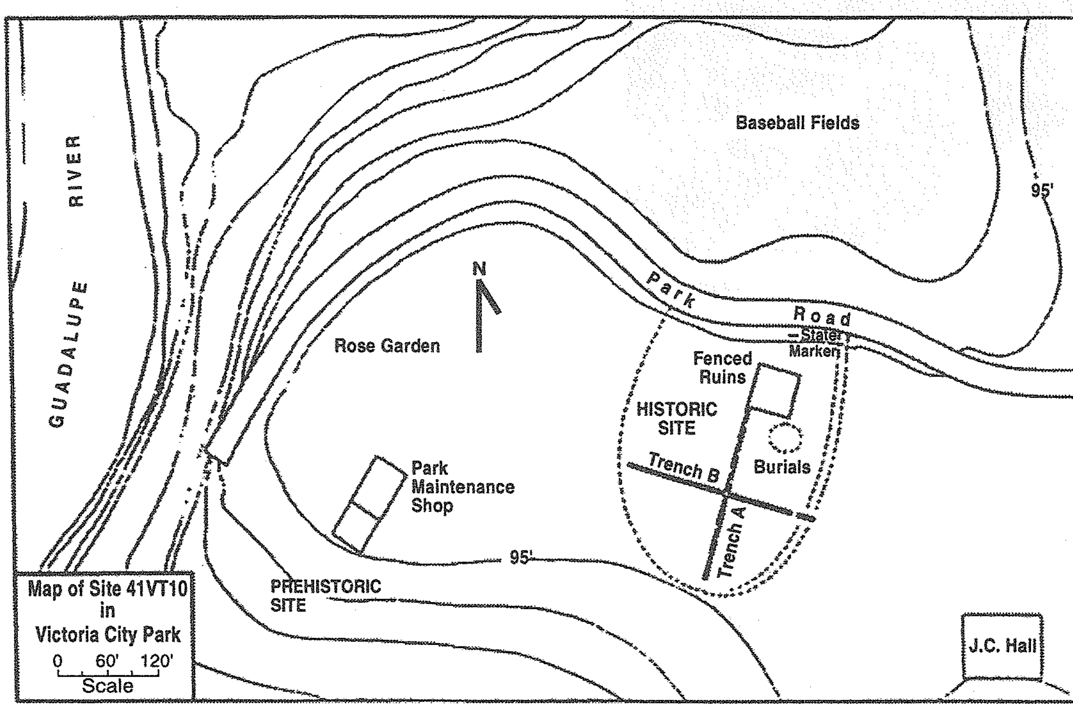


Figure 5. Map of Tonkawa Bank Site showing 1978 work (from Fox 1979) and adjusted site boundaries based on 1996 work.

Figure 6a. 1996 testing.

Figure 6b. Testing, 1996, park storage area.

site, in particular, whether the mission site extended beyond the south boundary into the Hiller property (Figure 6a-b).

Test units were placed in selected areas to determine the presence or absence of additional features (particularly in the southern third of the site area where earthmoving activities were believed to not have as severely impacted deposits). A reanalysis of artifacts from the site was also undertaken, and included collections placed at the Texas Archeological Research Laboratory at The University of Texas at Austin (TARL), CAR-UTSA, as well as a number of private collections.

While the 1978 testing appeared to show the artifact densities decreasing at the east and south ends of the test trenches, neither trench showed totally convincing evidence that sterile soil had been reached beyond where the trenches stopped. Relocating the original trenches was complicated by the numerous changes in the area between 1978 and 1996. The ruins had been completely covered with topsoil and overgrown with grass, so that only an occasional top of a stone could be seen. The fence that had surrounded the ruins had been removed, leaving only the historical marker still in place. The entire area was hip-deep in grass, except for the area immediately around the ruins.

The location of the 1978 test trenches was reestablished, using a transit, from an accurate map of the site done at that time. The east and south extensions of the trenches were staked out, measuring from the point where the trenches had crossed. To the east (Trench B), shovel tests were dug to sterile soil every five feet along the original line, but beyond the point where testing had stopped in 1978. Contrary to the original estimate, artifacts were present more than 30 feet beyond the end of the original trench. Artifacts were found from six inches to 30 inches below the present surface, and there was no sign of a Spanish colonial occupation surface. In order to more closely examine the stratification of the soils in this area, one half of a three-foot-square unit was excavated in six-inch levels, screening all soil removed. The soil was identified as Beaumont Clay, which cracks badly in dry weather, allowing artifacts to fall deeply into the subsoil. Ironically, this condition allowed the limits of the original artifact scatter on the site to be established in spite of the later removal of up to two feet of soil.

To the south of Trench A, approximately 40 feet lay between the end of the trench and the boundary fence at the top of the rise. Shovel tests were placed every ten feet beyond the end of the 1978 trenches. In this area, shovel tests were excavated to sterile soil every five feet, extending 40 feet to the fence and 40 feet beyond. This work clearly established the relationship between the historic site and the prehistoric site on the Hiller land to the south. There was no sign of artifacts of any age in these tests, which extended across the storage lot, across the boundary between this park land and the Hiller property to the south, and several ten foot intervals into the Hiller property.

To the west of Trench B (see Figure 5), sufficient testing had been done, particularly since the installation of the Rose Garden did not encounter significant evidence of ruins or numerous artifacts, unlike the intersection of the test trenches. To the east of Trench B, the main artifact concentration approached the end of the test trench and additional shovel tests were placed here to determine if any further remains extended in this direction. This was particularly important given the location of the burials observed in the 1960s by Mr. Jarratt farther to the north. These shovel tests, 15 inches in diameter, were executed in the same manner as those done by CAR-UTSA at Mission San Jose in 1993 (Hard et al. 1995). This entailed recording soil changes as they were discovered, changing the levels at each soil change, excavating to sterile soil, screening all soil removed, and bagging the artifacts by provenience for later analysis.

Portions of the foundation footings visible to the eye as well as those located by ground probing with a metal rod were flagged and found to measure approximately 25 x 50 feet. A photographic record of what was visible above the ground was made to complete our investigations.

## HISTORICAL AND ARCHIVAL RESEARCH

Abandonment of the first mission and presidio locations on Garcitas Creek was considered as early as April 15, 1725. On April 1, 1726, Juan Antonio Bustillo, Captain of the Presidio, selected and surveyed a site on the Guadalupe River for the new presidio. After a delay of almost a year from the time first considered for the move, Fernando Pérez de Almazan, the Governor of Texas, finally approved the site surveyed earlier by Bustillo. We do not yet know exactly when the mission was moved from Garcitas Creek; however, it was at its new location by April 1, 1726. Two of the three priests assigned to the mission had died by 1725: Fray Ignacio Baena (or Bahena) in 1725 and Fray Diego Zapata in 1723 (Leutenegger and Habig 1973:111). Word of the death of Fray Baena reached Zacatecas in March 1725. In 1729, his remains were taken to Zacatecas and interred in the cemetery at the college (Leutenegger and Habig 1973:111). Only Fray Agustín Patron remained at the mission, and we can surmise that Patron, afflicted with a "horrible disease of running sores" (Ramsdell 1963:6), was eager to find a more suitable location. He also wanted to find more receptive neophytes. The presidio was not moved until after August 29, 1726.

Bustillo wrote on June 18, 1726 (emphasis the authors'):

> ...I showed him (Almazan) a place on the banks of the Guadalupe River, about *five* leagues from here a little more or less. It is a place that I had previously noted for this purpose on the same river...In the cited mail of September 2nd, I had recommended the site of the ranch; however I had not seen this site, which is of greater extension, ...With the referred to advantages including a *creek at a quarter of a league, where I have built an irrigation outlet for a mission and the Father Missionary there is attending to the planting and is working to recruit Indians from the Jaraname nation...They are a nation that is spread far and wide, so that to gather them together it will be necessary to place another Mission, at the large creek that I reconnoitered on the new road that I opened going to the Rio Grande. This site is located about three leagues from the place selected for the presidio.*

Almazan, who accompanied Bustillo, to inspect the site chosen by Bustillo, wrote on July 4, 1726 (emphasis the authors'):

> ...I went to the presidio and carefully reconnoitered the area. A site was found *six leagues* to the northwest on the bank of the Guadalupe river. It has the advantage of being on high ground... at a distance of less than a league...there is a creek of sweet water...It is sufficient easily for a furrow and a half of water for farming land and to congregate some Indians in a *mission,...whose acequia is already being dug...Later I was given to understand that there has been discovered on this side of the river, at a distance of three leagues, another arroyo with abundant waters and sufficient lands for a copious mission that could*

*provide crops to supply the presidio.*

Bustillo reported the distance of the location chosen for the new presidio to be about five leagues *poco mas o menos* from the old presidio. Almazan stated that the distance was six leagues. The mission location (in relation to the site selected for the presidio), where the Mission fathers had established themselves and begun an *acequia*, is noted in both documents: Bustillo reports 1/4 league while Almazan recorded it as "less than a league." By extrapolation, the second mission location was 5 1/4 leagues (13.80 miles) to less than 7 leagues (18.41 miles) from the first presidio on Garcitas creek.

Father Habig believed the second location of the mission "could not possibly have been the Mission Valley site" (Habig 1969), but rather, was near Bloomington, or "near (or in) Victoria" (Habig 1983). Jarratt believed that the distances mentioned in translations indicated that the priests had settled at the Tonkawa (Toncahua) Bank (Jarratt 1967:10). Jarratt identified eight Spanish colonial sites for the Victoria County Historical Society in 1968. He produced a rough map showing the eight locations (Jarratt 1968). Jarratt's Site No. 3 is identified as the "Second site of Mission Señora del Espíritu Santo de Zuñiga." This site is the Tonkawa Bank site (41VT10) currently identified by an official Texas Historical Marker as the *visita* of the mission. Jarratt also identified the Mission Valley site as the "third location" (Jarratt 1968).

Most importantly, Almazan and Bustillo stated that the location selected for a larger mission (than the one already present on the Guadalupe River) was at a large creek three leagues distant from the site chosen for the presidio. By taking the extrapolated distances for the mission in relation to the site selected for the presidio, one arrives at five and one-fourth leagues (13.80 miles) to less than seven leagues (less than 18.41 miles). This would put the sites in the Victoria area, far short of the Mission Valley location. By adding the three leagues (7.89 miles) that both Bustillo and Almazan tell us was the place then chosen for the larger mission, we get a distance of 21.04-26.30 miles. The distance from 41VT4, the site of the Presidio Nuestra Señora de Loreto on Garcitas Creek, to the Victoria City Park area is approximately 20.5 miles. The 26.30 miles is fairly close to the approximate distance of 27.8 miles from the Presidio Nuestra Señora de Loreto on Garcitas Creek to 41VT11 (the Mission Valley site; see Walter 1997). Additionally, the three leagues (or 7.89 miles) given as the distance between the second (interim) site and the Mission Valley site closely matches the 7.61 miles between Victoria (as measured from the Tonkawa Bank site) and 41VT11.

## MATERIAL CULTURE

The following descriptions include the artifacts recovered in test excavations (Table 1) as well as all other known/available collections from the site (Table 2). These come from various sources: the artifacts recovered by Mr. Jarratt, and placed at TARL; the CAR-UTSA 1978 project; and Schmiedlin's collections from the surface and from his auger tests. Due to the irregularity of the sampling used, no attempt will be made to read significance into the numbers or proportions of artifacts recovered, limiting this article to descriptions. Additionally, the following descriptions do not include all artifacts recovered from the site by Mr. Jarratt, including some of those which are curated at TARL. For example, a number of the lithic artifacts as well as the human skeletal remains have not been included in this report. Due to the constraints of the project, only diagnostic artifacts were examined that could contribute to our understanding of the age of the Spanish colonial remains at the site.

### Ceramics

Probably the most useful artifacts for identifying and dating a historic site are the ceramic sherds. Fashions in ceramic patterns have changed with some regularity, making them excellent time markers. In addition, we are able to identify locations or cultural groups from which most of the ceramics on Spanish colonial sites came.

### Goliad Ware

Unglazed ceramics make up the second largest portion of the ceramic sherds from the Tonkawa Bank site. This is inconsistent with other Spanish colonial sites, in which the unglazed ceramics constitute the highest percentage of ceramic sherds. The majority of the sherds are from bone-tempered, hand-built vessels currently referred to as Goliad

**Table 1. Artifacts by Provenience, 1996 Testing**

| Unit/Trench Shovel Test | Ceramics | Metal | Daub | Shell | Chert | Bone | Total |
|---|---|---|---|---|---|---|---|
| Unit 1 | | | | | | | |
| 0-6" | 7 | | | | 2 | 2 | 11 |
| 6-12" | 12 | | | | | 7 | 19 |
| 12-18" | 7 | 1 | | | | 16 | 24 |
| 18-24" | 14 | | | 1 | | 15 | 30 |
| 24-30" | 3 | 2 | 1 | | 3 | 4 | 13 |
| Trench B | | | | | | | |
| ST-1 | | | | | | | |
| ST-2 | | | | | | | |
| ST-3 | 5 | | | | | | 5 |
| ST-4 | | | | | | | |
| ST-5 | 1 | | | | | 2 | 3 |
| ST-6 | 17 | | | | 1 | 8 | 26 |
| ST-7 | | | | | | | |
| ST-8 | | | | | | | |
| ST-9 | | | | | | | |
| ST-10 | 10 | | | | | 17 | 27 |
| ST-11 | 2 | | | | | | 2 |
| ST-12 | | | | | | | |
| ST-13 | | | | | | | |
| ST-14 | | 1 | | | | | 1 |
| ST-15 | | | | | | | |
| ST-16 | | | | | | | |
| ST-17 | | | | | | | |
| Trench D | | | | | | | |
| S-1 | 2 | | | | | 2 | 4 |
| N-1 | 6 | | | | | 5 | 11 |
| Unprovenienced | 4 | | 2 | | | | 6 |
| Total | 90 | 4 | 3 | 1 | 6 | 78 | 182 |

ware (Figure 7). Probably made by the Aranama in this case, they are also found on colonial sites elsewhere in the Victoria area, and range as far north as the San Antonio missions as well, where they are thought to have been made by other South Texas Indian groups. The Aranama women "manufactured cloth, and also waterjars used by themselves" (Linn 1883:336). Identical sherds have been excavated from Late Prehistoric sites in South Texas, suggesting a long continuity of this ceramic type (Ivey and Fox 1981:31). Two of the sherds illustrated are portions of vessel handles (see Figure 7f-g), two are rim sherds (see Figure 7b, e), and one is a sherd decorated with asphaltum (see Figure 7c).

### Unglazed Sandy Paste Ware

Also present on this site are a smaller number of unglazed, sandy paste sherds (see Figure 7a) that resemble coastal Rockport ware in color and texture, but their average thickness (7-8 mm) is greater than that of Rockport ware (5-6 mm). A number of these sherds also bear traces of what may once have been an immature lead glaze. Most of the sherds contain

**Table 2. Artifacts from all Previous Work (through 1996)**

| Collection | Jarratt | Schmiedlin | 1978 | 1996 | Totals |
|---|---|---|---|---|---|
| Unglazed Ware | 59 | 32 | 4 | 10 | 105 |
| Burnished Ware | 1 | 6 | | | 7 |
| Lead Glazed | 33 | 65 | 99 | 69 | 266 |
| Majolica | 24 | 7 | 4 | 11 | 46 |
| Copper | 3 | 3 | | 2* | 8 |
| Daub | | 11 | 5 | 3 | 19 |
| Beads | 5 | | | | 5 |
| Shell | | 4 | 4 | 1 | 9 |
| Pipe | 1 | | | | 1 |
| Chert | | 4 | 17 | 6 | 27 |
| Bone | | | 57 | 78 | 135 |
| Total | 126 | 132 | 190 | 180 | 628 |

Note: Two other metal artifacts were recovered during the 1996 work. These were not Spanish Colonial and are not included in this table.

what appear to be shell inclusions for binder. The uniformity of the paste firing appears to suggest that these sherds may have been fired in some sort of kiln. Similar sherds were excavated by the TAS Field School at 41VT8 in Mission Valley north of Victoria in 1968, and were also documented by Mounger (1959) from the mission site at Goliad, Texas. More study and analysis of this ceramic type is overdue. It does not appear in the San Antonio missions.

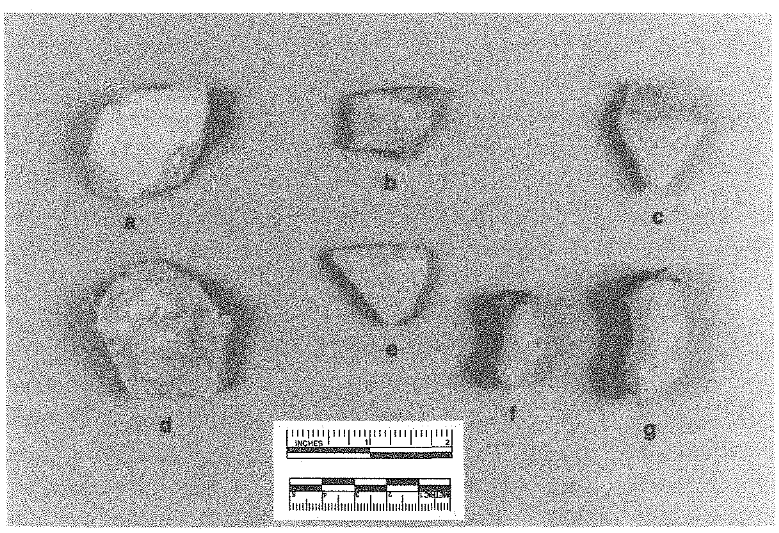


Figure 7. Goliad Ware and Unglazed Sandy Paste Wares: a, unglazed sandy paste ware; b-g, Goliad ware.

### Burnished Wares

Two types of unglazed burnished ceramics are customarily found on Texas colonial sites. One has a red paste (Figure 8a) and matte designs on a burnished background (Gilmore 1974:63). The other, with a tan paste has been identified as Tonalá Burnished Ware (Figure 8b) made in Jalisco (Ivey and Fox 1981:31, 34). The illustrated sherd is from the base of a small vessel. A few sherds of these two ceramic types are in the Jarratt and Schmiedlin collections. One sherd can be identified as a fragment of a small novelty figurine produced in Tonalá, Mexico during the 18th century (Deagan 1987:44-46). Also known as Guadalajara Polychrome (Deagan 1987:44-46), bowls, lidded bowls, and the novelty figurines were most popular in the first half of the 18th century (Deagan 1987:46).

### Lead Glazed Wares

Lead glazed wares comprise the single largest category of ceramic sherds from the Tonkawa Bank site. A great variety of lead

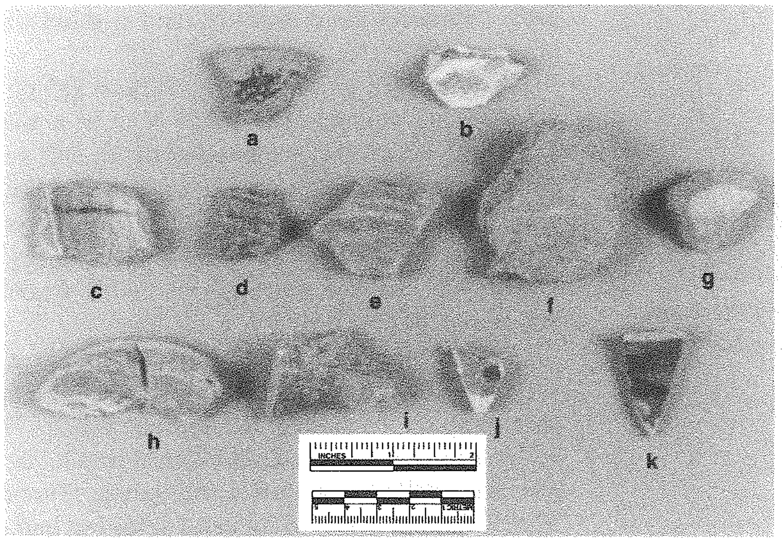


Figure 8. Burnished Wares and Lead Glazed Wares: a, red burnished ware; b, Tonalá ware; c, sandy paste lead glaze with green decoration; d, sandy paste with green lead glaze; e, olive jar; f-g, sandy paste lead glaze; h, unidentified fine paste with lead glaze; i, sandy paste with clear lead glaze; j, lead glaze on creamy beige paste; k, Galera ware.

glazed ceramic sherds has been collected from this site. Most have a sandy paste with glazes varying from clear to yellow to dark green. Several sherds appear to be decorated with green designs (see Figure 8c) and all are wheel-turned. A few of the sherds have incised and/or engraved lines on the exteriors. In comparison with lead glazed wares recovered from slightly later mission sites on the San Antonio River from Goliad to San Antonio (Fox 1974:56), these are more crudely made and often under-fired so that the glaze has failed to completely mature. They vary in thickness from 5-13 mm. Identical sherds were found at 41VT8 in 1968.

Two sherds with a fine-textured, creamy beige paste have a yellow glaze and brown under-glaze decoration (see Fox [1974:58] for a description of similar sherds from Mission Rosario in Goliad). A preliminary analysis of several of these sherds allow us to make some general comments on vessel forms as attributes of size and function. A small number of the sherds are basal sections of flat-bottomed vessels with a slightly flaring to straight-sided bodies (see Figure 8f-g). These appear to represent storage jars or containers, or flat-bottomed bowls. Two sherds (see Figure 8h) of a fine textured paste form the ringed basal portion of a small vessel, probably a jar.

### Galera Ware

A few sherds with a fine-textured red orange paste and brown and cream designs under a clear lead glaze (see Figure 8k) represent a type called Galera Ware across the Southwest (Fox 1974:57-58). The interesting point to be made about the presence of these sherds on this site is that the type has been generally accepted as not reaching the Texas frontier until ca. 1750 (Ivey and Fox 1981:34). If this date is accurate, it would appear that the Tonkawa Bank site may have continued in use at least until about the time that the Mission Valley mission and presidio were moved to the San Antonio River in 1749.

### Olive Jar

Several sherds of heavy wheel-thrown jars with green glaze (see Figure 8e) represent the only olive jar fragments from this site. Nearly always present on 18th century Texas sites, these storage vessels are indicators of a Spanish presence.

### Majolicas

A ceramic type called majolica bears a lead glaze to which tin was added to produce a white background for bright-colored decoration. The sherds recovered from this site are nearly all too small to identify the numerous varieties that are useful to archeologists for dating deposits. However, several sherds from Tonkawa Bank correspond to majolica patterns found at sites in Mission Valley.

Puebla Polychrome (Figure 9a-c), made in Puebla, Mexico, has blue geometric designs interlaced with black cobweb-like lines. It is generally found on sites occupied in the last half of the 17th century and the first quarter of the 18th century (Deagan 1987:82). Seventeen of the identifiable sherds fit this type. This represents 36 percent of the total, by far the majority of the majolica sherds from this site. Carlson's (1994) study of ceramic

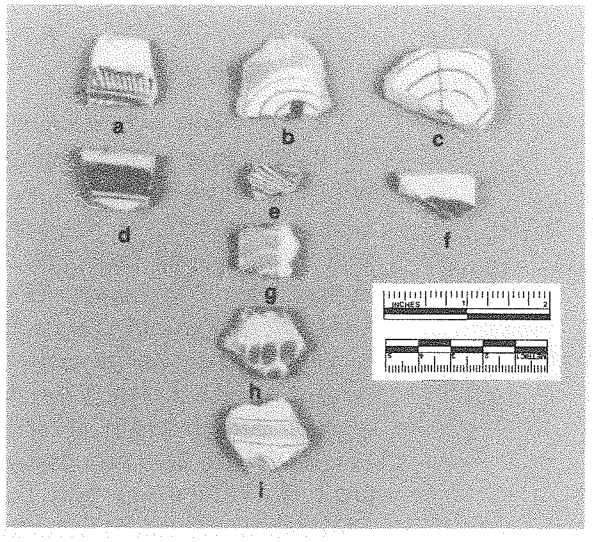


Figure 9. Majolicas: a-c, Puebla Polychrome; d-f, Abó type/Aranama ware; g, Puebla Blue on White; h, Puebla Blue on White II; i, unnamed variant.

assemblages from six 18th century Spanish colonial mission sites in Texas identified only two sherds of Puebla Polychrome ceramics, both of these from Mission Dolores de los Aís (41SA25).

Abó Polychrome Type B/Aranama covers a confusing group of patterns that have yet to be sorted out (see Figure 9d-f). These types have an orange band encircling the rim and "gaily painted floral and animal designs in yellow, orange, green-blue, and brown" (Deagan 1987:79). For the moment we are lumping these together even though the combined dating—Abó to the last half of the 17th century and into the early 18th century, and Aranama to the last half of the 18th century—is not in any way helpful. As an example of this confusion, the polychrome sherds from this site all appear to fall into a variety that Ronald May in California has named Quiburi Polychrome (Barnes and May 1972:35) and dated 1770 to 1800, yet in Spanish sites in Texas this type seems to be contemporary with Puebla Polychrome, as it is here. A total of nine sherds from Tonkawa Bank can be typed to this category. This represents 19 percent of the total documented tin-glazed majolicas. Ongoing analysis of collections from two sites know to be associated with Presidio La Bahía (41VT8 and 41GD7) will attempt to help solve this problem, since presidial sites are known to produce proportionately more majolica than mission sites (Goggin 1968:223; Fontana 1973:12).

Puebla Blue on White (see Figure 9g) consists of one or more shades of blue in a wide rim band, below this a narrower band, and suspended from this is a row of single petals alternating with whole blossoms. In the center is a flower, a long-legged bird, or a deer (Goggin 1968:191). It is contemporary with Puebla Polychrome.

Puebla Blue on White II (see Figure 9h) is a variation of Blue on White whose decoration appears only on the exterior of cups and bowls. The design consists of numerous horizontal parallel light blue lines dotted with darker blue petals (Tunnell 1966:8; Seifert 1977:186). It dates to the last half of the 18th century.

One sherd of an unnamed variety (see Figure 9i) bears a form of decoration seen only in the collections of Presidio La Bahía at Goliad (41GD7). On the larger sherds, pale blue, orange, yellow, and pale green elements are surrounded by very thin brown/black lines with the usual amount of creamy white background exposed, giving a light, airy appearance. Other sherds of this variety include a yellow rim band with one brown/black line above and two below (see Figure 9d), identifying it as a member of the Abó/Aranama family.

## Metal

The back half of a compound copper/brass button (Figure 10a) was found at the site by Mr. Jarratt. A loop is brazed to the back, which tends to date the button to the late 18th to early 19th century. This may not be a Spanish colonial button.

Mr. Jarratt also found a 4-inch-long, worm-shaped piece of lead (see Figure 10c), the purpose for which is unknown. An unidentified metal object was also in the Jarratt collection (see Figure 10b), along with a number of fragments of badly rusted iron.

Eight fragments of thin sheet copper came from the site (see Figure 10d-h). All of these appear to have been cut from a larger object, perhaps to repair a cooking pot. Two of the fragments are elongate (see Figure 10d) with shapely pointed and tapered ends. One lug fragment (see Figure 10f) has a rivet hole where the handle would have been attached to the pot. Repaired copper pots

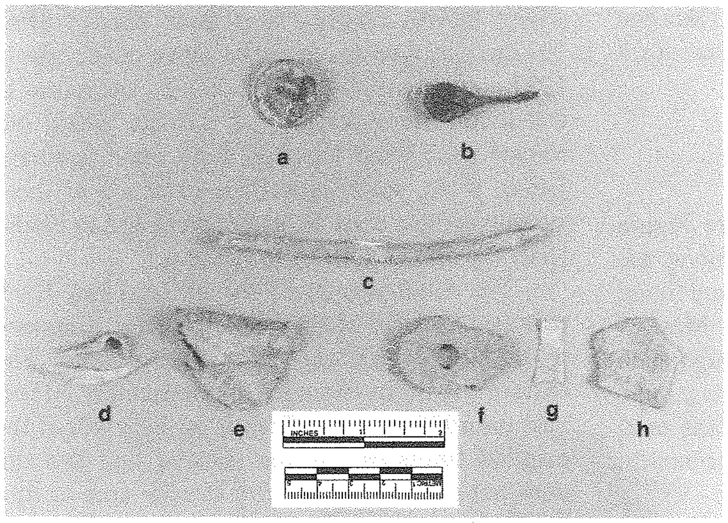


Figure 10. Metal artifacts: a, metal button; b, unidentified; c, worm-shaped lead; d-h, thin sheet copper fragments.

bearing patches cut from other pots are commonly found on colonial sites.

### Daub

Nineteen fragments of burned clay daub (Figure 11a-c) are evidence that at least some of the structures on the mission site were typical Spanish *jacals* built of upright poles plastered with clay. In order for the clay to have survived intact, the structures must have been burned. Alternatively, if fires used as a heat source for cooking and warmth were built within the interiors of these structures, the resultant heat from these fires may have served to partially bake the clay. Additionally, a natural source of drying would be the sun, baking the clay much like sun-dried adobe bricks are pro-duced. There were probably many more such burned daub fragments on the surface when Mr. Jarratt first made his collections from the site, but he would not have recognized them as important enough to save.

### Shell

Fragments of river mussel shell and other shell species are commonly found on colonial and prehistoric sites in Texas. Here again, Mr. Jarratt would not have recognized these as worth saving, but the archeologists habitually collect them.

### Beads

A bead made from the columella of a conch shell (see Figure 11d) is in the Jarratt collection. Such beads are not uncommon on historic period Indian sites, probably in this case indicating trade between the Aranama and coastal groups.

Three pink clay beads, only two of which remain in the collection (see Figure 11e) were found by Mr. Jarratt near the neck of burial No. 2. The two surviving beads are very small (ca. 5 mm in diameter) and fragile. Clay beads were listed in the inventory of goods acquired for the Mission Santa Cruz de San Saba in 1757 (Hindes et al. 1995:72).

Two yellow-colored wire wound glass trade beads are also in the Jarratt collection (see Figure 11f). These beads, ca. 7 mm in diameter, contain eight facets, and were also found near the neck of burial No. 2. Marvered beads such as these are commonly found on Spanish sites dating to the 18th century (i.e., Schuetz 1980), and in particular between 1700-1750/1775 (Deagan 1987:178). Most

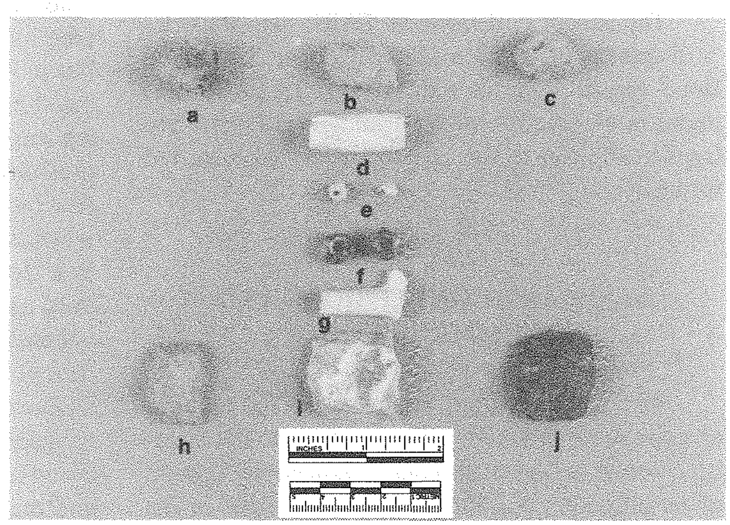


Figure 11. Miscellaneous artifacts: a-c, daub; d, conch shell, columella bead; e, clay beads; f, glass beads; g, pipe-stem fragment; h-j, gun flints.

contain eight to ten irregular facets (Deagan 1987:178-179). They most commonly represent rosary beads (Deagan 1987:159).

### Pipe

A white clay pipe stem fragment (see Figure 11g) of probable European origin is among the Jarratt artifacts. Similar fragments have been found at Mission Concepcion (Krueger and Meskill 1992:23) in 19th century deposits. Although such pipes were made as early as the 18th century, pipe smoking did not come into fashion in Texas until the arrival of the Anglo-Americans and Germans in the early 19th century.

### Chert

Of the 27 chert fragments recovered during the excavations, three are identifiable as gun flints (see Figure 11h-j). They are quite different in shape and are made from three distinctly different colors of chert. All appear to be locally made.

### Animal Bone

The fragments of bone recovered from the two excavation projects were nearly all splinters and fragments too small to identify as to species.

### Other

The Jarratt collection at TARL also includes "a fragment of Braid made of Copper Silver and Brass thread" (Jarratt n.d.:8). This fragment was found in association with burial No. 1. Due to the fragile condition of this artifact, it was not removed for analysis.

## SUMMARY CONCLUSIONS AND RECOMMENDATIONS

The Tonkawa Bank site contains the remains of stone ruins and other features dating to the Spanish colonial period. Although a tremendous amount of modification activities have taken place at the site within the last 40 years, "the fact that Jarratt could still locate wall footings suggests that there are probably more structural remains present even where topsoil removal was most severe" (Fox 1979:6). Infrared photographs taken of the site in 1997 appear to show several distinct anomalies in the southeastern portions of the site where our shovel tests were located; these may represent *jacals*. If so, some subsurface evidence of these structures must exist or be intact enough to be detected by remote sensing techniques.

The 1996 investigations at Tonkawa Bank revealed that the site limits originally proposed by the 1978 work were substantially valid. The eastern site limits extended approximately 30 feet past the 1978 margins. Testing to the south of the original limits of the site showed that the site does not extend into the city storage area or into the Hiller property. Revised estimates of the site limits based on a surface and subsurface artifactual scatter of approximately 240 feet by 300 feet is consistent with other known and documented mission sites.

Based on the statistically significant presence of certain tin-glazed ceramic sherds, of which the largest majority (36 percent) are Puebla Polychrome (e.g., Deagan 1987:29, 82), an initial occupation date of 1725 (or earlier) can be established for the Tonkawa Bank site. This date corresponds *directly* with the archival data, supporting the hypothesis that this site is the second site of Mission Espíritu Santo de Zuñiga. Based on distances given in the archival records, the second location of the mission could not have been the Mission Valley site (41VT11). The exact date for the removal of the mission from the Garcitas Creek location is not currently known, but it is clear that the mission had already relocated prior to the official permission of the Spanish authorities, and before the relocation of the presidio. The site remained in use throughout the first half of the 18th century. We do not yet know when, or if, the Tonkawa Bank site ceased to exist as a "formal" mission after the construction of the third and larger mission site (41VT11), but archival data supports a contemporary occupation. The date of the relocation and reburial of Father Baena to Zacatecas may help to clarify this increasingly complex series of removals and relocations. Thus, based on material culture as well as retranslations and reanalysis of primary source documents, the site appears to represent a much more substantial mission location than that of a *visita* (Fox 1979) or an interim location (Hindes 1995).

The artifactual material and its similarity to the ceramics from the mission and presidio sites at Mission Valley indicate that the sites were all occupied during the same time period. An important conclusion that is suggested by the analysis of ceramics at the Victoria Park site is that this site must have continued in use right up to the time that site 41VT11 (the Mission Valley site) and 41VT8 (the presidio site) were moved to the San Antonio River in 1749. This is based on the presence of Galera Ware, which did not appear in Texas until the mid-18th century, and Puebla Blue on White II majolica, also thought to date to the last half of the 18th century. Indeed, artifactual material located in several collections (not included in this article) found over a large area of Tonkawa Bank, but away from the main Spanish colonial occupation, suggests an historical occupation dating from ca. 1725 to the mid-19th century.

To recapitulate, archival documents consulted so far, then, suggest that the mission was removed from Garcitas Creek sometime prior to 1725 to the Victoria City Park area, and was actively occupied by the mission fathers prior to the removal of the presidio from Garcitas Creek. Because of the great numbers of Aranama Indians, a third mission site was selected at the Mission Valley location and was also established and occupied contemporaneously with the Tonkawa Bank site for a period of time. Artifactual material correlates with the archival documentation and suggests that the site was definitely occupied through the first half of the 18th century, or until the time that both the missions and presidios were removed to the San Antonio River at current Goliad, Texas.

Documentary evidence and material culture remains thus point to four mission sites. The first site on Garcitas Creek is yet unlocated (Hindes and Mallouf n.d.). The second site was apparently in the immediate area of present-day Victoria at the Tonkawa Bank site. The next location was at 41VT11, where the University of Texas at Austin field school conducted investigations in 1996 and the 1997 and 1998 TAS Field School was held, and the fourth and final site is at Goliad.

## ACKNOWLEDGMENTS

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# A Preliminary Report of the 1997 TAS Field School Excavations in Area A at Mission Espíritu Santo de Zuñiga (41VT11), Victoria County, Texas

*Tamra L. Walter*

**ABSTRACT**

The third location of Mission Espíritu Santo de Zuñiga (41VT11), located in Victoria County, Texas, was the site of the Texas Archeological Society's 1997 summer field school. Archeological investigations were conducted in an area (Area A) of the site believed to represent the mission Indian living quarters. Three large excavation blocks were opened up in Area A in an attempt to find evidence indicative of mission Indian occupation. The results of these investigations are the focus of this article.

## INTRODUCTION

During the 1997 Texas Archeological Society (TAS) field school at Mission Espíritu Santo, investigations were carried out across the site. Area A (Figure 1), believed to be the mission Indian habitation, was the primary focus of these investigations. Work was also completed in and around the mission ruins (Area D) and in Area E (see Figure 1), where excavations uncovered an intact lime kiln. Anne Fox and Jack Eaton oversaw the architectural investigations in Area D and a report of their findings is available in the 1998 TAS Field School Manual (Eaton 1998). Excavations at the lime kiln in 1997 and 1998 were supervised by Cecil Calhoun and Bryan Jameson. The results of these excavations were summarized in a paper given by Calhoun and Jameson (1998) at the 69th Annual Meeting of the TAS in Waco, Texas.

In addition to the work conducted at 41VT11, TAS field school investigations were also carried out at several sites related to 41VT11, including 41VT121, 41VT13, and 41VT10. Limited testing was completed at 41VT121, a sandstone quarry located less than a mile south of the mission structures. Investigations at the site indicate that the quarry was the primary source of stone for the mission buildings (Jones 1998). A mission dam and *acequia*, 41VT13, is located approximately eight miles northwest of Victoria on the left bank of Mission Creek. It is presumed that the dam and *acequia* were built in conjunction with the mission in an attempt to irrigate the mission fields (Calhoun 1966). During the 1997 TAS Field School, portions of the dam and *acequia* were mapped and recorded under the supervision of Jim Blanton. A full scale investigation of the *acequia*, undertaken during the 1998 TAS Field School, consisted of the recording and mapping of all intact portions of the *acequia* (Rinker et al., this volume). Archeological and architectural investigations were also conducted at 41VT10, the second location of Mission Espíritu Santo in Victoria City Park under the direction of Kay Hindes during both the 1997 (Hindes 1997) and 1998 TAS Field Schools (see also Hindes et al., this volume).

### A Brief History of Mission Espíritu Santo

The Espíritu Santo mission was first established in 1722 at a location along Garcitas Creek near what is now Matagorda Bay (Figure 2). The mission, founded by Franciscan missionaries sent from Mexico, was originally established for the Karankawa Indians. The Karankawa, however, were antagonistic and hostile toward the Spaniards. The reaction of the Native population, in combination

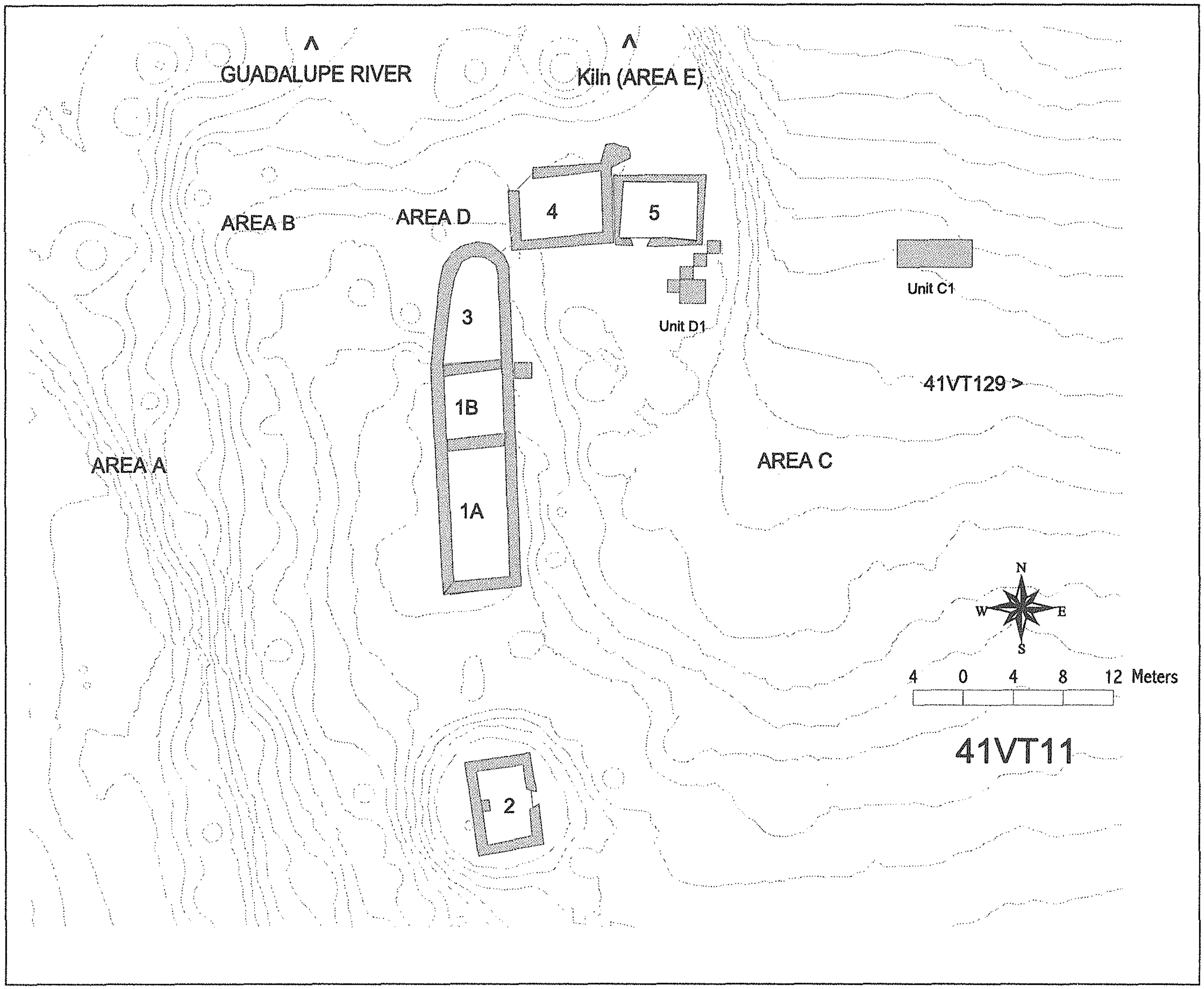


Figure 1. Map of Site 41VT11.

with the inhospitable climate of the coast and the failure of crops, prompted the missionaries to relocate the mission to a site further inland (Almazan 1724). The mission was moved sometime in 1725 or 1726 to its second location at Tonkawa Bank in today's Victoria City Park (see Figure 2). This temporary location of the mission later served as a *visita* of the third location of the mission (Hindes 1995). Recent archeological and archival work by Kay Hindes (see Hindes et al., this volume) has firmly established this site as the second location, or interim site, of Espíritu Santo.

The third location of the mission was founded in 1726 along the west side of the Guadalupe River in Mission Valley, Texas (see Figure 2). It remained in operation here for 23 years before it was moved a fourth and final time in 1749 to a site located on the San Antonio River in modern-day Goliad (see Figure 2). The removal of Espíritu Santo from Mission Valley to the San Antonio River was part of José de Escandón's colonization plan for the province of Nuevo Santander (O'Conner 1984). The Espíritu Santo mission continued to operate until its secularization in the 1830s.

At the third location of Espíritu Santo in Mission Valley (41VT11), the Spaniards hoped to Christianize the Aranama and Tamique and convert these Indians into loyal Spanish citizens. Little is known about the two groups. Historical records mention their presence at Espíritu Santo but there is a noticeable lack of information about their lifeways and customs. Moreover, historical documents render no information about where these groups were from. Subsequently, there is much speculation about the origins of the Aranama and Tamique Indians. Historical accounts cite the Aranama as the dominant group at Espíritu Santo and mention the presence of some 400 Aranama at one point during its history on the Guadalupe River (Ramsdell 1938). From a linguistic standpoint, the Aranama may have some relation to Coahuilteco (Campbell 1996). We can be fairly certain, however, that they practiced many of the same habits and subsistence strategies employed by other groups in the area in the Late Prehistoric period. Like their prehistoric predecessors, the Aranama and Tamique were probably hunter-gatherers who traveled up and down the Guadalupe River, and perhaps across much of the Gulf coastal plain, in search of bison and other local animals and plants (Walter 1997). At Espíritu Santo, cattle ranching played a major economic role and the mission Indians were expected to care for and tend the herds. Later accounts note the mission Indians' expertise as skilled ranchers and cowboys (Oberste 1980).

## Previous Investigations

Excavations at the mission have provided an excellent opportunity to define the components of the mission complex and to learn more about the lifeways of the Aranama and Tamique Indians. Archeological investigations have been primarily focused on recovering information related to the mission Indian occupation. In the spring of 1995, the first formal investigations at 41VT11 were conducted by the Office of the State Archeologist (OSA) at the Texas Historical Commission. The OSA completed limited testing in and around the mission ruins and determined that further investigations were warranted (Mercado-Allinger 1995). More intensive testing was carried out during The University of Texas at Austin field school in the summer of 1995. Under the direction of Thomas R. Hester, test excavations at the site were completed in Areas A, B, C, and D (see Figure 1): Area A represents a mission Indian habitation zone; Area B includes the area to the northwest of the mission ruins; Area C encompasses a gentle sloping terrace to the east of the mission structures; and Area D represents the mission structures. Testing activities in 1995 were primarily concentrated in Areas A and B. Excavations in Area C were restricted to one test unit and a few shovel tests. In addition, Jack Eaton supervised architectural testing of the mission ruins (Area D) and positively identified two Spanish Colonial structures related to the mission (Structures 1 and 2).

In the fall of 1995, the author, several students from the University of Texas at Austin, and local volunteers returned to the site to remove the remaining portions of a "bone bed" feature that was uncovered in Area B in the summer (see also deFrance, this volume). Construction of the landowners' home threatened the feature area, so efforts were made to completely excavate the midden. Additionally, in 1996, members of the TAS, the Southern Texas Archaeological Association (STAA), and several University of Texas at Austin students participated in a salvage operation to recover artifacts from a portion of Area B that was also extensively bulldozed during construction.

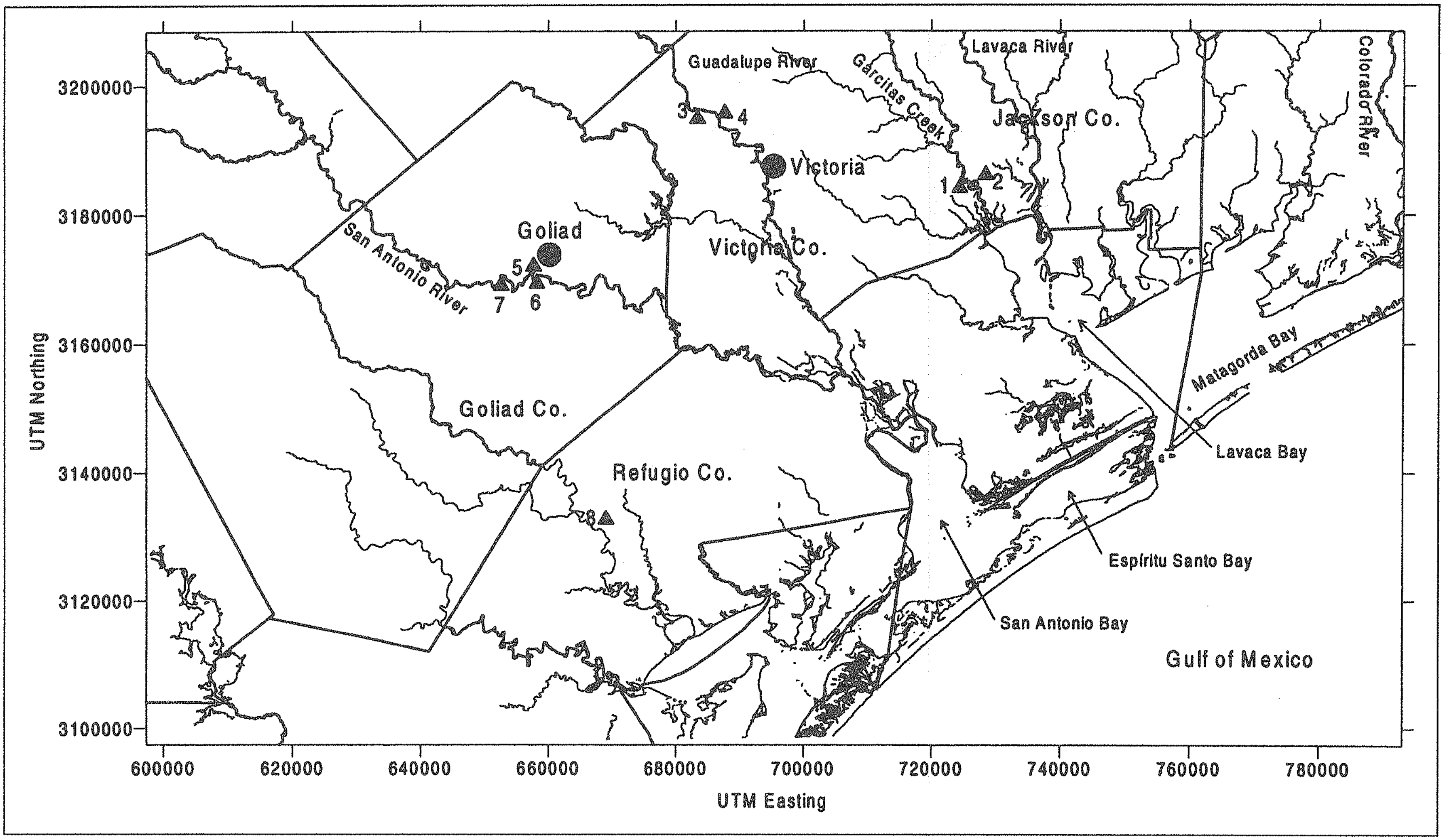


Figure 2. Location of Espiritu Santo missions and presidios. Key: 1, 2, first location of Espíritu Santo Presidio and mission; 3, 4, Espíritu Santo Presidio and Mission (41VT11) until 1749; 5, 6, Espíritu Santo and Presidio after 1749; 7, Rosario; 8, Refugio Mission, 1795–1830.

The 1995 test excavations at 41VT11 indicated a mission Indian occupation in Area A and the possibility of finding intact midden deposits was strongly evidenced in the results of these initial investigations. Materials recovered in 1995 from Area A (Table 1) include bone-tempered pottery, European and Mexican ceramics, glass beads, lithic scrapers, Guerrero, Cuney, Perdiz, and Darl projectile points, bifaces, hammerstones, metal, bone, freshwater mussel shell, marine shell, and various pieces of worked shell and bone. The mixture of both Spanish and Native cultural materials found in Area A is similar to artifact assemblages from other Indian habitation zones at mission sites across South Texas (Hester 1989), including Mission Rosario (Gilmore 1974; Ricklis 1998), Mission San Jóse y San Miguel de Aguayo (Hard et al. 1995), Mission Espíritu Santo in Goliad (Mounger 1959; Ricklis 1998), and Mission San Juan Capistrano (Schuetz 1968).

## 1997 TAS INVESTIGATIONS

### Methods

From June 14 to 21, 1997, the TAS conducted their annual field school at the mission. Encouraged by our findings in Area A from the 1995 excavations, we decided to focus the majority of our efforts in this part of the site. Three large excavation blocks were opened up in Area A (see Figure 1). Block A-I, the smallest unit, was a 4 x 4 meter block; A-II was a 6 x 8 meter block; and A-III was a 4 x 6 meter block. During the course of the field school, over 200 people worked in Area A. A total of 59 $m^2$ was opened and over 16 $m^3$ of dirt were excavated.

A Total Datum Station was used to establish the grid for each excavation block. In addition, actual elevations were established and used during the excavations. For the purposes of this article,

**Table 1. Area A, 1995 Test Units**

| Level (cmbs) | Bone | Debitage | Native Pottery | Non-Native Ceramics | Mussel Shell | Marine Shell | Lithic Tools | Metal | Glass |
|---|---|---|---|---|---|---|---|---|---|
| **1 (0-10)** | 269 | 172 | 88 | 5 | 4 | 0 | 1 Biface | 10 | 5 |
| **2 (10-20)** | 1668 | 591 | 302 | 5 | 59<br>1 Worked Shell | 6 | 3 Points<br>3 Bifaces<br>1 Core<br>1 Scraper | 29 | 1 Bead |
| **3 (20-30)** | 746 | 908 | 146 | 2 | 141 | 10 | 2 Points<br>1 Biface | 2 | 0 |
| **4 (30-40)** | 192 | 526 | 28 | 3 | 28 | 1 | 0 | 1 | 0 |
| **5 (40-50)** | 11 | 221 | 2 | 0 | 7 | 1 | 0 | 0 | 0 |
| **Total** | 2886 | 2418 | 566 | 15 | 240 | 18 | 12 | 42 | 6 |

however, the elevations have been converted to cm below the ground surface (cm bs). The blocks were divided up into 2 x 2 meter squares made up of four 1 x 1 meter units. Levels were removed in 5 cm increments with the exception of the first levels. Beginning levels were excavated in 10 cm segments in order to remove the overburden. All of the excavated dirt was water-screened through 1/8-inch wire mesh. An eight liter flotation sample was taken from the southwest unit of each 2 x 2 meter square for every level excavated.

## SUMMARY OF FINDINGS

Excavations in Area A were geared towards answering specific questions about both the mission Indian activities and the layout of the habitation area. Through a study of the distribution and patterning of artifacts, the purpose or purposes of Area A are examined. First, the findings from each block are summarized and then the implications of these results are discussed. The results described here are not intended to be conclusive. Rather, they represent a preliminary assessment of Area A based on the patterning of cultural materials and basic artifact categories.

## BLOCK A-I

A total of 61 levels or 3.8 m$^3$ of dirt was removed from Block A-I. The deepest units were excavated to ca. 45 cm bs. A variety of cultural materials were recovered from Block A-I, including bone-tempered aboriginal pottery, Spanish Colonial ceramics, mussel shell, lithic debitage, metal, glass, and bone (Table 2). No features, however,

**Table 2. Cultural Materials from Block A-I**

| Level (cmbs) | Bone | Debitage | Native Pottery | Non-Native Ceramics | Mussel Shell | Lithic Tools | Metal | Glass |
|---|---|---|---|---|---|---|---|---|
| **1 (0-10)** | 332 | 1240 | 337 | 7 | 30 | 5 | 11 | 27 |
| **2 (10-15)** | 353 | 939 | 270 | 7 | 31 (2 Beads) | 5 | 1 | 0 |
| **3 (15-20)** | 344 | 1196 | 242 | 7 | 33 | 3 | 2 | 1 |
| **4 (20-25)** | 92 | 634 | 116 | 2 | 13 (1 Bead) (1 Pendant) | 3 | 0 | 0 |
| **5 (25-30)** | 38 | 999 | 36 | 0 | 15 | 3 | 0 | 0 |
| **6 (30-35)** | 3 | 146 | 8 | 0 | 2 | 0 | 0 | 0 |
| **7 (35-40)** | 0 | 84 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | 1162 | 5238 | 1009 | 23 | 124 | 19 | 14 | 28 |

were encountered in the block. The majority of mission materials appear to be concentrated between 0-30 cm bs.

## Bone

Comparatively, Block A-I produced the least amount of faunal materials of the 1997 block excavations. Of the faunal remains recovered from Block A-I, over 90 percent were removed from 0-25 cm bs. This figure is skewed slightly by the fact that, on average, only five levels, or 25-30 cm of matrix, were excavated from the units in Block A-I. Faunal counts decrease as the depths of units increase. Again, this may also be the result of fewer units being excavated below 30 cm. The faunal remains recovered from Block A-I are summarized in Table 3. Almost half (45 percent) of the bone found in Block A-I was identified as either bovid (cow/bison) or cow-sized mammal (McClure 1999). The remaining faunal materials, with the exception of the unidentified bone and the non-specific artiodactyl remains, are all wild taxa.

## Lithics

Lithic debitage was the most abundant lithic artifact type found in all three blocks. Block A-I yielded more debitage than both blocks A-II and A-III. Debitage counts are high between 0-35 cm bs, with a slight decrease from 20-25 cm bs. The number of flakes decrease more significantly from 35-45 cm bs, correlating with a decrease in the number of units that reached these levels. Only two 1 x 1 meter units were excavated to levels 6 and 7. Despite the low number of units that reached levels 6 and 7, debitage counts remained relatively high in the deposits.

Only 19 lithic tools are represented from Block A-I. They include three hammerstones, one Guerrero point (Figure 3a), the proximal end of a

**Table 3. Bone from Block A-I (McClure 1999)**

| Level (cmbs) | Cow/ Bison | Snake | Turtle | Fish | Deer | UID | Bird | UID Mammal | Non-Specific Artiodactyl | Frog | Opossum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 (0-10) | X | X UID | X UID | X UID | X | X | X UID | X | | | |
| 2 (10-15) | X | X UID, RS | X SS, BX | | X | X | X UID | X | X | | |
| 3 (15-20) | X | X UID, HN, RS | X BX | X UID | X | X | | X | X | | X |
| 4 (20-25) | X | X UID, RS | X UID | X UID, CF | X | X | | X | X | X | |
| 5 (25-30) | | X UID | | | | X | | X | | | |
| 6 (30-35) | | | | | | X | | | | | |

UID=Unidentified; RS=Rattlesnake; HN=Hognose Snake; SS=Softshell Turtle; BX=Box Turtle; CF=Catfish

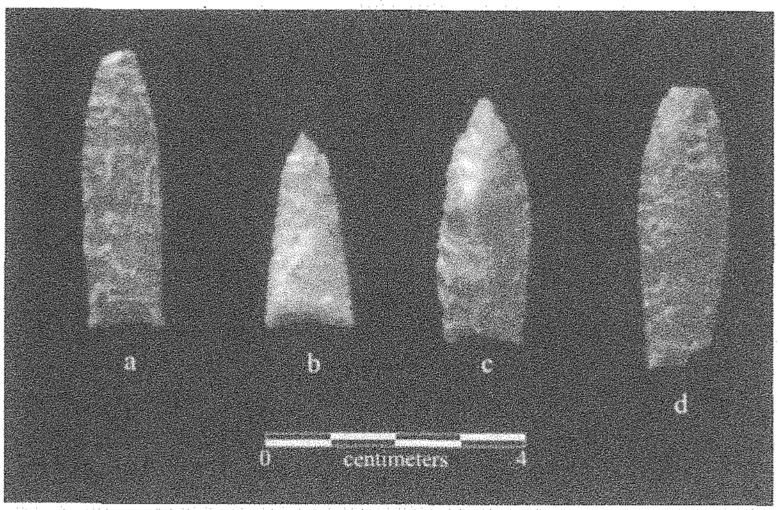


Figure 3. Arrow points: a-b, d, Guerreo; c, Guerrero preform.

### Native Pottery

The Native pottery found in Area A and across the site, by and large, refers to the bone-tempered ware that dominates the collection (Figure 4). Bone-tempered pottery, which is similar to Leon Plain ware (Hester 1989), outnumbers Spanish Colonial wares (non-Native) 50:1 in Area A. Block A-I produced the least amount of bone-tempered sherds in Area A. Of the 1009 sherds collected, approximately 80 percent were recovered from the upper 25 cm of the block. The remaining sherds were found in levels 4-6 (25-40 cm bs).

straight to contracted stem dart point, four unifaces, two bifaces, and four edge-modified flakes. In addition, five cores were also recovered. Lithic artifacts were only found between 0-35 cm bs; however as previously mentioned, both levels 6 and 7 (30-40 cm bs) are under-represented in this sample. Table 4 provides vertical locations for the tools and lithic artifacts found in Block A-I.

### Non-Native Ceramics

Twenty-three pieces of Spanish Colonial ware are represented in the Block A-I collection. Twenty-one of the 23 specimens were found between 0-25 cm bs. Level 4 (20-25 cm bs) had two sherds and no non-Native ceramics were recovered from 30-45 cm bs. Nine varieties of ceramics were identified

**Table 4. Lithic Artifacts from Block A-I**

| Level (cmbs) | Guerrero Point | UID Dart Point | Bifaces | Cores | Modified Hammerstones | Flakes | Unifaces |
|---|---|---|---|---|---|---|---|
| **1 (0-10)** | X | X | X | X | X | | X |
| **2 (10-15)** | | | | X | | X | X |
| **3 (15-20)** | | | X | X | | X | |
| **4 (20-25)** | | | | | X | | X |
| **5 (25-30)** | | | | X | X | X | |

UID=Unidentified

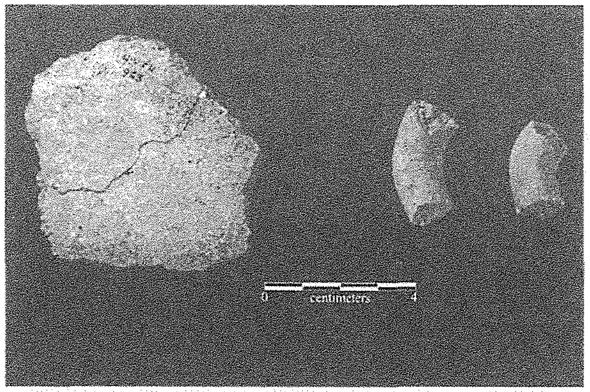

Figure 4. Bone-tempered pottery.

from this block (Lakeman 1998). Four of these varieties either pre-date or are contemporaneous with the mission occupation of 41VT11. These include Puebla Blue on White majolica (Figure 5a-b), Puebla Polychrome (Figure 5c), olive jar (Figure 6a), and Galera ware (Figure 6b). Two of the varieties, 1830s whiteware and Puebla Blue on White II, post-date the occupation of the mission.

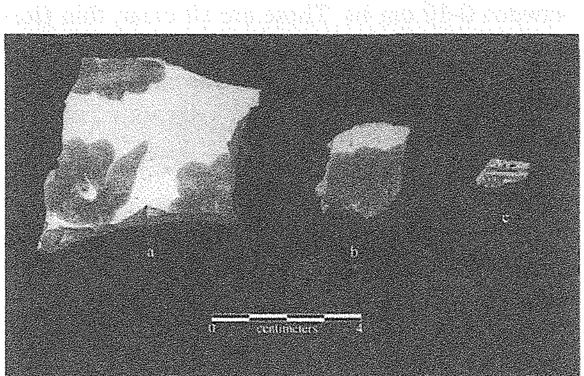

Figure 5. Majolica: a-b, Puebla Blue on White; c, Puebla Polychrome.

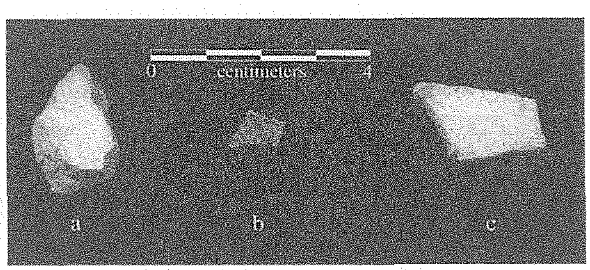

Figure 6. Lead-glazed Wares: a, Olive Jar; b, Galera ware; c, Guadalajara polychrome.

Aranama Polychrome (Figure 7a) may or may not post-date the mission occupation at the site. Deagan (1987) places the production of Aranama Polychrome from 1750-1800. Similarly, Goggin (1968) also dates its span from the middle of the 18th century onward. Dates for two of the types present, an unidentified lead-glazed ware and undecorated majolica, are unknown.

Puebla Blue on White majolica sherds were the most common non-Native ceramic found in Block A-I (n=8), followed by Aranama Polychrome (n=2) and unidentified Mexican lead-glazed ware (n=2). The remaining ceramic types are represented by one sherd each. The vertical proveniences of these non-Native sherds are listed in Table 5.

## Molluscan Remains

A total of 124 freshwater mussel (Unionidae) shells and fragments was counted from Block A-I. This represents both whole and fragmented shells, *not* a minimum number of individuals. Block A-I also produced the least amount of shell from the three blocks.

Over half of the Block A-I mussel shell came from 0-20 cm bs, although levels 4-6 (20-35 cm bs) also produced shell. Two shell beads were collected from level 2 (10-15 cm bs). The larger of the two shell beads (Figure 8a) is barrel-shaped, while the smaller bead (Figure 8b) is more donut-shaped. Level 4 (20-25 cm bs) also contained worked shell: a small, donut-shaped shell bead (Figure 8c) and a portion of a rectangular mussel shell pendant with two drilled holes near its edge (Figure 8d). No shell

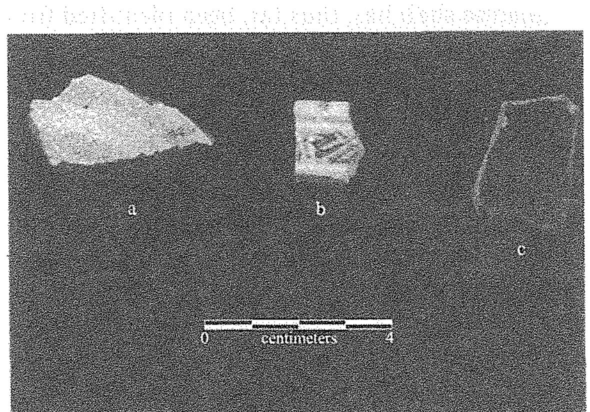

Figure 7. Other Ceramics: a, Aranama Polychrome; b, Chinese porcelain; c, Mexican lead-glazed.

**Table 5. Non-Native Ceramics from Block A-I**

| Level (cmbs) | UID L-G | Puebla B/W | 1830s Whiteware | Olive Jar | Undec. Majolica | Aranama Poly. | Galera Poly. | Puebla B/W II | Puebla Poly. |
|---|---|---|---|---|---|---|---|---|---|
| **1 (0-10)** | X | X | X | X | | | | | |
| **2 (10-15)** | | X | | | X | | | | |
| **3 (15-20)** | | X | | X | | X | X | X | |
| **4 (20-25)** | | | | | | X | | | X |

UID L-G=Unidentified lead-glazed; B/W=Blue-on-white; Poly = Polychrome; undec = undecorated.

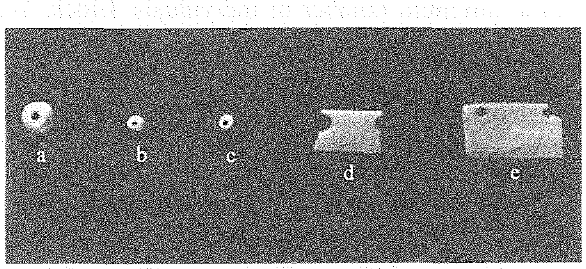


Figure 8. Shell Artifacts: a-c, shell beads; d-e, shell pendants.

was recovered below 35-40 cm bs. In addition, no marine shell has, thus far, been identified from the block.

### Metal

Fourteen metal fragments and objects were found in Block A-I. Eleven were recovered between 0-10 cm bs, including a child's ring (Figure 9a) with a blue inset glass stone. The ring was probably given to a mission Indian child by a missionary. One metal fragment was collected from 10-15 cm bs and two others were retrieved from 20 cm bs. The vast majority of the metal found, with the exception of the ring, are unidentifiable fragments.

### Glass

Twenty-eight sherds of glass were collected from Block A-I. All but one glass sherd was found between 0-10 cm bs. These are all clear, thin (less than 1 mm thick) glass pieces that appear to be from the same vessel or object. One piece of opaque, brown/black glass (5 mm thick) was found in level 3 (15-20 cm bs).

## BLOCK A-II

Block A-II was the largest excavation block opened up in Area A. A total of 7.9 m$^3$ of dirt was removed from 28 m$^2$. The block was excavated to a maximum depth of 50 cm bs. Block A-II yielded much of the same mission

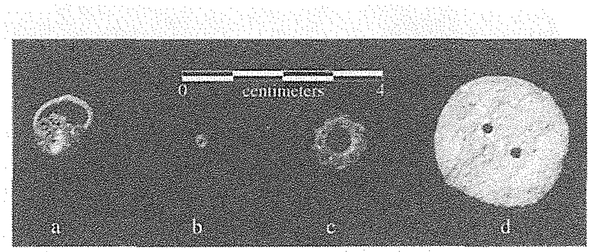


Figure 9. Ornaments: a, Child's ring; b, glass seed bead; c, mulberry bead; d, metal button.

Indian materials as Block A-I, but in greater quantities (Table 6). Furthermore, Block A-II also contained two features.

### Bone

Block A-II produced the largest quantity of bone. Bovid bone, including long bone fragments, adult and sub-adult teeth, and near-complete mandibles, constituted 71 percent (n=715) of the identified fauna. Cow/bison bone was found in abundance from 0-30 cm bs, but in lesser amounts between 35-40 cm bs (Table 7). Domesticated taxa from Block A-II include sheep/goat, pig, and horse. Notably, all of the domesticated animal remains, with the exception of undistinguished cow/bison bone, were found in the upper 4 levels (0-25 cm bs) of the block. In addition, two dense concentrations of bone were uncovered in levels 3 (15-20 cm bs) and designated features.

### Feature A-II-1

Feature A-II-1 (Figure 10) covered almost 1 m$^2$ and was encountered at the bottom of level 2 (10-15 cm bs). In addition to the clustering of bone, Feature A-II-1 also contained lithic debitage, bone-tempered pottery, a Spanish Colonial ceramic sherd,

**Table 6. Summary of Cultural Materials from Block A-II**

| Level (cmbs) | Bone | Debitage | Native Pottery | Non-Native Ceramics | Mussel Shell | Marine Shell | Lithic Artifacts | Metal | Glass |
|---|---|---|---|---|---|---|---|---|---|
| **1 (0-10)** | 3505 | 1554 | 856 | 14 | 67 | 1 | 8 | 34 | 19 |
| **2 (10-15)** | 1763 | 530 | 383 | 5 | 260 | 0 | 8 | 5 | 3 |
| **3 (15-20)** | 1160 | 568 | 354 | 7 | 107 | 0 | 8 | 10 | 3 |
| **4 (20-25)** | 748 | 385 | 173 | 4 | 37 | 0 | 2 | 3 | 1 Bead |
| **5 (25-30)** | 308 | 180 | 55 | 0 | 27 | 0 | 0 | 0 | 0 |
| **6 (30-35)** | 68 | 140 | 23 | 0 | 12 | 0 | 1 | 0 | 0 |
| **7 (35-40)** | 21 | 60 | 2 | 0 | 7 | 0 | 1 | 0 | 0 |
| **8 (40-45)** | 18 | 27 | 4 | 0 | 4 | 0 | 0 | 0 | 0 |
| **9 (45-50)** | 0 | 8 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| **TOTAL:** | 7591 | 3452 | 1850 | 30 | 523 | 1 | 28 | 52 | 26 |

**Table 7. Bone from Block A-II (McClure 1999)**

| Level (cmbs) | Cow/ Bison | Snake | Turtle | Fish | Deer | UID | Bird | UID Mammal | Non-Specific Artiodactyl | Sheep/ Goat | Raccoon | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 (0-10)** | X | X<br>CW, UID, RT, PV, CR, RS | X<br>UID, BX, SS | X<br>GAR, CF | X | X | X | X | X | X | X | Rodent; Rabbit; Rock Squirrel; Pocket Gopher; Alligator; Armadillo; Pig |
| **2 (10-20)** | X | X<br>RT, RS/CW | X<br>SS, UID, ST | X<br>UID, CF | | X | | X | X | X | X | Domestic Cat; Armadillo |
| **3 (20-30)** | X | X<br>UID, PV | X<br>UID, SS ST, BX | X<br>UID, GAR CF | X | X | X<br>UID, TK | X | X | X | | Striped Skunk; Bobcat; Jackrabbit |
| **4 (30-40)** | X | X<br>UID, PV | X<br>SS | X<br>UID, CF GAR | X | X | X<br>TK | X | | X | X | Opossum; Horse |
| **5 (40-50)** | X | | X<br>UID, SS | | | X | | X | | X | | |
| **6 (50-60)** | | | | | | X | | X | | | | |
| **7 (60-70)** | X | | | | | X | | X | X | | | |
| **8 (70-80)** | | | | | | X | | | | | | |

UID=Unidentified; CW=Coachwhip; RT=Rat Snake; PV=Pit Viper; CR=Cotton Rat Snake; RS=Racer Snake; BX=Box Turtle; SS=Soft Shell Turtle; ST=Slider Turtle; CF=Catfish; TK=Turkey

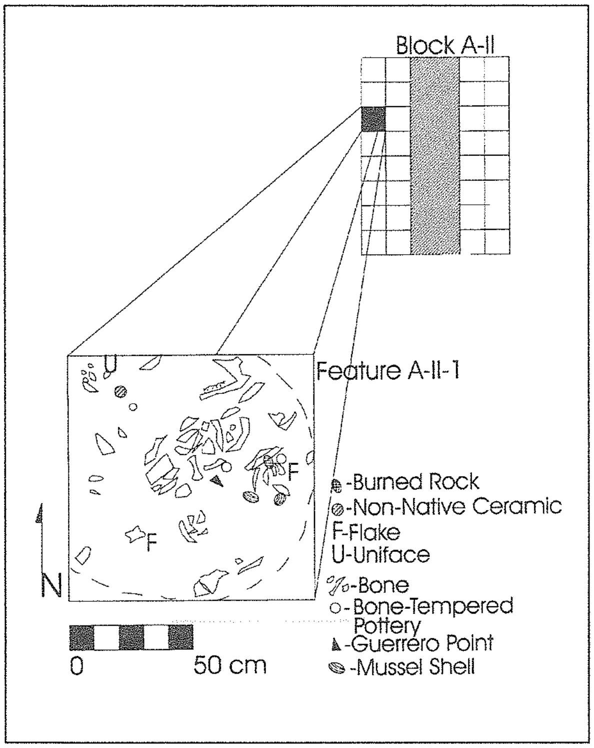


Figure 10. Feature A-II-1, Block A-II.

mussel shell, one uniface, and one Guerrero point (see Figure 3b). Both domestic and wild taxa were recovered, including catfish, unidentified fish, pit viper snake, turtle, softshell turtle, turkey, deer, cow/bison, large mammal, and sheep or goat. Although not designated as part of the feature during the excavations, it appears that much of the faunal and lithic debris in the units directly south of Feature A-II-1 are part of the feature. The accumulation of materials in these units appears to extend outside the excavation block. Feature A-II-1 is probably the remains of a small trash heap where food remains were discarded after being processed and consumed. The presence of the Guerrero point, the Spanish Colonial ceramic sherd, and domestic faunal materials suggests that the small midden is contemporaneous with the mission period occupation.

### Feature A-II-2

Feature A-II-2 (Figure 11) is a smaller concentration of bone than Feature A-II-1. The top of Feature A-II-2, east of Feature A-II-1, was encountered in level 2. The feature extends into the east wall of the unit and probably extends into the unexcavated mid-section of Block A-II. This feature also appears to be the remains of a small trash midden that is directly associated with, if not part of, Feature A-II-1. The association of Feature A-II-2 with Feature A-II-1 indicates that they are contemporaneous. Both features appear to have accumulated during the mission Indian occupation.

The majority of bone recovered from Feature A-II-2 is cow/bison. Gar fish, unidentified large mammal, and several bone-tempered sherds were also present in the feature, along with mussel shell, a burned rock, and unidentified faunal materials.

### Lithics

Debitage counts were lower in Block A-II than in the other two blocks. Nearly 90 percent of the debitage was recovered from 0-25 cm bs, although

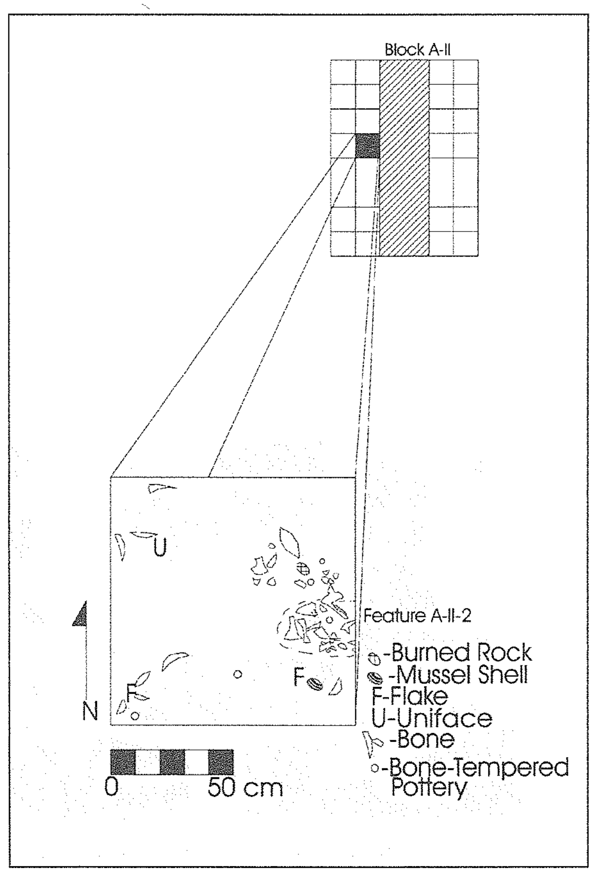


Figure 11. Feature A-II-2, Block A-II.

flakes were also found in the deeper levels. An average of 4.6 levels per unit was excavated in Block A-II. This may account for the decrease in flakes below levels 4 (20-25 cm bs); however, 46 percent of the 28 units opened were excavated below level 4.

Twenty-seven stone tools are identified from Block A-II: eight unifaces; four hammerstones; four cores; two possible gunflints; one biface; one edge-modified flake; one metate fragment; one mano fragment; one Guerrero point (see Figure 3b); a Guerrero preform (see Figure 3c), a proximal fragment of a side-notched dart point (Figure 12b); the proximal end of a Marcos point (Figure 12c); and the proximal end of a Perdiz point (Figure 12d). Twenty-six of these lithic artifacts were recovered from the first four levels (Table 8). Interestingly, the older dart point and Marcos point were found in levels above the Perdiz and Guerrero points. The stratigraphic reversal of these points is probably the result of either natural or cultural disturbances.

### Native Pottery

Bone-tempered pottery was found in all levels of Block A-II except level 9 (45-50 cm bs). Ninety-five percent of the sherds were recovered from 0-25 cm bs, but below 20-25 cm bs, sherd counts of bone-tempered ware dropped significantly. However, more than half of the units opened ended at levels 4. Block A-II yielded more bone-tempered pottery than either blocks A-I or A-III.

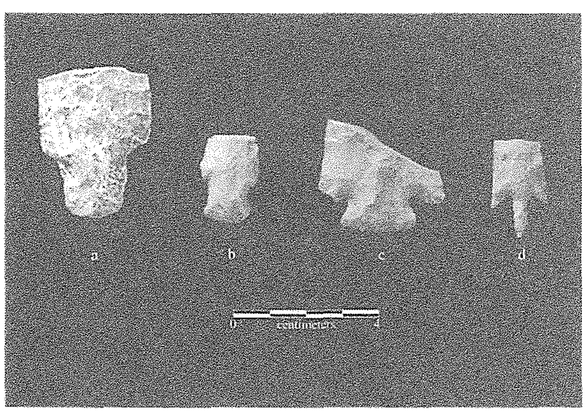

Figure 12. Projectile Points: a, unidentified dart point base; b, side-notched dart point base; c, Marcos point base; d, Perdiz arrowpoint.

### Non-Native Ceramics

Thirty non-Native sherds were collected from Block A-II. All 30 sherds were found from 0-25 cm bs, but 47 percent came from 0-10 cm bs (Table 9). These sherds include nine identifiable and three unidentified types (Lakeman 1998), including undecorated majolicas, olive jar sherds (n=5), whiteware (n=3), two pieces each of lead-glazed ware, Puebla polychrome, Aranama polychrome, Puebla blue on white, and Guadalajara polychrome pottery (see Figure 6c). In addition, one piece of Chinese porcelain (see Figure 7b), a Mexican lead-glazed rim sherd (see Figure 7c), and one unidentified sherd were also collected from Block A-II.

### Molluscan Remains

Freshwater mussel shell (Unionidae) was present in levels 1 through 9 (0-50 cm bs). Over 60 percent of the shell was found between 0-15 cm bs. The shell counts decrease rapidly in the lower levels of the block. In addition to freshwater shell, a marine shell (Olividae) fragment was also found in level 1 (0-10 cm bs).

### Metal

Metal was found in the most abundance in Block A-II, with more than 50 pieces of metal collected from the excavations. The majority are non-diagnostic fragments, found from 0-10 cm bs. Several of these metal objects included modern nails and fragments of barbed wire fencing that post-date the occupation of the mission. The remaining metal artifacts were found between 10-25 cm bs.

### Glass

Block A-II contained more glass (n=26) than either blocks A-I or A-III. Among the block's glass artifacts was one glass trade bead. Most of the glass items are broken pieces of glass from unidentified objects or vessels. Although glass was found between 0-25 cm bs, level 1 (0-10 cm bs) had 73 percent of the glass artifacts from the block.

Sixteen of the glass fragments are very thin (less than 1 mm thick) clear glass sherds that appear to be from the same object. Two of the

**Table 8. Lithic Artifacts from Block A-II**

| Level (cmbs) | Biface | GF | Points | Uniface | Cores | HS | Modified Flakes | Metate | Mano |
|---|---|---|---|---|---|---|---|---|---|
| 1 (0-10) | X | X | Guerrero Preform | X | X | | | | |
| 2 (10-15) | | X | UID Dart Point Marcos | X | | X | | X | |
| 3 (15-20) | | | Perdiz Guerrero | X | | X | X | | X |
| 4 (20-25) | X | | | | X | | | | |
| 5 (25-30) | | | | | | | | | |
| 6 (30-35) | | | | | X | | | | |
| 7 (35-40) | | | | | X | | | | |

GF=Gunflint; HS=Hammerstones

glass artifacts from level 1 are refits that most likely post-date the occupation of the mission. Both of these clear glass pieces have bubble-shaped decorative rims and may have formed part of a bowl or cup. One additional glass fragment found in level 1 also appears to post-date the mission occupation. It is a clear piece of broken glass (2.5 mm thick) with the letters "r's" raised on its surface. The fragment likely came from a bottle or mason jar.

There were four glass artifacts, including a glass bead, from 10-15 cm bs. The remaining glass artifacts include three small pieces of clear, thin glass with a thickness of 1-2 mm. The glass trade bead (see Figure 9c) is a large necklace bead (Harris type no. 42) or "mulberry" bead. It is barrel-shaped and of mandrel-wound, pressed facet, simple construction. Its surface resembles that of hobnail glass and it dates from 1700-1740 (Harris and Harris 1967).

Three pieces of glass were recovered from level 3 (15-20 cm bs), including one small, heavily patinated sherd of clear glass (3 mm thick), a piece of brown patinated glass 2.5 mm in thickness, and one small sherd of clear glass 2 mm in thickness. No glass was found between 25-50 cm bs.

## BLOCK A-III

An area of 16 $m^2$ was opened and 4.45 $m^3$ of dirt were removed from Block A-III during the 1997 TAS Field School. The block was placed along

**Table 9. Non-Native Ceramics from Block A-II**

| Level (cmbs) | Olive Jar | GB | Undecorated Majolica | UID L-G | 1830 WW | Puebla Poly. | Arana Poly. | Puebla B/W | UID | PC | Burnished Rim |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 (0-10)** | X | X | X | X | | | | | | | |
| **2 (10-15)** | | | | | X | X | X | | | | |
| **3 (15-20)** | | X | | X | X | X | | X | X | | |
| **4 (20-25)** | | | X | | | | | | | X | X |

GB=Guadalajara burnished; UID L-G=Unidentified lead-glazed;PC=porcelain; WW=whiteware; B/W=Blue-on-white; UID=unidentified; Poly=Polychrome

a westward facing slope in Area A (see Figure 1). Test excavations in 1995 suggested the possibility of a dense bone midden in this part of Area A. In addition, a cattle trail and small east-west drainage that runs across the area revealed bone, sherds, and lithics. Block A-III was opened up in order to investigate these findings. An average of 4.5 levels was excavated per unit in the block, and approximately 50 percent of the excavation block was excavated below level 4. The block was excavated to a maximum depth of 40 cm bs.

Block A-III excavations yielded similar artifact assemblages to those found in blocks A-I and A-II. However, the quantity of certain cultural materials (Table 10) from Block A-III varied greatly from the other two blocks.

## Bone

Bone was found from 0-40 cm bs. Ninety-four percent of the faunal materials recovered from Block A-III were found between 0-25 cm bs, and counts dropped significantly from 20-25 cm bs. The frequency of bone also declined from 25-40 cm bs, coinciding with a decrease in the number of units that were excavated below 20-25 cm bs.

Forty-eight percent (n=137) of the identified faunal materials are either bovid or cow-sized mammals. Domestic taxa include sheep/goat and domestic pig (both categories comprise less than 1 percent of the identified faunal remains), found in the upper 20 cm of the block (Table 11). A tubular bone bead (Figure 13) similar to the bone beads found at the site in 1995 and 1996 (Hester et al. 1996; Walter 1997) was collected from level 2 (10-15 cm bs).

## Lithics

Lithic debitage in Block A-III, although found in all levels, was concentrated between 10-20 cm bs. The flake counts decrease below 20-25 cm bs, which corresponds with a decline in the number of units that were taken below this depth.

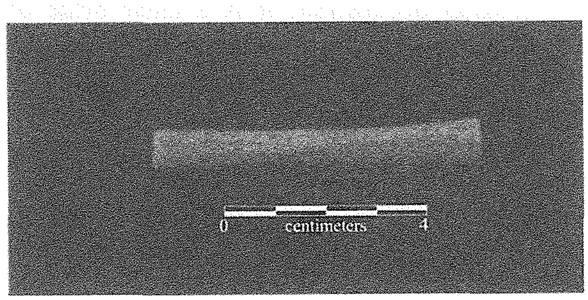


Figure 13. Tubular Bone Bead.

**Table 10. Summary of the Cultural Materials from Block A-III**

| Level (cmbs) | Bone | Debitage | Native Pottery | Non-Native Ceramics | Mussel Shell | Marine Shell | Lithic Artifacts | Metal | Glass |
|---|---|---|---|---|---|---|---|---|---|
| **1 (0-10)** | 1344 | 707 | 317 | 5 | 83 | 0 | 7 | 17 | 2 (1 Bead) |
| **2 (10-15)** | 920 (1 WRK) | 1000 | 514 | 12 | 108 (1 Pendant) | 0 | 9 | 5 | 0 |
| **3 (15-20)** | 1653 | 1195 | 346 | 2 | 219 | 0 | 15 | 2 | 1 |
| **4 (20-25)** | 174 | 865 | 114 | 0 | 146 | 0 | 13 | 0 | 1 |
| **5 (25-30)** | 57 | 433 | 53 | 1 | 129 | 1 | 10 | 0 | 0 |
| **6 (30-35)** | 23 | 138 | 6 | 0 | 59 | 0 | 2 | 0 | 0 |
| **7 (35-40)** | 2 | 21 | 1 | 1 | 10 | 0 | 0 | 0 | 0 |
| **TOTAL:** | 4173 | 4359 | 1351 | 21 | 754 | 1 | 56 | 24 | 4 |

WRK=Worked Bone

More lithic tools and artifacts were found in Block A-III than either of the other two blocks combined. Fifty-four stone tools were recovered between 0-35 cm bs in the block. The collection is comprised of 13 hammerstones, 12 edge-modified flakes, five cores, five unifaces, four choppers, three bifaces, two perforators (Figure 14a-b), a medial fragment of a dart point, an arrow point preform, three mano fragments, one Guerrero point (see Figure 3d), and one gunflint (Figure 14c). The largest concentration (68 percent) of lithic tools was recovered between 15-30 cm bs (Table 12).

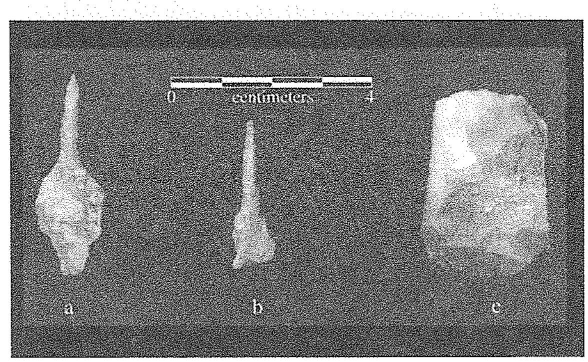


Figure 14. Lithic Artifacts: a-b, perforators; c, gunflint.

**Table 11. Bone from Block A-III**

| Level (cmbs) | Cow/ Bison | Snake | Turtle | Fish | Deer | UID | Bird | UID Mammal | Non-Specific Artiodactyl | Sheep/ Goat | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 (0-10)** | X | X UID | X UID | X UID, GAR | | X | | X | | | Leopard Frog; Toad; Domestic Pig; Raccoon; Rodent; Jack Rabbit; Alligator |
| **2 (10-15)** | X | X CW | X UID, SS BX | X UID, GAR, CF | | X | X UID | X | X | X | Ringtail; Opossum; Cougar; Armadillo; Domestic Cat; Pig; Jackrabbit |
| **3 (15-20)** | X | X CW, RS | X UID, BX SS | X UID, SMB LN, GAR | X | X | | X | | X | Domestic Cat; Opossum; Rodent |
| **4 (20-25)** | X | X NP | X UID, ST BX | X UID, SCF | X | X | | X | | | Armadillo; Pocket Gopher |
| **5 (25-30)** | | | X UID | | | X | | | | | |
| **6 (30-35)** | X | | | | | X | | X | | | |
| **7 (35-40)** | | | | | | | | X | | | |

UID=Unidentified; CW=Coachwhip; RS=Racer Snake; NP=Non-Poisonous Snake; SS=Softshell Turtle; BX=Box Turtle; ST=Slider Turtle; CF=Catfish; SMB=Small-Mouth Buffalo Fish; LN=Longnose Gar; SCF=Sea Catfish

## Native Pottery

Native bone-tempered pottery was present in all levels of Block A-III. Eighty-seven percent of the aboriginal pottery, however, was found from 0-20 cm bs. The quantity of bone-tempered pottery decreases substantially from 20-25 cm bs to ·40 cm bs.

### Non-Native Ceramics

Non-Native ceramic counts are low in Block A-III, with 21 sherds found in five of the seven levels excavated in the block. The majority came from 0-15 cm bs. Two other sherds were found between 15-20 cm bs, another from 25-30 cm bs, and one sherd from 35-40 cm bs. Eight types of ceramics are present, including lead-glazed wares (n=6), plain majolica (n=5), Puebla Blue on White majolica (n=1), Puebla Polychrome (n=1), olive jar (n=4), Aranama Polychrome (n=1), 1830s whiteware (n=2), and Chinese porcelain (n=1) (Table 13).

### Molluscan Remains

Block A-III contained more freshwater mussel shell (Unionidae) than the other two blocks. Greater than 50 percent of the mussel shell sample was found between 0-20 cm bs.

A rectangular mussel shell pendant with two drilled holes near the top of an elongated edge (see Figure 8e) was recovered between 10-15 cm bs. The pendant is similar to the shell ornament found in Block A-I, and to shell pendants recovered from the 1995 excavations (Walter 1997). One marine shell or scallop (Pectinidae) was found in level 5 (25-30 cm bs). In addition, three shell features, including a feature that was identified during the 1995 excavations, were encountered in Block A-III.

### Features

Feature 95-2 was described by Walter (1997) as a dense concentration of freshwater mussel shell that appeared to be the result of shell processing and subsistence activities. The remaining portion of Feature 95-2 (Figure 15), exposed at 15-20 cm bs, extends approximately 20-35 cm to the north of the previously excavated northern edge of the feature and measures approximately 10 cm in thickness. In addition to shell, the feature also contained snail shells, chert flakes, and a few bone fragments, along with a broken biface and bone-tempered pottery.

**Table 12. Lithic Artifacts from Block A-III**

| Level (cmbs) | GF | MF | Uniface | UID Points | Guerrero Point | Biface | Chopper | HS | Mano | Cores | PRF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 (0-10)** | X | X | X | X | X | | | | | | |
| **2 (10-15)** | | X | | | | X | X | X | | | |
| **3 (15-20)** | | X | X | | | X | X | X | X | X | |
| **4 (20-25)** | | X | X | | | | | X | X | | |
| **5 (25-30)** | | X | | X (Preform) | | | X | X | X | X | X |
| **6 (30-35)** | | | | | | X | | X | | | |

GF=Gunflint; MF=Modified Flake; UID=Unidentified; HS=Hammerstone; PRF=Perforator

**Table 13. Non-Native Ceramic from Block A-III**

| Level (cmbs) | Puebla B/W | Olive Jar | Aranama Poly. | 1830 WW | Puebla Poly. | UID L-G | Undec. Majolica | Porcelain |
|---|---|---|---|---|---|---|---|---|
| **1 (0-10)** | X | X | | | | | | |
| **2 (10-15)** | | X | X | X | X | X | X | X |
| **3 (15-20)** | | | | | | X | | |
| **4 (20-25)** | | | | | | | | |
| **5 (25-30)** | | | | | | X | | |
| **6 (30-35)** | | | | | | | | |
| **7 (35-40)** | | | | | | X | | |

WW=Whiteware; UID L-G=Unidentified lead-glazed ware; B/W=Blue-on-white; Poly=Polychrome; Undec=Undecorated

Both Features A-III-1 and A-III-2 are contemporaneous refuse heaps (Figure 16) that were found in the same 1x1 meter unit and encountered at the same depth (25-30 cm bs). Feature A-III-1 is a small, dense concentration of freshwater mussel shell. Feature A-III-2 is located just northwest of Feature A-III-1. This feature is also a dense concentration of mussel shell intermixed with flakes, a broken hammerstone, and one edge-modified flake.

An additional clustering of shell (Figure 17), although not designated a feature, was also noted in another unit at the same depth (25-30 cm bs) as Features A-III-1 and A-III-2. This discrete concentration of shells was associated with several flakes and a few, scattered burned rocks. The feature most likely represents another small trash heap that amassed during and after subsistence activities.

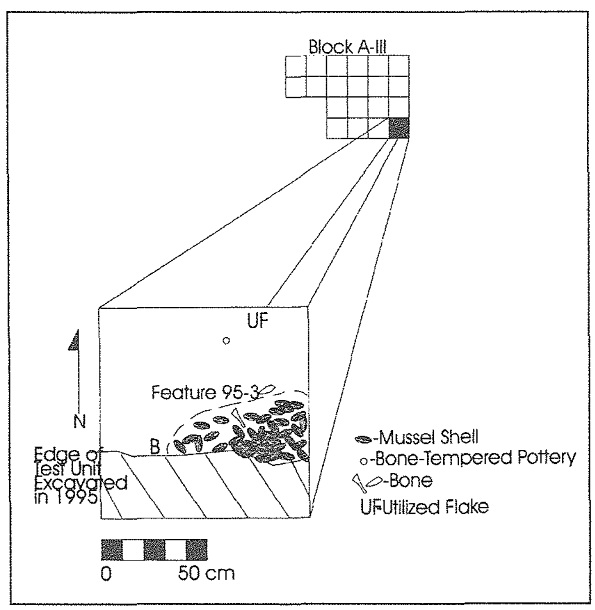


Figure 15. Feature 95-3, Block A-III.

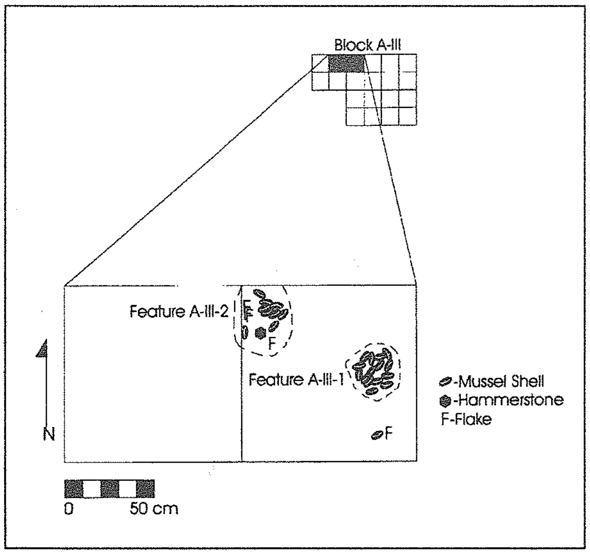


Figure 16. Features A-III-1 and A-III-2, Block A-III.

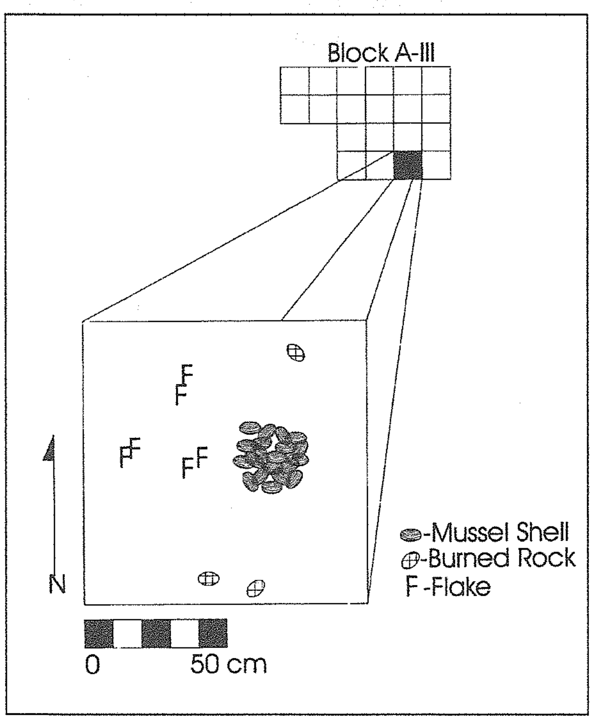


Figure 17. Shell cluster, Block A-III.

### Metal

Metal was found only in the first three levels of Block A-III, with more than 50 percent of the 24 metal fragments found in the first levels. Although no formal analysis has been completed, initial examination of the metal indicate a large number of modern items (e.g., nails and barb wire fencing), and several fragmentary and unidentifiable pieces. A metal button hammered from a lead musket ball, however, was collected from the block (see Figure 9d).

### Glass

Four glass items were found in Block A-III: one glass trade bead and several miscellaneous and undated glass fragments. Level 1 (0-10 cm bs) contained one small sherd of beige-colored, frosted glass (1.5 mm thick) and a glass trade bead. The glass bead (see Figure 9b) is a donut-shaped, translucent blue seed bead (Harris type No. 48) that dates from 1700-1836 (Harris and Harris 1967). Level 3 (15-20 cm bs) had one bottle neck fragment of amber-colored glass. The glass fragment measures 1 mm in thickness at the body and 4 mm at the neck. A small piece of light green glass was found from 20-25 cm bs.

## DISCUSSION

All three of the excavation blocks from Area A produced similar concentrations of cultural materials. Although only five features were uncovered, evidence of mission Indian occupation is manifested in the assemblage and patterning of artifacts throughout Area A.

### Block A-I

When examining the horizontal provenience of cultural materials from Block A-I, there appear to be no discrete concentrations of artifacts or faunal materials, but rather a light scattering of mission Indian materials. Of all three excavation blocks opened up in Area A, Block A-I was the smallest excavation area. Not surprisingly, this block also had the least amount of cultural materials. The lithic debitage count in Block A-I, however, is high relative to its size and the density of artifacts recovered from the other two blocks. High flake counts are noted in the lower as well as the upper levels of the deposits, and this may reflect the discard of materials from lithic reduction or tool manufacturing activities.

The lithic materials encountered in levels 5-7 (below 30 cm bs) of Block A-I probably pre-date the mission period and are indicative of a Late Prehistoric occupation of the site. Judging from the vertical and horizontal locations of artifacts, the mission Indian deposits are encompassed in the first four levels (0-30 cm bs) of the block. The mission deposits are characterized by domestic faunal materials, Spanish Colonial ceramics, and glass and metal artifacts that are probably related to the Spanish occupation of the site.

### Block A-II

Block A-II is the largest block in Area A, and it yielded the largest sample of cultural materials. Like Block A-I, the mission deposits here appear to be confined to the upper 25 cm, although some stratigraphic mixing of mission and pre-mission deposits may have occurred, based on the provenience of dart points and arrow points.

Most of the midden deposit encountered in Block A-II consist of bone. In addition, the two Spanish Colonial age features identified are comprised of discrete bone clusters with domestic and wild taxa. The dense concentrations of bone are probably indicative of animal processing and/or food consumption. The occurrence of several lithic unifaces or scrapers in association with the faunal materials suggests that food preparation activities were being performed here. Although no complete metal tools were found, the relative abundance of metal fragments from the block suggests the importance of metal tools in combination with lithic scrapers in butchering and processing both indigenous and Spanish-introduced animals. This was also evidenced in the faunal materials collected from Area B during the 1995 excavations (Walter 1997).

### Block A-III

Block A-III produced the densest concentration of materials. Unlike blocks A-I and A-II, however, the mission deposits in Block A-III are not as dense, but are concentrated between 0-15 cm bs. Also, the bulk of Late Prehistoric cultural materials are found below the mission deposits (15-25 cm bs). The placement of the block along a slope suggests that erosion may have removed much of the upper portion of the mission deposits, leaving only a thin layer of mission-related materials. The erosion and disturbance of the soil deposits may also account for the occasional mission period artifact found in the lower levels of the block (Shoberg 1998). Unquestionably, there were mission deposits present in Block A-III; however, the bulk of the materials appear to be related to a Late Prehistoric occupation.

Freshwater mussel shell, bone-tempered pottery, and lithic debitage and tools were found in abundance in Block A-III, along with three shell features, including part of a feature that was uncovered in 1995. Most likely, these features resulted from the processing and consumption of mussels.

## IMPLICATIONS

The patterning of artifacts from Area A indicate that mission Indian habitation deposits are present in this part of the site, although there was little evidence obtained regarding specific activities (i.e., very few discrete features were found). Furthermore, a Late Prehistoric occupation of the site was identified below the mission Indian archeological deposits. A preliminary comparison of these two separate occupations suggests that certain Late Prehistoric technologies and lifeways continued into the mission period.

The Toyah horizon represents the Late Prehistoric period (ca. A.D. 1300-1600) in southern Texas (Black 1986, 1989). This period is characterized by Perdiz projectile points, end scrapers, gravers, perforators, knives, bone tools, bison faunal remains, and bone-tempered pottery (Leon Plain) (Black 1989; Hester 1989). Interestingly, Area A yielded a collection of artifacts and faunal remains from both the upper and lower levels of the excavation blocks that resemble Toyah horizon assemblages. Lithic debitage, Perdiz projectile points, scrapers, unifaces, perforators, mussel shell, shell and bone ornaments, and bone-tempered pottery comprised much of the collection from the Area A excavations of 1995 and 1997. The presence of these artifacts in both the pre-mission and mission deposits suggests a persistence of Late Prehistoric traditions and technologies into the protohistoric and historic eras.

The appearance of Spanish-introduced cultural materials and their association with Native cultural remains marks the mission occupation period at the site. More specifically, this collection of cultural materials indicates a mission Indian occupation in Area A. What separates the mission deposits from the prehistoric occupation of the site is the presence of Spanish-introduced artifacts such as metal, glass, European and Mexican ceramics, and Spanish-introduced livestock. In addition, the appearance of Guerrero projectile points and Native-made gunflints is also indicative of the mission era (Hester 1989). Undoubtedly, the lithic artifacts, worked shell and bone, and bone-tempered pottery are aboriginal in origin and the Spanish-introduced artifacts were incorporated, to some degree, into the lifeways of the Native inhabitants.

Although no direct evidence of living structures was found, the cultural materials recovered indicate a strong mission Indian presence in Area A. Area A consists, primarily, of scattered intact midden deposits suggestive of Native residence. At present, relating Area A to the rest of the site is difficult. Unfortunately, the entire layout of the mission complex is not presently known. However, the 1995, 1997, and 1998 investigations in the architectural ruins, Area D, do provide some interesting clues to the mission's organization.

Five structures have currently been identified at 41VT11. The mission structures were constructed of sandstone cut from the quarry. Mortar for building was most likely produced in lime kilns, such as the kiln discovered in Area E (Figure 18). The structures form an L-shaped pattern (see Figure 1) that appears to be the west and north edges of a plaza or compound. The outer western walls of the structures are presumed to have formed part of a protective wall for that portion of the complex. Although no direct evidence of a wall or enclosure was found, it is assumed that a protective wall or palisade extended eastward from the mission structures to form the compound (Walter and Hester 1998).

During the 1995 University of Texas Field School, Jack Eaton identified two mission structures (Structures 1A and 2). The partially standing ruins represent Structure 1A (Figure 19). The sturdy construction and thick walls of Structure 1A indicate that it may have served as the granary or part of the mission church. Structure 2, a detached building directly south of Structure 1A, was completely uncovered in 1997 during the TAS Field School and is identified as the friar's living quarters (Eaton 1998). The structure has red painted plaster on its interior walls and a base of an altar or shrine that was probably used to hold a religious statue or cross (Eaton 1998).

Three additional structures were uncovered during the 1997 and 1998 TAS Field Schools. Structures 1B and 3 extend north from Structure 1A and may form part of the church. The north wall of Structure 3 forms a semi-circular pattern or apse-like feature. The poor construction of Structure 3 and the lack of symmetry suggests that the structure may have been added later (Walter and Hester 1998). Structures 4 and 5, oriented east-west, presumably form part of the northern wall of the

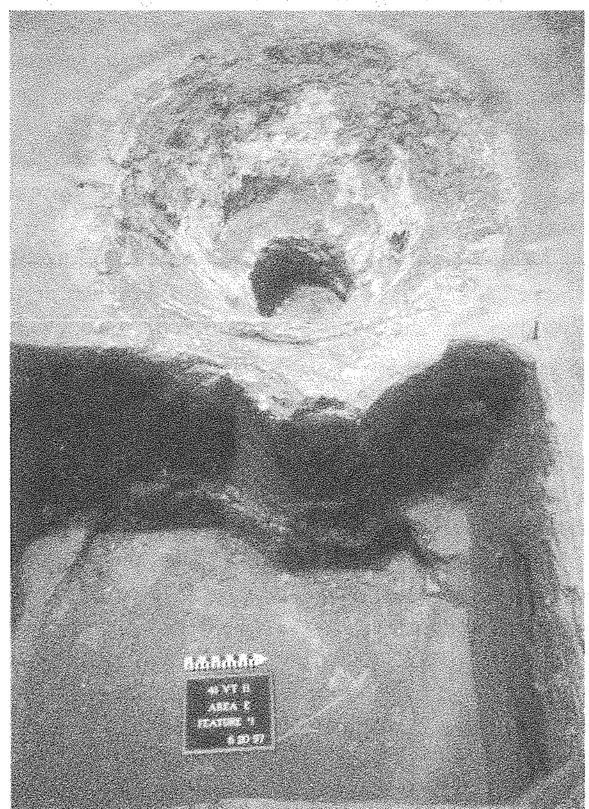

Figure 18. Lime Kiln.

Figure 19. Standing Ruins of Structure 1A.

mission complex. The two structures share a common wall; however, it does not appear that they were built at the same time. Structure 5, for example, shares construction details with Structure 3, indicating that both structures may have been built haphazardly. The base of a buttress was found along the northeast corner of Structure 4 and a similar feature was located outside of Structure 1B. In addition, two layers of cobble floors were also uncovered during the 1998 investigations just outside a splayed doorway of structure 5. In direct association with the cobble floors was a midden containing mission Indian bone-tempered pottery, majolicas and other Spanish Colonial ceramics, some Caddo Indian pottery, various metal objects, glass beads, and large amounts of processed animal bone (Walter and Hester 1998).

As stated above, it is probable that structures 1 through 5 helped to form the western and northern boundaries of the enclosed mission complex. It appears that all of these structures opened up into a central plaza area just east of Structures 1, 2, and 3. Seemingly all of this area would have been surrounded by a protective stone wall or, more likely, a wooden palisade; the size of the compound remains unknown. Despite the lack of evidence for a compound wall, archeological reports and historical accounts note their presence at several of the missions in Texas (Hard et al. 1995; Mounger 1959; Oberste 1980; Ricklis 1998). The Native inhabitants at Espiritu Santo probably lived outside the compound walls, at least during the initial years of a mission's existence when more permanent residences inside the complex were not yet constructed (Anne Fox, 1998 personal communication).

Despite the paucity of information on the size and dimensions of the mission complex, the layout of the existing structures suggest that Area A was outside the mission compound. The mission Indians were known to have left the mission at different times throughout the year to return to traditional territories and lifeways (Castañeda 1936–1939). The mission was at a disadvantage because of its isolated location along the northern frontier of New Spain, making it difficult to acquire necessary supplies to support themselves and the Native population. Because the Aranama and Tamique were not permanent residents of the mission— and due to the brief amount of time the mission was occupied—it is plausible that a large portion of the Indian habitation areas were outside the mission walls where temporary shelters may have been constructed. Area A probably comprises the largest Native residence area at the site.

## CONCLUSIONS

Over the course of three years, investigations at Espíritu Santo (41VT11) in Mission Valley, Texas, have largely focused on the mission Indian habitation areas of the site (Area A). Initial testing at the site in 1995 revealed a significant mission Indian occupation in Area A, and subsequent excavations in 1997 verified this area as a Native habitation zone. The 1997 TAS field school excavations constituted the largest investigation of Area A and the entire mission to date.

Three large excavation blocks were opened in Area A. The goal of our investigations there was to expand the 1995 excavations. The cultural materials recovered in the block excavations indicated that both Late Prehistoric and mission period occupations are present in Area A. The mission period deposits were marked by the presence of both Spanish and Native cultural remains. The mission deposits are concentrated in the upper 30 cm of Area A and a Late Prehistoric occupation is present beneath these deposits. No direct evidence of living structures (e.g., post holes or daub) was found; however, the combination of the artifact assemblage and the layout of the mission structures distinguishes Area A as a mission Indian living area.

This article represents a preliminary study of the 1997 TAS excavations. Certainly future analyses will expand our knowledge of the Native habitation zones. Additional materials from both the 1997 and 1998 TAS Field Schools have yet to be analyzed and more extensive archival research is currently underway. Our initial findings, however, provide a general understanding of the functions of Area A and future work is not likely to contradict our initial conclusions. Ideally, more intensive investigations of Area A will contribute to a better understanding of the everyday lives of the mission Indians.

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# The Dam and Acequia Systems of Espíritu Santo de Zúñiga: Construction, Use, and Abandonment

*Jennifer Rinker, I. Waynne Cox, and C. Britt Bousman*

## INTRODUCTION

Investigations at the Texas Archeological Society field school at Mission Espíritu Santo de Zúñiga in the summers of 1997 and 1998, under the direction of Dr. Thomas R. Hester, included the relocation and documentation of the *acequia* (irrigation) system. Over the period of occupation at the mission, two *acequia* systems were built and abandoned. Physical, historical, and paleoclimatic analyses indicate that the *acequia* system was established during a drought and abandoned during a wet period when the mission inhabitants shifted to dry land farming.

## HISTORICAL RECORDS ANALYSIS AND INTERPRETATION

On April 10, 1722, the Marquis de Aguayo authorized Father Patron to establish a mission near the new presidio on the banks of Garcitas Creek. The murder of Captain Domingo Ramon in 1723, followed by the inept leadership of his son, Diego, and the continuing hostility of the Karankawa, doomed the first attempt to settle the area at Espiritu Santo Bay (O'Connor 1966:10-13). An inspection of the inhospitable environment and inaccessible region by Governor Perez de Almazan, in April 1726, caused him to order its relocation to the Guadalupe River valley. The mission Nuestra Señora del Espíritu Santo de Zúñiga and the presidio La Bahía (Nuestra Señora de Loreto) were in their new location (now 41VT11) when Pedro de Rivera y Villalon arrived, on November 27, 1727, to include them as a part of his four year inspection of the frontier defenses of New Spain (Jackson and Foster 1995:40). It has been reported that during his short visit Rivera recommended that "the soldiers and mission Indians should construct a dam in order to irrigate the lands" (Castañeda 1938:85).

This recommendation is not unexpected considering the mind set of the Spanish. The high, arid land of central Spain required the utmost care and management of the limited water sources to support its population. The Moors had elevated that requirement to a refined science. That is not to say that the irrigation skills of Spain were solely a gift of the Islamic occupation; the Roman innovations in classical Europe are still dramatically evident in the remains of the first century A.D. stone aqueducts near Segovia (Glick 1970:188). The Moors brought with them, through their Middle Eastern heritage, techniques that had made the deserts of North Africa lush and productive, and applied them to their new land across the Mediterranean. Upon their conquest of Mexico, the Spanish found an abundance of canal irrigation in use in the New World (Doolittle 1990:6). It was only natural for them to make this their first consideration in the selection of a site for a new settlement.

Although it is not known exactly when the recommendation from Rivera was taken and the construction of an *acequia* system initiated, all early reports of the mission are consistent in the results of the venture. Herbert Eugene Bolton (1915:19-20) reported:

> ...several years had been spent, after the transfer to the Guadalupe River, in an attempt to build a dam across that stream as a preliminary to irrigation. Meanwhile the missionary had supported his charges on provisions purchased with his annual stipend. But this did not suffice, and during the greater part of the

> year the Indians sought their own food on the prairies and the forest. In 1736, however, the attempt to build the dam was abandoned, and agriculture without irrigation was at once successfully established. Thereafter the Indians raised, by their own labor, plentiful maize and vegetables, and cared for large herds of stock.

Over two decades later, Carlos Castañeda (1938:85) repeated essentially the same story, noting that "for ten years they all tried in vain to carry out this impossible project." The consistency of the reports is not remarkable since there is virtually only one account of this venture that has been located to date, the report of Father Ignacio Antonio Ciprian to the Commissary General of October 27, 1749:

> The two tribes of the Tamiquez and the Xaranamas Indians joined the mission and for ten continuous years the poor missionary supported the Indians at a great financial strain, paying the expenses with the allowance His Majesty gave him for his maintenance. The provisions were transported 110 leagues from the Rio Grande missions or 60 leagues from the missions of San Antonio. This supply was not sufficient to maintain the Indians, who for a good part of the year supported themselves by hunting and by gathering what they found in the fields. Beset with all these problems, the mission now pressed for ways of drawing water from the river to irrigate the fields. A great amount of money and time were spent in carrying out this plan, which was given up in 1736, when planting was done during the rainy season of the year. The Indians now had sufficient food, and the superfluous corn of the preceding year is given to the Captain of the presidio and in lean years he pays for it (Leutenneger 1979:22-23).

Father Ciprian arrived in Texas before 1731 and administered the first baptism at the newly established Villa de San Fernando, later to become the city of San Antonio. In 1738, he was chosen vicar and secretary of the College of Zacatecas, and in 1741 he was elected as consultor. He apparently replaced the missionary at Nuestra Señora del Espíritu Santo in August 1747. Although it is unfortunate that the only accounts of the period of irrigation were written by the missionary who was not present during that time, the late arrival of Father Ciprian does not greatly weaken the reliability of his account; the truth is, his is the only one available. Father Mariano de Anda y Altamirano had served as the missionary at the mission from 1727 until he was replaced to travel to Mexico City to present a memorial on behalf of the San Xavier missions. Due to the relocation of these missions to the San Antonio River, he probably did not return to that post (Habig 1973:110, 115).

## TECHNOLOGICAL ANALYSIS

There are, in fact, not one but two separate structures in association with the irrigation system, both apparently constructed during the colonial period while the mission was occupied. The one referred to by Father Ciprian is located on the west bank of the Guadalupe River approximately 300 m south of the De Witt County line, and has been recorded as 41VT135. The other structure, 41VT13, is located on the left bank of Mission Creek approximately 13 km northwest of Victoria (Calhoun 1966). Both are diversion dams, or weirs, meaning that their purpose is to redirect the flow of water into the *acequia*, and not to serve as impoundment structures.

The structures are constructed of hewn limestone block quarried at their respective locations, and they appear to have been fully completed at the time of their abandonment. Although the report states that the period of hardship lasted a full decade, it does not state that the effort to construct the Guadalupe dam was undertaken for that length of time. In fact, it appears to indicate that after enduring food supply shortages for some period of time, the dam and *acequia* construction was undertaken as a means to alleviate the situation. It is clear that the attempt was abandoned in 1736 when dry land agriculture was attempted and found to be the solution. There is no mention of the second system established on Mission Creek, although the *acequia* was apparently completed, but of limited success. The primary limitation to the second system is that Mission Creek, at present, is an intermittent stream and contains water only during rainy periods, and would have had very limited use during periods of drought stress when irrigation would have been most essential.

## 41VT135: THE GUADALUPE DAM AND ACEQUIA

We suspect that the initial water control efforts associated with the mission were conducted on the Guadalupe River at 41VT135. The location of the dam is approximately 11 km from the mission site. The dam is 23.47 m long (Figure 1) and averages 1.7 m in width. The present height of the dam is approximately 75 cm above bedrock, but was presumably significantly higher at its construction. The dam does not extend the full distance across the river and, therefore, was not intended to function as a full containment or impoundment dam. The dam served to slow down the flow at an already slow bend in the river, and funnel the water through an off-take and into the *acequia*, which then carried the water to the fields under cultivation.

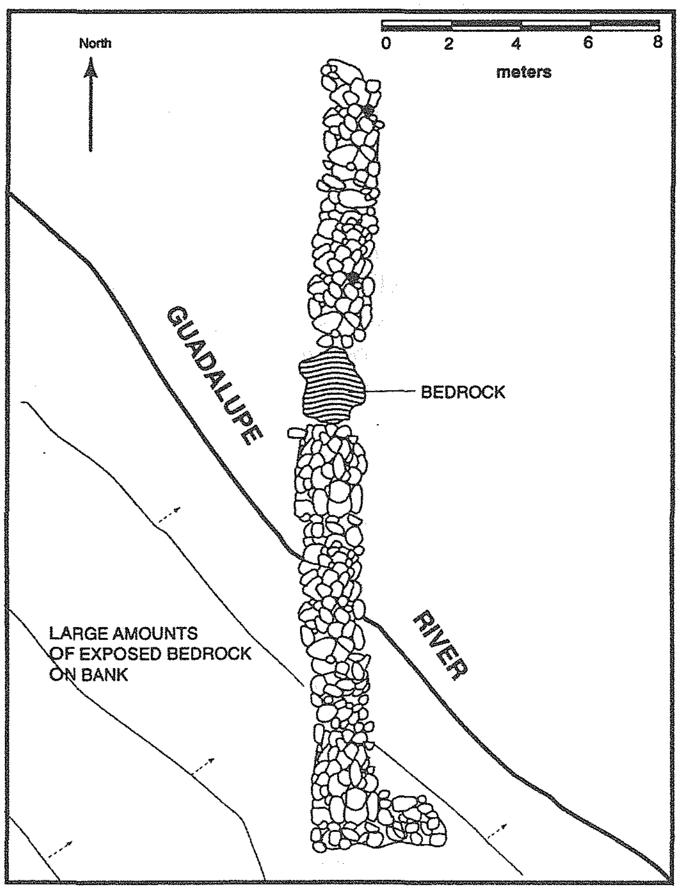


Figure 1. Planview of diversion dam (41VT135) on the Guadalupe River.

The channel of the Guadalupe River is extremely wide at this location, and the bedrock is exposed both on the bank and into the riverbed. The typical sequence of decision-making for dams and *acequias* is to identify prime agricultural lands in the area and then determine the off-take location on the major water source (James Neely and William E. Doolittle, 1997 personal communications). This decision is critical in determining the canal grade, as too steep a gradient would cause the canal channel to erode out of use, while too slight a gradient would cause the canal channel to silt up out of use; both cases would require frequent maintenance in order to have a fully functional irrigation system. Having traveled approximately 5 km upstream and 11 km downstream from the dam, we feel that this location is the better of only two possible locations for a dam on the Guadalupe River within the vicinity of the mission. The banks of the Guadalupe are highly clayey with sands and gravels that would not provide stable footing to support such a substantial structure. In addition, the banks, at least presently, are relatively downcut and would not provide the necessary grade to allow water to flow into an *acequia*; in other words, water would either have to flow uphill or such an enormous structure would have to be created to achieve the water level necessary to flow at that elevation. The floodplain and low terraces all along the banks of the Guadalupe River from this location to the mission would be well-suited for agricultural activities; they are good to excellent soils for a variety of crops and are relatively level lands. Therefore, we suspect that the decision-making process in the manufacture of the dams and *acequias* differed from the norm. Because there would have been sufficient arable lands in the vicinity, the limiting factor would have been a solid foundation for a dam structure. In this instance, the dam location was chosen initially and the field areas subsequent to that. Therefore, the reasons for locating the dam such a far distance from the mission location were made out of necessity, not choice.

Even though the area at the dam is relatively flat compared to the rest of the river, the topography is still significantly steep between the river and the probable irrigation lands that the *acequia* would have to have paralleled the river for quite a distance before the path could have been taken away from the river. We found no evidence of the *acequia* in our brief reconnaissance, but the topography dictates that, unless they had devised some way to make water go uphill, this is the only possibility. In addition, we feel that, due to the extension of the dam well into the present bed of the river, the dam was constructed during a dry year. Therefore, because the location of the dam necessitated that the *acequia* very closely parallel the river for quite a distance, one slightly heavy rain would cause the river to rise significantly and potentially destroy a large portion of the *acequia*. When the *acequias* are earthen with no berm reinforcements or channel protection, as these appear to have been, the system could have been destroyed beyond repair with one minor flood. However, because accessibility to private lands prevented any further investigations of the *acequia*, what we propose here is only the most probable explanation with the present data.

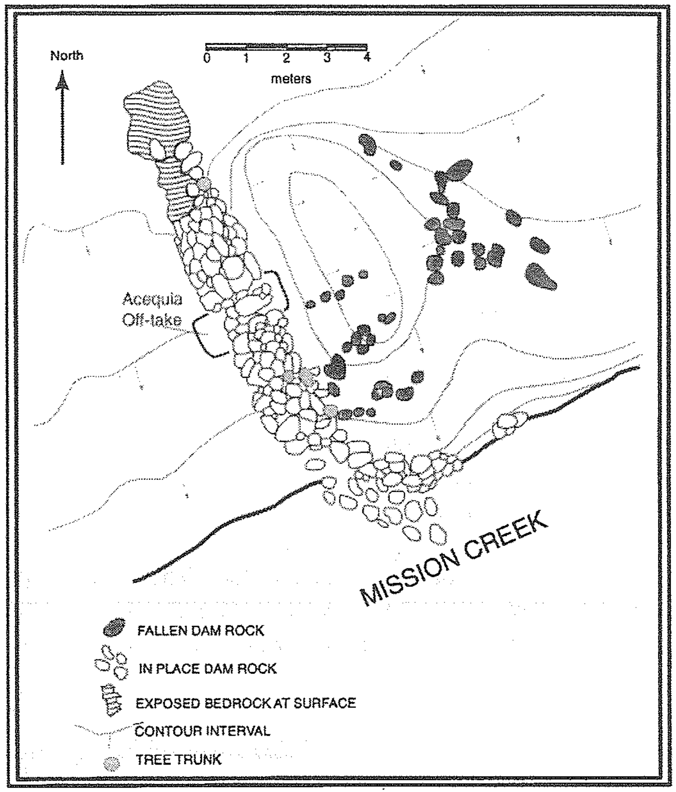


Figure 2. Planview of the diversion dam (41VT13) located on Mission Creek.

## 41VT13, THE MISSION CREEK DAM AND ACEQUIA

The better-known dam structure associated with the mission occupation is located on Mission Creek approximately 13 km northwest of Victoria, just off Lower Mission Valley Road. The dam is 14 m long (Figure 2) and does not extend more than 5 m into the present creek. Although the highest point of the structure is only ca. 1.25 m above the present ground surface (bs), testing during the 1997 Texas Archeological Society field school indicated that the coursing continued 1.50 m bs to the base of the dam on a bedrock foundation. This indicates that although some of the upper courses of the dam are certainly missing now, the dam stood at least 2.75 m in height from its bedrock footing. The dam is located at a slight bend in the creek that would have facilitated the flow of the water toward the west bank where the dam is located. The offtake to the *acequia* is well-defined as an intentional opening in the approximate center point of the dam. There is also evidence of a set of slots cut into the dam for a sluice gate to control the flow of water into the canal.

One hand-dug trench across the *acequia* (Figure 3), located 190 m from the dam, indicated that the *acequia* itself was wide and shallow. Our 4 m-long trench excavated just over half of the width, from spoil bank (berm) to spoil bank, of the *acequia*; the channel itself may have been from 4-5 m wide. The substrate is a mottled clay that appeared to have served as the channel bottom; it would be relatively impermeable so there was no reason to prepare the canal bottom to prevent seepage. A dense layer of cobbles were located on the creek-side of the *acequia* trench that may be an intentional armoring of the downslope side of the canal for reinforcement.

Evidence of the *acequia* is present along most of its 2 km course from the dam to the point very

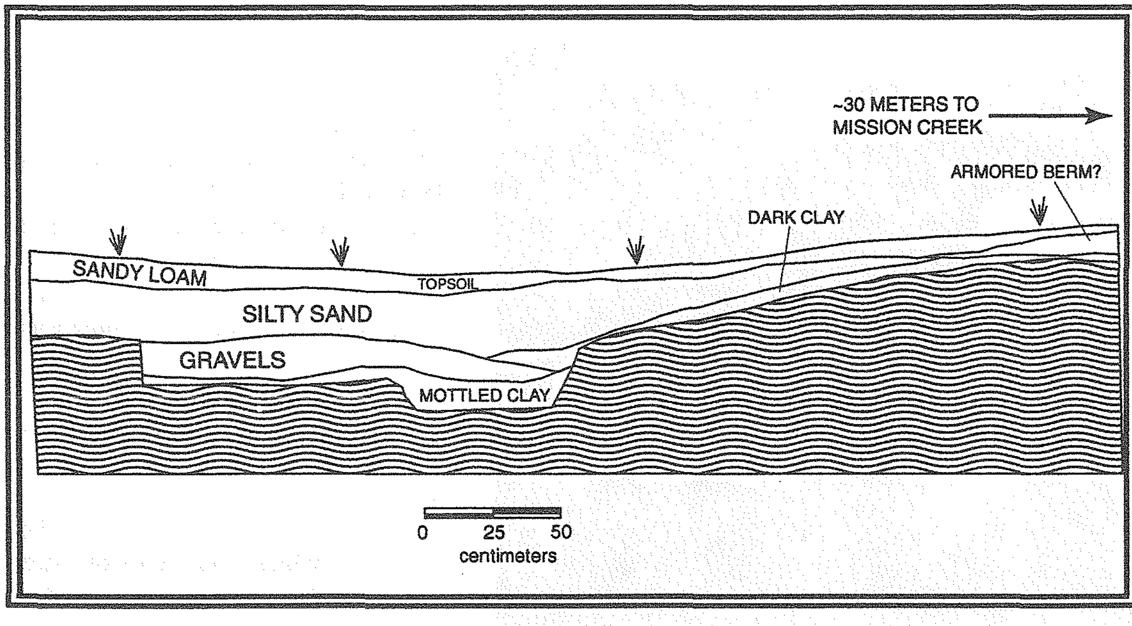


Figure 3. Trench profile of Mission Creek *acequia*.

near the mission location where waters were reclaimed into the Guadalupe River (Figure 4). The *acequia* path was identified from spoil banks and a channel depression, linear alignments of large trees within the waterway, or, when no surficial evidence was available, the topography of the landscape. In the segments where the *acequia* was not evident on the surface, our methodology was to follow the probable contours from the last known point; with one notable exception, there were few instances when this was necessary and when it was, we seldom went more than 50 m without encountering a recognizable segment of the *acequia*. The *acequia* parallels the creek for more than half of its distance.

A large meander in Mission Creek, located approximately 1 km from the dam, would have been the most likely location for the *acequia* to begin traveling away from the creek toward the mission. Unfortunately, it was at this critical location where erosion and modern plowing and farming activities has obliterated 300 m of the *acequia* at the surface. The topography dictates that the *acequia* must travel further to the east in order to get around the changes in elevation also present at this location. The *acequia* then cuts across the landscape, parallels the modern fields located on the Guadalupe River to the east of the mission, and appears to empty into the river. Two possible *acequia* laterals were identified based on anomalies from early aerial photographs, but were not actually located on the surface; modern farming may have obliterated any surface evidence of them. The overall gradient of the *acequia* is 0.7 percent. This slope is excellent to maintain channel integrity, but might result in slight to moderate sedimentation. The maintenance that this implies may explain the height of the spoil banks in some segments of the *acequia*; muck from the channel would have been placed immediately to the sides of the channel, or on the spoil banks.

The Mission Creek *acequia* crosses four soil types in its course (Figure 5). The soil into which the first half of the *acequia* is excavated is Straber loamy fine sand. According to Miller (1982:32), the permeability is low, runoff is slow or medium, and the hazard of water erosion is slight. Present uses of this soil type include primarily range and pasture lands, and the acidity of the soil may have prevented the growth of certain types of crops. Therefore, the likelihood of small field areas along the length of the *acequia* is low. The second soil type through which the *acequia* courses is Valco clay loam. Permeability is moderate, surface runoff is medium, and the hazard of water erosion is moderate to severe (Miller 1982:35). This soil is also the exact location where severe erosional gullies have helped to obliterate evidence of the system. We could conjecture that erosion in this area may have contributed to the eventual abandonment of the irrigation system on Mission Creek. The third

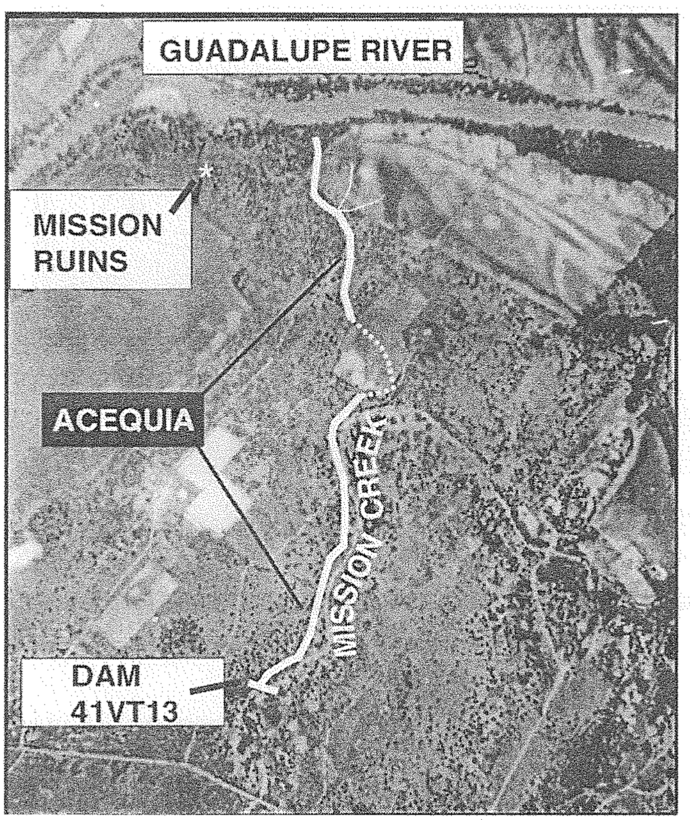


Figure 4. Course of the Mission Creek *acequia* toward the Guadalupe River and the mission location. Dotted line represents segment of *acequia* destroyed by modern farming.

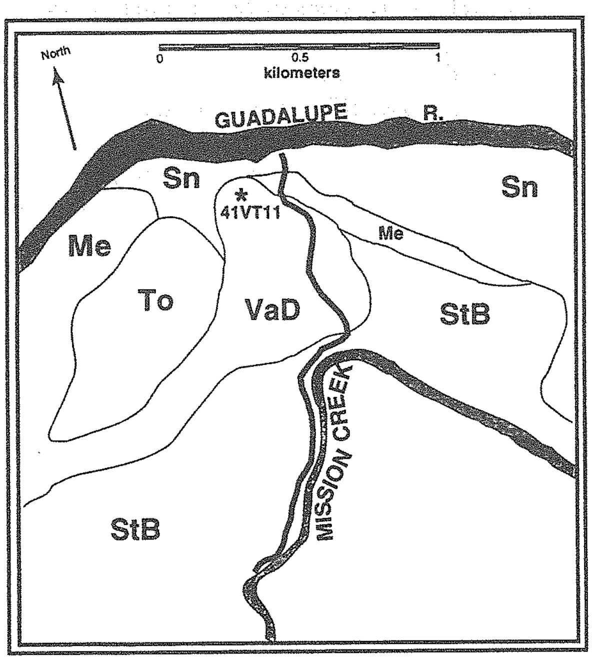


Figure 5. Soils through which the Mission Creek *acequia* flows in its course.

and fourth soil types are Meguin silty clay and Sinton loam. These soils are nearly level and located along the floodplain of major rivers. Flooding is frequent and these soils are inundated once every 2-8 years. Permeability is moderate, runoff is slow, and the hazard of water erosion is slight except in areas subject to stream bank caving. Both the Meguin and Sinton are extremely well-suited for farming and have the highest rating potentials for grain and seed crops (Miller 1982).

Based on investigations conducted in the field and archives, we propose the following scenario for the irrigation system at mission Nuestra Señora del Espíritu Santo de Zúñiga. The provisions supplied from the Rio Grande and San Antonio missions were not sufficient, and Rivera made the recommendation in 1727 to initiate irrigation efforts in the area. The first attempts were made on the Guadalupe River, and a substantial diversion dam was constructed. Due to the topography, the *acequia* had to very closely follow the river for quite a distance, and was probably badly damaged with the first hard rain. Efforts after some unknown time on the Guadalupe were abandoned, and a less torrential, more manageable water source was chosen. A second diversion dam and *acequia* system were constructed on nearby Mission Creek. Irrigation efforts were tried for some time before they were eventually abandoned in 1736. Reasons for the abandonment of the Mission Creek system could have been any combination of the following: (1) severe erosion problems in the mid-section of the *acequia*; (2) water availability in Mission Creek was too low during the dry months; (3) realization that rainfall would provide the needed water for dry farming; and/or (4) realization that livestock prospered on the lands.

## TREE-RING RECORD

The above interpretation of the *acequia* system was completed only from the historical and technological analyses. After these were complete, the local tree-ring record was reviewed; tree-ring records are available nearby from Coleto Creek and a generalized record is available for the region (Stahle and Cleaveland 1988). This record is based on post oak (*Quercus stellata*) from living trees and specimens preserved in log cabins (Stahle and Herr 1984; Therrell n.d.).

Stahle and Cleaveland (1988, 1993), Stahle et al. (1998), and Therrell (n.d.) have demonstrated that post oak tree ring width correlates well with both the June Palmer Drought Severity Index (JPDSI) and the Southern Oscillation. In both cases, narrow tree rings reflect dry conditions and wide rings represent wetter years. Figure 6 shows the tree ring width index for the years from 1725-1750 for Coleto Creek and the generalized South Texas records. As all tree ring widths become systematically narrower with declining growth rates and larger tree diameters as the tree ages, tree ring width indices provide a standardized measurement to account for this systematic decline in ring width. Although the South Texas and Coleto Creek tree ring width indices vary during any specific year, both show similar dry and wet periods. As the Coleto Creek tree is closer to the mission, its record is relied on to a greater degree in this analysis. However, as the recent flood of October 1998 sadly demonstrates, the Guadalupe River has a large catchment basin that extends far into the western portion of Central Texas, and flooding in the downstream portion can occur due to heavy rains in any portion of its catchment basin. For this reason the generalized South Texas tree ring indices are also shown. In addition, the June PDSI reconstructions are presented to provide a measure of drought and wetness intensity (Figure 7).

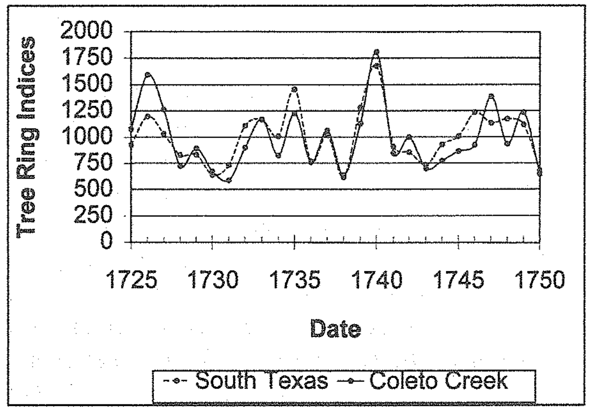


Figure 6. Coleto Creek and generalized South Texas tree-ring indices for 1725-1745 (data from NOAA Paleoview Internet Site and Therrell n.d).

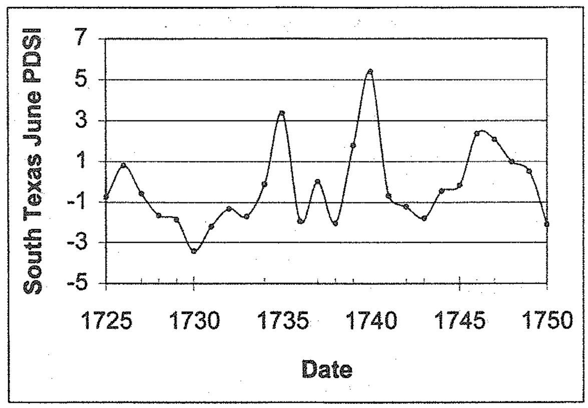


Figure 7. June Palmer Drought Severity Index for South Texas (after Stahle and Cleaveland 1988).

The tree-ring data substantiates our interpretation of the sequence of activities remarkably well. In the South Texas record, 1726 and 1727 were average rainfall years (between –1 and +1 JPDSI); however, at Coleto Creek, the tree ring indices indicate it was much wetter than the regional record. It was during this time that the mission was moved to the Guadalupe River, and Rivera recommended irrigation efforts there. Therefore, the conditions in which they had observed the Guadalupe River were during an average regional period and during a locally wet period. During this 25 year period in the South Texas June PDSI record, 17 years were either wet or dry (less than –1 or greater than +1), and only nine years fall between +1 or –1. Thus, while these years were mathematically average, they were not common. The Spanish perceptions of the utility and manageability of the river would have been skewed by these average-to-wet rainfall amounts.

The period from 1728-1732 were dry years locally and regionally. We suggest, as postulated from the technological analysis of the *acequia* system, that the Guadalupe River dam was constructed during this dry period. The area then experienced three alternating wet and moderately dry years from 1733 to 1735. The *acequia* system on the Guadalupe River could have been washed out by high water, especially in 1735, that need not have been a result of locally heavy rainfalls. This scenario suggests a longer use-history of the Guadalupe dam and *acequia* than implied in the technological analysis. In 1733 and 1735 moderate local rainfalls are suggested by the Coleto Creek tree ring record. We propose that it was during this period when the Mission Creek dam was probably constructed. Water levels in Mission Creek would have probably been reliable during this period in order to provide the *acequia* system with enough water. In 1736, however, the tree-ring records suggest that conditions were dry and possibly so little rainfall fell that Mission Creek dried up, and the *acequia* did not flow. This is the exact year Bolton (1915) indicates attempts to irrigate were abandoned. The next year (1737) was wet enough to favor dry-farming, followed by a year of likely water availability problems for dry-farming; 1739 and 1740 were two years of wet conditions when dry-farming would have been productive, and irrigation would no longer have been necessary. The following six years were dry as indicated by the Coleto Creek tree-ring record, and the next year, 1747, was wet.

Therrell (n.d.) has demonstrated that the South Texas post oak record is reflected in the Anglo-American historic observations on weather and climate in the mid-19th century. Our interpretation of this tree-ring record suggests that minor variations in climate directly affected the Spanish colonial and Native American farming practices at Mission Espíritu Santo de Zúñiga in Texas. Stahle et al. (1998) have made a similar case for the abandonment of the Lost Colony of Roanoke (1587-1589) in North Carolina and the high mortality and near abandoment of Jamestown, Virginia (1606-1612).

## SUMMARY

Historic records, technological analyses of the irrigation system, and tree-ring evidence have been combined to propose a sequence of construction, use, and abandonment of the irrigation systems at the Mission Espíritu Santo de Zúñiga, Victoria County, Texas. The *acequia* system was constructed on the Guadalupe River during a drought period when water levels in the river were low. Terrace topography and bedrock morphology limited the potential dam sites and forced the placement of the *acequia* near the river. A series of wet years, especially in 1735, resulted in flooding that may have destroyed the *acequia* system along the Guadalupe River, but favored its relocation along Mission Creek, a intermittent tributary of the Guadalupe River. The *acequia* system on Mission Creek was dependent on its consistent flow. Even after a series of locally wet years in 1733 and 1735, this system was abandoned in favor of dry-land farming. Historic records indicate it is unlikely that the *acequia* system was ever used after 1736.

## ACKNOWLEDGMENTS

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# The Spanish Colonial Missions of Espíritu Santo (41GD1) and Nuestra Señora del Rosario (41GD2), Goliad, Texas: Exploring Patterns of Ethnicity, Interaction, and Acculturation

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## ABSTRACT

Recent excavations at the mission sites of Espíritu Santo (41GD1) and Rosario (41GD2) provided large samples of colonial period artifacts and fauna, along with limited samples of macrobotanical remains. The excavations in two different midden areas at Espíritu Santo show differences in the proportional representation of some artifact classes, indicating spatial variability in the colonial period assemblage at that site. At Rosario, a stratified series of middens was found to overlie a colonial wall foundation and associated floors, indicating the existence of at least one previously unrecorded building outside the main mission compound. Majolica typological data, in conjunction with the documentary record, suggest that the lower middens at Rosario date prior to 1780, while the upper midden dates to between ca. 1790 and the closing of the mission in 1806. Changes in artifact assemblages at this site suggest modifications in Native lithic technology, notably a marked decline in the production of traditional tool types, probably as imported metal implements replaced those of Native manufacture. Comparisons of the Native pottery assemblages from the two sites indicate distinctly different ceramic traditions, that at Espiritu Santo linked to the Late Prehistoric bone-tempered plainware tradition of the inland Toyah horizon, and that at Rosario linked to the sandy paste, asphaltum-decorated Rockport ware series of the central Texas coast. Based on the findings, several inferences are made concerning the ethnicity of Native groups, their mobility patterns, economic activities, and patterns of interaction.


## INTRODUCTION

The investigations reported here were carried out under the auspices of Coastal Archaeological Studies, Inc. during 1997 and 1998. Our primary goals were to define patterns of adaptation at the missions and to explore the kinds of changes which took place in Native American culture in response to the novel opportunities and constraints inherent in mission life. This article presents a general summary of the findings, with an emphasis on those aspects of artifact assemblages and depositional contexts most relevant to an understanding of the cultural processes that operated at these missions during the latter part of the 18th and very early 19th centuries (detailed descriptions of artifacts, features, and additional data are contained in Ricklis n.d.).

## THE GOLIAD MISSIONS IN CULTURAL AND HISTORICAL CONTEXTS

The mission of Espíritu Santo was originally established in 1722 on Garcitas Creek, near Matagorda Bay, for conversion of the Karankawan tribes of the central Texas coast. Following a breakdown in relations with these coastal peoples, the mission was moved inland to the lower Guadalupe River in 1726 (Hindes 1995; Walter 1997; Walter and Hester 1998; see also Hindes et al. and Walter, this volume). Attendant upon changes in the geopolitical map of colonial Texas, Espíritu Santo was moved to its final location on the San Antonio River at present-day Goliad, Texas, in 1749 (Bolton 1915; Chipman 1992). Concomitantly, the Royal Presidio of La Bahía, originally established near the mission at its initial location, was moved first to the Guadalupe River area and finally re-established within 1 km of the final mission site, on the opposite bank of the San Antonio River (Figures 1 and 2).

Upon relocation to the Guadalupe River, the missionary activities at Espíritu Santo were redirected from the coastal tribes to the Aranama and

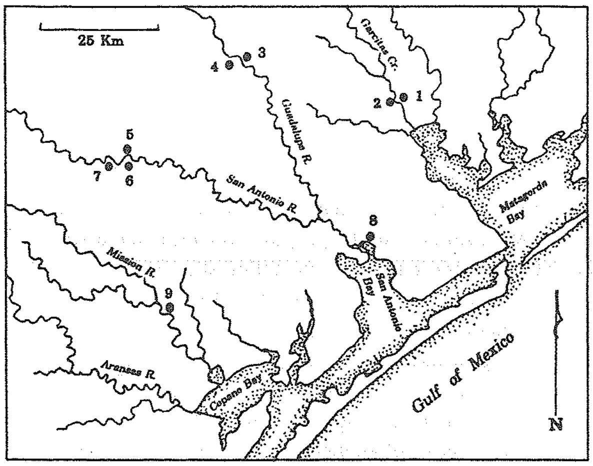


Figure 1. The central Texas coastal prairie region, showing locations and relocations of Spanish colonial missions and Presidio de la Bahía. Key: 1, 2, first location, established in 1722, of Espíritu Santo Mission and Presidio; 3, 4, Espíritu Santo (41VT11) and Presidio until 1749; 5, 6, Espíritu Santo and Presidio after 1749; 7, Rosario; 8, first location of Nuestra Señora de Refugio Mission, 1795; 9, Refugio Mission, 1795-1830.

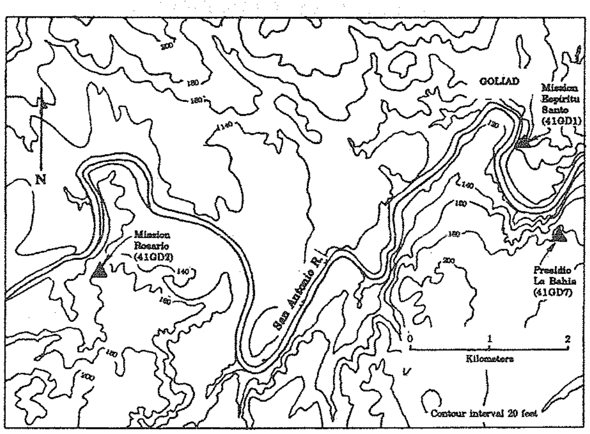


Figure 2. The locations of Espíritu Santo Mission, (41GD1), Rosario Mission (41GD2), and Presidio de la Bahía in relation to the San Antonio River and local topography.

Tamique, inland Native groups of the area. Initially, both the mission and presidio consisted mainly of wooden buildings and protective walls; excavations conducted in 1940 at Espiritu Santo revealed post molds and other evidence of the early wooden buildings and surrounding stockade. By 1758, the mission complex included a church and priests' quarters of stone and mortar, and thatched roof *jacales* that served as domiciles for resident Native people. Herds of cattle and other livestock, the economic mainstay of the Goliad missions, grew tremendously, reaching peaks of tens of thousands of head by the 1780s. The wooden structures at Espíritu Santo had been replaced by 1768 with stone buildings, including a sizable church, a granary, priests' houses, and workshops. By 1786, the enclosing wall was also made of stone and mortar, with Indian *jacal* housing extending along the insides of the walls (Mounger 1959:33). The mission continued to be occupied up until around 1830, although it declined in population and general significance during the early decades of the 19th century.

In 1754, the Spanish authorities made a fresh attempt to bring the coastal Karankawans, with whom relations had been generally hostile since the 1720s, into the sphere of colonial life and politics (Bolton 1906, 1915; Gilmore 1984). To this end, the Mission of Nuestra Señora del Rosario was established in 1754 on a hilltop overlooking the San Antonio River floodplain, some 6 km west of Espíritu Santo and the Presidio of La Bahía (see Figure 2).

As in the case of Espíritu Santo, the original buildings at Rosario were of wooden construction, although, as discussed below, our findings show that stone foundations and adobe-brick floors were incorporated into the construction effort. Excavations directed by Kathleen Gilmore in 1973-1974 yielded a wealth of information about the buildings and construction phases at Rosario. At least two episodes of church construction were documented, and evidence for an early wood-post stockade enclosure was uncovered (Gilmore 1974a, 1974b). Based on historical documentation, Gilmore defined several periods of construction at Rosario:

1. initial wooden construction, which lasted, apparently, until the time of the visit of inspection of Fray Gaspar de Solís in 1768;

2. construction of buildings and enclosing wall of stone between 1768 and 1779. Gilmore's

archeological work indicated a stone church of this period, decorated with wall murals, as well as various structures/rooms near the church;

3. by 1780, Rosario was abandoned. The Karankawans returned to their home territories along the coast because of "unreasonable and cruel punishments...and because the priests wanted to constrain and deprive the Indians of their liberty" (Reyes 1790); and

4. after a decade of abandonment, Rosario was reopened by Fr. Reyes at the end of 1789. Reyes initially officiated at a small, crude chapel made of poles and thatch, but by 1791 the stone buildings and enclosing wall had been rebuilt, and a new church with a second-story loft, supported by a flying buttress, was constructed (Gilmore 1974b:81).

With the reopening of Rosario, some of the Karankawa returned to the mission. This coincided with a new phase of relatively peaceful and cooperative interaction between the coastal groups and Spaniards (Ricklis 1996), which also involved the founding of a second Karankawa mission, Nuestra Señora del Refugio (Oberste 1942; Ricklis 1996). At the request of the Karankawa themselves, Mission Refugio was initially established in 1791 at the mouth of the Guadalupe River, near the shore of San Antonio Bay. However, the location proved unsuitable to the Spaniards, and in 1795 Refugio was relocated to its final location on the Mission River, where it functioned until 1830. Rosario was officially closed in 1806-1807, when its resident Native peoples were transferred to Refugio (Gilmore 1974b).

Historically, it is well documented that both Espíritu Santo and Rosario derived their primary economic viability from extensive cattle ranching (e.g., Mounger 1959; Myers 1969; Gilmore 1974a, 1974b; Jackson 1986; Thonhoff 1992; de la Teja 1995). Although limited agriculture was practiced, rainfall was unreliable and the deeply entrenched San Antonio River was unsuited to the *acequia* irrigation technology of colonial times. Consequently, maize and other agricultural products often had to be purchased from the San Antonio missions, where extensive irrigation made for more reliable crop yields. Cattle, on the other hand, thrived in the open grasslands of the coastal prairie environment. At the time of its final relocation in 1749, Espíritu Santo owned some 3,000 head of cattle; their number increased to some 15,000 by 1774, not counting "an incomparably greater number of unbranded" animals (Lopez 1940). Similarly, Rosario Mission's herd grew from 700 head in 1754 to over 30,000 (including unbranded) by 1780 (Ramsdell n.d.)

## THE NATIVE AMERICANS

Both the archeological and ethnohistorical records indicate that the inland and coastal Native groups associated, respectively, with the Espíritu Santo and Rosario missions were ethnically and linguistically distinct. Describing the region's Native peoples of the early 16th century, Cabeza de Vaca was able to make clear distinctions between coastal and interior groups (e.g., Campbell and Campbell 1981; Covey 1983). Eighteenth century Spanish colonial personnel consistently noted that the Karankawan tribes of the coast could be readily distinguished from inland groups on the basis of language and a lifeway revolving significantly around economic reliance on coastal food resources (Newcomb 1983; Ricklis 1996).

Archeologically, the material cultures of the coastal Karankawan peoples and various poorly defined inland coastal prairie peoples are represented by distinct Late Prehistoric/Protohistoric assemblages. Many traits are shared by coastal and inland archeological cultures during the Late Prehistoric, including a lithic techno-complex consisting of Perdiz arrow points, unifacial end scrapers, prismatic blade technology, and thin bifacial and sometime alternately beveled knives, plus limited ground stone and bone industries.

It is in the respective ceramic assemblages that the coastal and inland assemblages are readily distinguishable, primarily on the basis of rather consistent differences in ceramic attributes of paste inclusions and surface treatment (Ricklis 1992a, 1995a). On the coast, pottery can be generally assigned to the Rockport ware series, the most diagnostic component of the Rockport phase, which can be linked to the early historic Karankawa (e.g., Campbell 1961; Suhm and Jelks 1962; Corbin 1974; Ricklis 1995a, 1995b, 1996). Typically, Rockport ware consisted of small to medium-sized bowls, jars, ollas, and bottle-like vessels that were coilbuilt with sandy paste clays. Vessel surfaces were either smooth or, less commonly, striated or scored with ribbed bivalve shells used on still-moist pots prior to firing (see Calhoun 1960). The surfaces of Rockport vessels were often coated and/or decorated with asphaltum, a natural black beach tar applied to fired pots. The most typical designs consisted of narrow bands of asphaltum along the lips of vessel rims and vertical squiggles or wavy lines that extended from the rims down along the exterior of vessel bodies. Less commonly, incised and/or punctated decor-ation was executed in moist vessel exterior surfaces prior to firing.

The archeological culture of the inland coastal prairies can be subsumed under the general rubric of the Toyah horizon (Hester 1980; Black 1986, 1989). The ceramics of the Toyah horizon consist primarily of undecorated bowls, jars, and ollas made of more or less heavily bone-tempered clay. Vessels tended to be rapidly fired in oxidizing atmospheres, so the surfaces were light in color (buff, reddish, or pink), while cores of vessel walls were dark gray; occasionally a red wash or slip is found on sherd surfaces (Hester 1975, 1980; Black 1986; Highley 1986; Johnson 1994; Ricklis 1994, 1995a).

Both ethnohistory and archeology indicate that coastal and inland populations of the region subsisted as hunter-gatherers. To date, aside from a scant amount of maize in certain Central Texas Toyah sites, all indications are that peoples of the Toyah horizon and Rockport phase had no reliance on horticultural products. Coastal populations incorporated significant amounts of estuarine fish and shellfish into their diets, and patterned variability in site location, size, and the relative intensity of occupation suggest that fall-through-early spring aggregates of economically important estuarine fish species permitted sizable seasonal congregation of people into "macro-bands" of several hundred individuals (see Ricklis 1992b, 1996). In response to a dearth of usable chert along the coast, people of the Rockport phase made extensive use of estuarine/marine mollusk and gastropod shells for various cutting and scraping tools (e.g., Campbell 1957, 1960; Story 1968; Ricklis and Cox 1993; Ricklis 1996).

## INVESTIGATIONS AND FINDINGS AT ESPÍRITU SANTO (41GD1)

The 1997-1998 excavations at Espíritu Santo were carried out on hillslopes situated immediately outside of the stone wall that surrounded the mission compound, the lower parts of which still stand. Four 1 $m^2$ units were excavated on the west slope, and the same number were dug on the north slope near the northeast corner of the compound (Figure 3). Excavations were controlled in 10 cm arbitrary levels, and all excavated soil was screened through 1/8-inch hardware cloth. Additionally, 15 liter soil samples were retained for fine (1/16-inch mesh) water screening in the laboratory to recover small faunal elements and macro-botanical materials. In both areas, the presently wooded slopes were covered with anthrogenic middens consisting of matrices of silty soil with abundant colonial period artifacts and faunal material. Both middens were found to be essentially intact, with remarkably little admixture of modern debris.

The midden on the west slope was by far the thicker of the two, as great as 120 cm in thickness. Here a relatively complex deposit was found, with lenses of midden material discernible by variable quantities of sandstone rubble, mortar/plaster fragments, ash, and differences in soil color (Figures 4

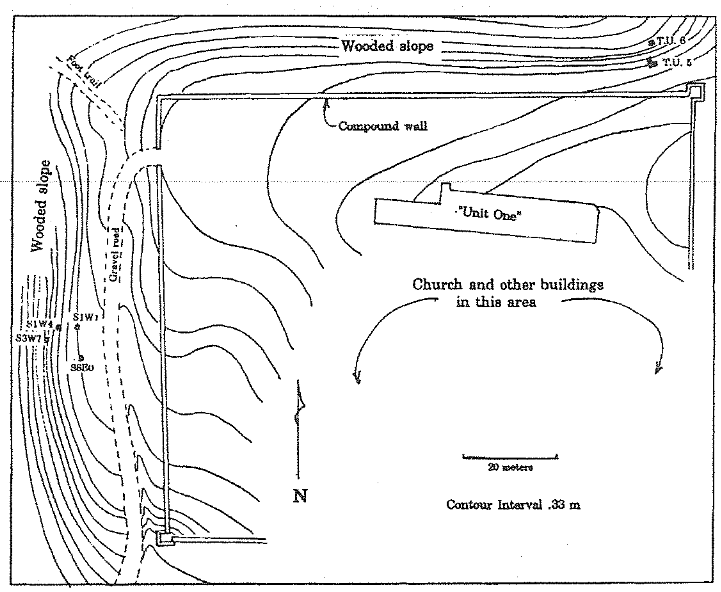


Figure 3. Site map of Espíritu Santo Mission (41GD1), with locations of excavation units on west and northeast slopes.

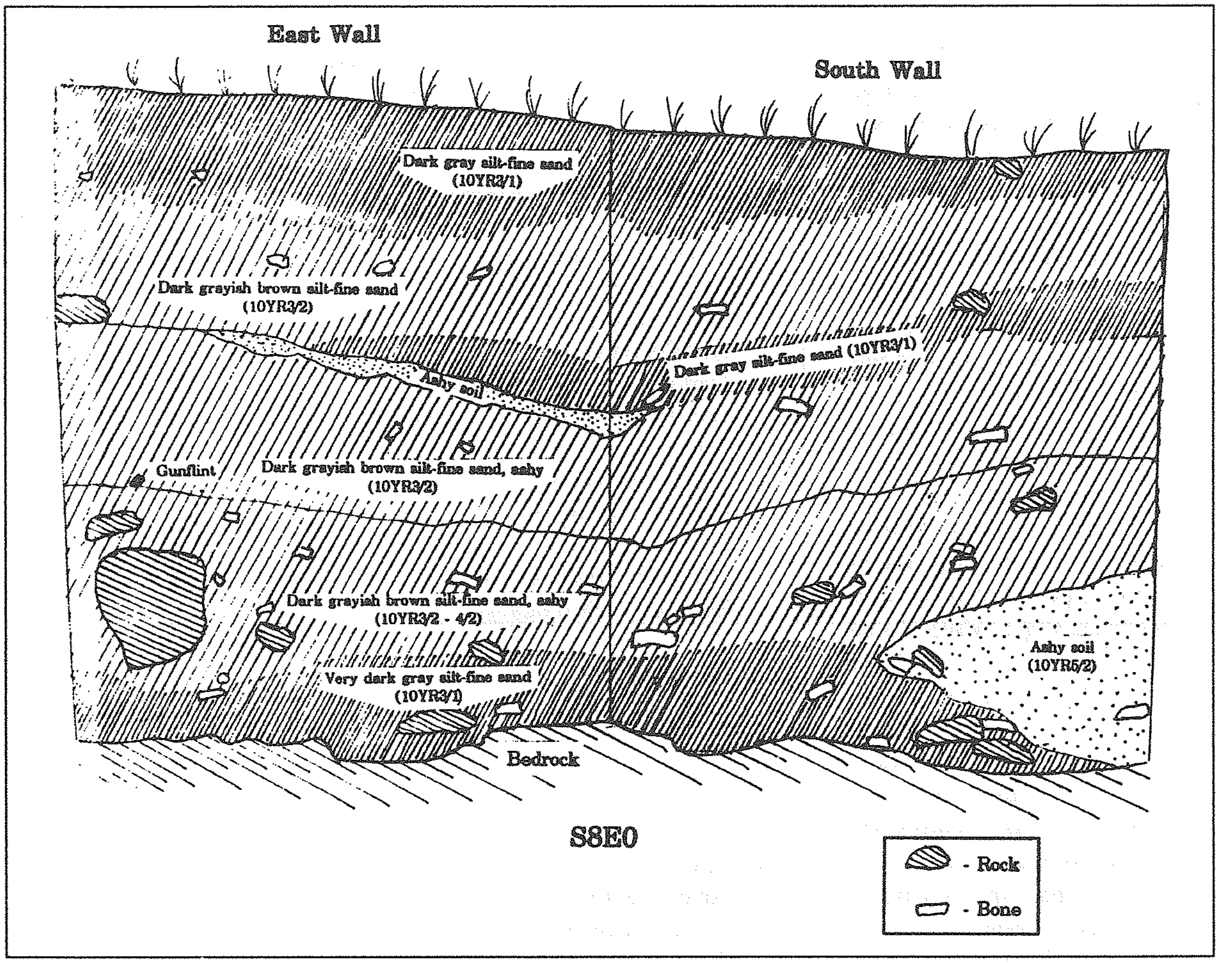


Figure 4. Profile drawing of east and south walls of Unit S8E0 on west slope, Espíritu Santo. Note lensing of midden material.

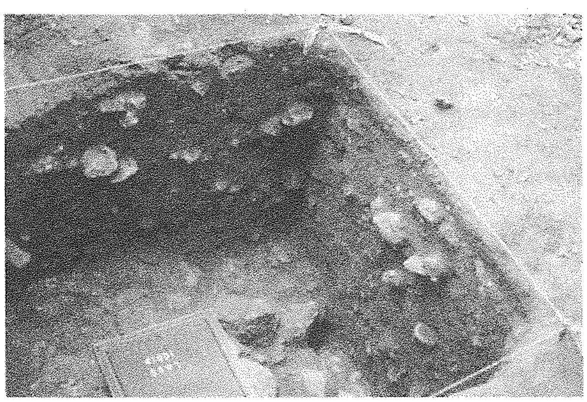

Figure 5. East and south walls of unit S3W7, west slope, Espíritu Santo. Note sandstone rubble within midden soil, and natural sandstone bedrock ledge on which the midden directly rests.

and 5). Artifacts and faunal remains were abundant at all depths. In each of the west slope units, a solid sandstone bedrock was found at the base of the midden deposits, indicating that prior to the colonial occupation the slope consisted of exposed bedrock ledges.

The midden on the northeast slope was relatively shallow, with a maximum thickness of approximately 30 cm. Once again, the matrix was a silty soil. In this area, however, the midden rested on Pleistocene clay rather than on bedrock, and did not exhibit the complex lensing seen on the west slope. Although artifacts were less abundant here than on the west slope, a significant quantity were recovered, along with abundant faunal fragments.

## ARTIFACTS

The artifacts recovered from the two midden areas investigated at Espíritu Santo are listed in Table 1. Because laboratory analyses have revealed no clear trends in artifact forms or types according to depths, vertical proveniences are not indicated in the table. It can be seen, however, that there are some interesting differences in the relative abundance of artifact classes between the two middens. By volume of excavated matrix, Native ceramics are more abundant in the west slope midden than on the northeast slope, while flaked lithic artifacts are relatively more abundant in the latter area than the former. Also, items of non-utilitarian or ornamental function (e.g., brass/copper ornaments and glass beads) are relatively more abundant on the west slope than the northeast slope; in fact, while the former midden yielded a range of non-utilitarian copper, brass, and glass items, the latter produced only three small glass beads.

Another apparent difference in the material remains in the two middens is the fact that non-Native or Spanish colonial ceramics were notably scarce on the northeast slope. From the west slope, 136 sherds of Spanish colonial pottery were recovered along with 2,468 sherds of Native pottery; the ratio of Native to non-Native sherds is 18:1; in the northeast midden that ratio is double (36:1).

While the reasons for these differences are unclear, it is apparent that there is spatial variability in the kinds and relative abundance of artifacts in extramural middens at Espíritu Santo.

**Table 1. Espíritu Santo Mission (41GD1), 1997–1998 Excavations, Artifacts by Class and Midden Areas**

| CLASS | West Slope Midden | North Slope Midden |
|---|---|---|
| Flaked Lithics | | |
| Guerrero arrowpoints | 3 | 3 |
| Guerrero preform | – | 1 |
| Round–based | 1 | – |
| Distal/medial fragments | 2 | 2 |
| Dart point, distal fragment | 1 | – |
| Dart point preform (?) fragments | 2 | – |
| Scrapers | 7 | 4 |
| Biface fragments | 2 | 1 |
| Gouge–like biface | 1 | – |
| Prismatic blades | 21 | 8 |
| Edge–trimmed cobbles | 1 | 6 |
| Edge–retouched flakes | 21 | 5 |
| Cores | 3 | – |
| Gunflints | 4 | 2 |
| Debitage | 869 | 290 |
| Shell | | |
| Edge–utilized mussel | 1 | – |
| Native Ceramics | | |
| Pottery sherds | 2,453 | 313 |
| Handle fragments | 14 | 11 |
| Basal sherd with foot | 1 | – |
| Non–Native Ceramics | | |
| Majolica | 76 | 2 |
| Earthenwares, various | 56 | 7 |
| Chinese porcelain | 1 | – |
| Stoneware | 2 | – |
| Sherd disk, ground | 1 | – |
| Glass | | |
| Bottle/container fragments | 18 | 15 |
| Flat glass fragments | 11 | 12 |
| Guerrero arrowpoint | – | 1 |
| Iron | | |
| Nails | 21 | 10 |
| Tack | 1 | – |
| Straight pin | 1 | – |
| Button with date 1783 | 1 | – |
| Rings | 2 | – |
| Furniture fixture (?) | 1 | – |
| Disk fragment | 1 | – |
| Flint lock | – | 1 |

**Table 1.** *(Continued)*

| CLASS | West Slope Midden | North Slope Midden |
|---|---|---|
| Gun shot | 1 | – |
| Misc. fragments | 7 | 2 |
| Copper/brass | | |
| Cut sheet fragments | 5 | – |
| Arrowpoint, brass | 1 | – |
| Arrowpoint, copper | 1 | – |
| Casing fragments | 1 | – |
| Utensil fragments | 1 | – |
| Non–Native Ornamental/Dress | | |
| Earring loops, brass | 1 | – |
| Brass wire earring loop with glass bead | 1 | – |
| Earring, brass | 1 | – |
| Hawk bell, brass | 1 | – |
| Gem backing, brass | 1 | – |
| Jeweled cross fragment, brass | 1 | – |
| Button, copper | 1 | – |
| Jet rosary beads | 2 | – |
| Ceramic bead fragment | 1 | – |
| Glass beads | 61 | 3 |
| Plaster Fragments | | |
| Unpainted | 15 | – |
| White–painted | 192 | – |
| Red–painted | 92 | – |

The findings from the northeast midden give the impression of less material wealth, both in the dearth of non-utilitarian goods and in the relative scarcity of non-Native imported colonial ceramics. Assuming that both middens represent debris largely generated by Native American residents at the mission, it is possible that different Native groups within the mission community had unequal access to imported goods. Alternatively, it is possible that at least some of the differences reflect a greater input of debris from non-Native residents at the mission; in other words, a larger proportion of the west slope midden may represent the activities of resident Spanish personnel at the site than is the case with the northeast midden. This possibility may find support in the presence in the former area of considerable amounts of building rubble (e.g., plaster fragments; see Table 1) that may represent repair/rebuilding of formal, non-Indian buildings within the mission compound, the kinds of structures which were probably the primary residences for Spanish personnel. Our data on spatial variability at the site are presently too limited for definitive answers to these questions. They do, however, suggest that a spatially oriented analysis of assemblage variability at the site may ultimately offer significant insights into community layout and questions of differential access/use of material goods.

Although detailed descriptions of the many artifacts recovered in the 1997-1998 excavations are not possible in this summary article, several general observations can be made on the nature of the material remains from Espiritu Santo. As may be seen in Table 1, the most abundant class of artifact is Native pottery (Figure 6), virtually all of which falls into the category of Goliad ware.

Goliad ware, defined on the basis of large samples from this site excavated during the 1930s and 1940s (Mounger 1959), consists for the most part of small to medium-size plain bowls, jars, and ollas with smooth surfaces, and the virtually consistent use of more or less abundant crushed bone temper. Similar pottery, usually also identified as Goliad ware, has been recovered from the previous location of Espíritu Santo (41VT11) on the lower Guadalupe River in Victoria County (Walter 1997; see also Walter, this volume), as well as at mission sites in the San Antonio area (e.g., Fox et al. 1976; Dial 1992) and at non-mission colonial sites in South Texas, such as Rancho de las Cabras (41WN30) in Wilson County (Ivey and Fox 1981; Taylor and Fox 1985:27). Goliad ware is also abundant at the

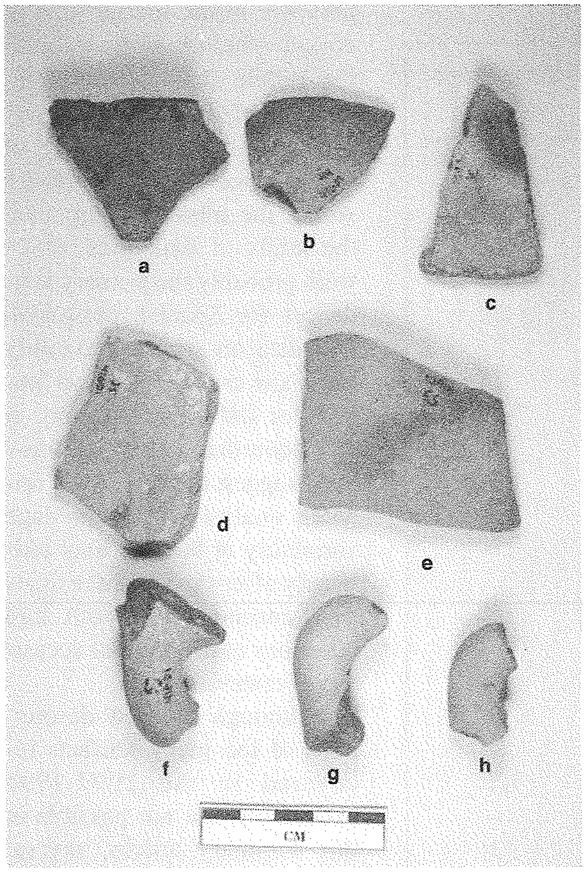


Figure 6. Selected sherds of native-made Goliad ware pottery, Espíritu Santo Mission (41GD1): a-b, rimsherds; c-e, body sherds; f-h, loop handle fragments.

site of Presidio de la Bahía (41GD7), where it was probably used by non-Native personnel as a readily available, locally made utilitarian pottery (Anne Fox, 1998 personal communication). Goliad ware closely resembles the Late Prehistoric/Protohistoric bone-tempered plainware of the Toyah horizon, and it is virtually certain that is represents an early historic continuity in an inland coastal prairie ceramic tradition that was rooted in the Late Prehistoric period.

While Mounger identified decorated sherds in her Goliad ware series (e.g., Goliad Black-on-Buff, which was decorated with asphaltum paint, and Goliad Red-on-Buff), these were extremely scarce, comprising no more than a few dozen sherds in a sample of thousands of sherds (Mounger 1959). Thus, it is not surprising that in our total sample of 2,792 sherds from Espíritu Santo, only five bore decoration in the form of asphaltum paint. In the sample of 230 rim sherds, only a single specimen bore asphaltum decoration.

The Native ceramics at Espíritu Santo exhibit a distinctive set of attributes. In the 230 rim sherds that had an attribute analysis, it was found, based on rim profiles, that the most common vessel form (31 percent) was a shallow bowl; deep bowls, at 24 percent of the sample, were less common. Jars were represented by straight-walled and everted rim forms (12 and 22 percent of the rim sherd sample, respectively). Vessel orifice diameters, estimated on the basis of rim sherd curvatures, ranged from 5-35 cm. Only seven percent have diameters greater than 25 cm, indicating that, despite the presumably sedentary lifeway of Natives at the mission, vessels were rather small. Simple loop handles were added to some vessels, with attachment effected by "riveting" the ends of the handle through holes in the vessel walls. Most vessels were fired in an oxidizing atmosphere, resulting in surfaces ranging in color from buff to orange-red or pinkish-red. Firings were apparently of short duration, given that oxidation was in most cases incomplete, as sherd interiors are dark gray in color. Clay bodies were tempered with crushed bone, often in profuse quantities, and were generally devoid of other aplastic inclusions, with only four percent of the analyzed rimsherds containing sand.

Lithic artifacts were flaked from local cherts and, in a minority of cases, pale brown or purple quartzite. Artifact forms include arrow points, all of the triangular-to-lanceolate Guerrero type (e.g., Hester 1980; Turner and Hester 1993) with the exception of a single round-base specimen (Figure 7a-e, j). Guerrero arrow points, ubiquitous on southern Texas mission sites, appear to have largely replaced earlier forms such as Perdiz by the 18th century; for example, the Guerrero type was predominant at 41VT11, the previous location of Espíritu Santo Mission (Walter 1997).

Eleven flakes bear steep unifacial edge retouch suggesting use as scrapers. It is notable, however, that our sample contains no examples of the "classic" round-ended unifacial end scrapers so commonly found on Late Prehistoric sites in the region and still present in significant numbers at 41VT11 (see Walter 1997). Another lithic tool form common in Late Prehistoric assemblages but absent from our sample from Espíritu Santo is the flaked drill or perforator. I infer that these tools had been largely replaced by metal forms. Prismatic blades (Figure 8) were fairly abundant, indicating technological continuity from earlier times.

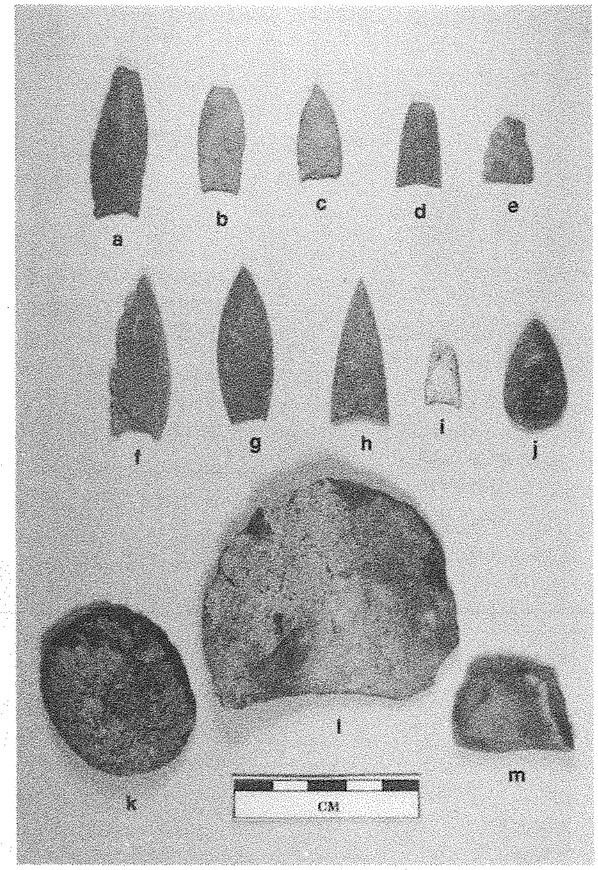


Figure 7. Selected lithic artifacts and glass arrowpoint: a-e, chert Guerrero arrow points, Rosario Mission (41GD2); f-h, chert Guerrero arrow points, Espíritu Santo Mission (41GD1); i, glass Guerrero arrow point, Espíritu Santo; j, round-base chert arrow point, Espíritu Santo, k-m, chert scrapers (k, m, Rosario; l, Espíritu Santo).

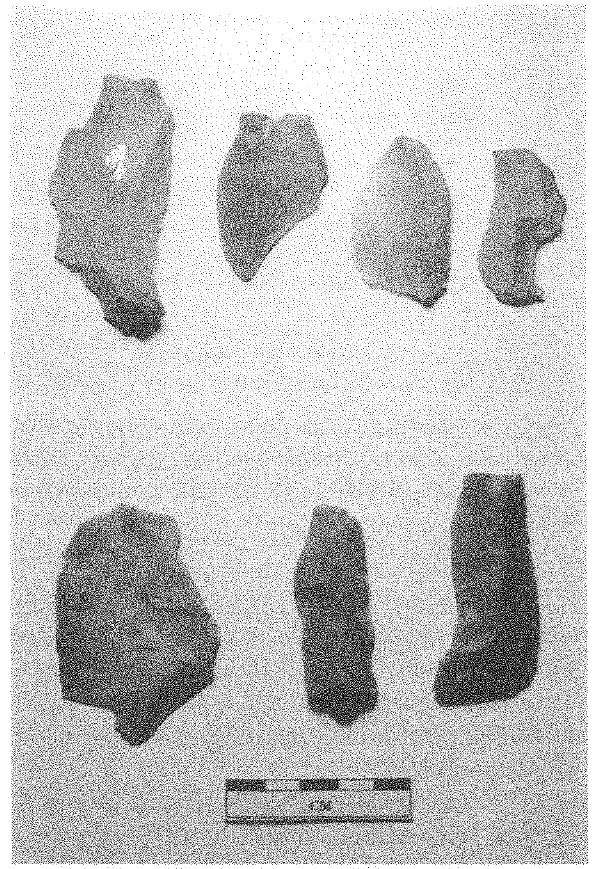


Figure 8. Chert prismatic blades: top row, Rosario Mission (41GD2); bottom row, Espíritu Santo Mission.

Six gunflints were recovered, four from the west slope midden and two from the northeast slope midden (Figure 9). All are rectangular in outline and made from flakes of local cherts.

Non-Native ceramics include tin-enamel glaze majolicas (Figure 10) and a variety of other wares, mostly low-fired lead-glaze earthenwares and slipped burnished wares. A single sherd of Chinese porcelain was recovered from the west slope. All of the majolica sherds assignable to known types come from the west slope midden; the four types represented are San Agustín Blue-on-White (42 percent), Huejotzingo Blue-on-White (8 percent), Puebla Blue-on-White II (25 percent), and San Elizario Polychrome (25 percent); the latter has blue designs on white, with thin dark brown accents in the blue motifs. These types are typical of the colonial period of the latter part of the 18th century (e.g., Dial 1992; Texas Archeological Stewardship Network 1997; Anne A. Fox, 1998 personal communication). Interestingly, none of several multi-colored polychrome majolicas characteristic of the period after 1790 are present (nor are the diagnostic colors such as green, orange, yellow, or pale blue background, on the many sherds too small to type), suggesting that the west slope midden was deposited largely or entirely during the earlier decades of occupation at Espíritu Santo.

Glass fragments represent both bottles and flat panes (see Table 1). The glass bead sample consists almost entirely of small beads of various colors and types typical of the latter part of the 18th century in Texas and adjacent areas (e.g., Gregory and Webb 1965; Brain 1979; Harris n.d.). The single artifact of reworked glass is a small Guerrero arrow point (see Figure 7i) flaked from a fragment of aquamarine-colored bottle glass. Metal artifacts include several iron implements, an iron button bearing the

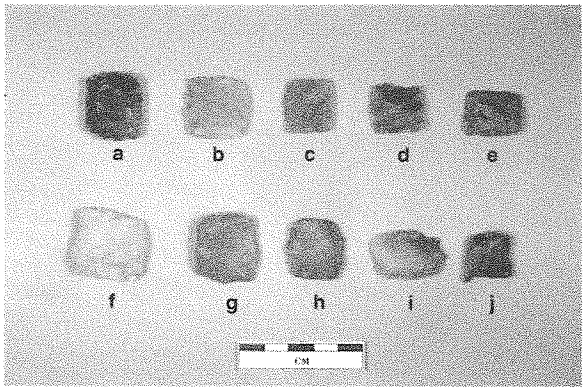


Figure 9. Gunflints made from local gray and brown cherts; h is local pale purple quartzite: top row, Espíritu Santo Mission (41GD1); bottom row, Rosario Mission (41GD2).

date 1783, wrought nails, and a flintlock. Copper and brass items include five cut sheet fragments, a brass arrow point, a possible copper arrow point, a small fragment of copper casing, and a copper utensil (spoon?) fragment.

The variety of ornamental objects (Figure 11) include brass earring loops, a small brass "hawk" bell, an undecorated copper button, a molded flat teardrop-shaped brass piece that may be the backing or setting for a gem, a small fragment of a copper cross with an inset blue glass faceted gem, two faceted jet rosary beads (one square, the other diamond-shaped), and a non-Native ceramic bead fragment (see Table 1). An additional seemingly non-utilitarian item is comprised of two small ground, unperforated disks, one made from a sherd of burnished Spanish colonial Tonala ware, and the other made from a fragment of grayish-white mortar or plaster.

The west slope midden yielded 299 fragments of wall plaster, which, as mentioned above, presumably represent debris generated by repair or reconstruction of buildings within the mission compound. The smooth, finished side of 15 of these fragments are unpainted. Of the remaining pieces, 192, or 64 percent of the total sample, are white-washed and 92 (31 percent), are painted a deep red color. It is interesting that approximately one-third of the plaster fragments bear red paint, perhaps reflecting the practice of painting the lower parts of interior walls red (as is in fact exhibited in the restored church and other buildings at the site).

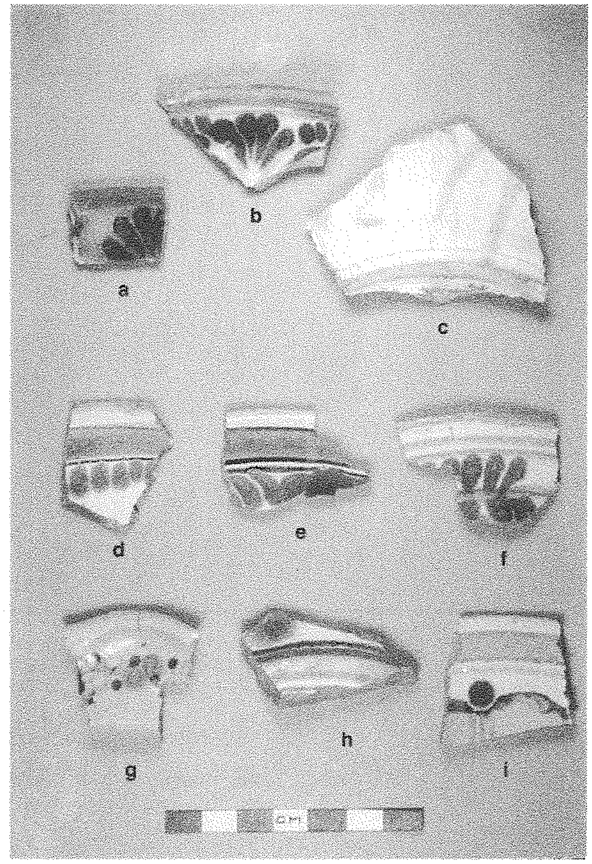


Figure 10. Selected sherds of Spanish colonial majolica pottery from Rosario Mission: a, untyped blue-on-blue; b, San Agustín Blue-on-White; c, exterior of San Agustín Blue-on-White showing typical blue loops; d-e, San Elizario Polychrome (blue designs on white, with dark brown accents); f, exterior of Puebla Blue-on-White II bowl; g, Tumacácori Polychrome (orange, blue and yellow on pale blue); h, Monterey Polychrome (green, orange and brown on white); i, untyped early 19th century polychrome (blue, green, yellow and brown on white).

## FAUNAL REMAINS

Faunal bone was abundant in all excavation units in both middens. By far the greatest bulk of this material is comprised of fragments of bovid bone. The variation is size suggests both adult animals of different sizes as well as the butchering of juvenile cattle. Also present are chicken and possibly turkey (wild?), opossum, rabbit, white-tailed deer, turtles, and a small quantity of fish. Susan deFrance (this volume) discusses the proportional representation of various taxa and implications for understanding diet at Espíritu Santo.

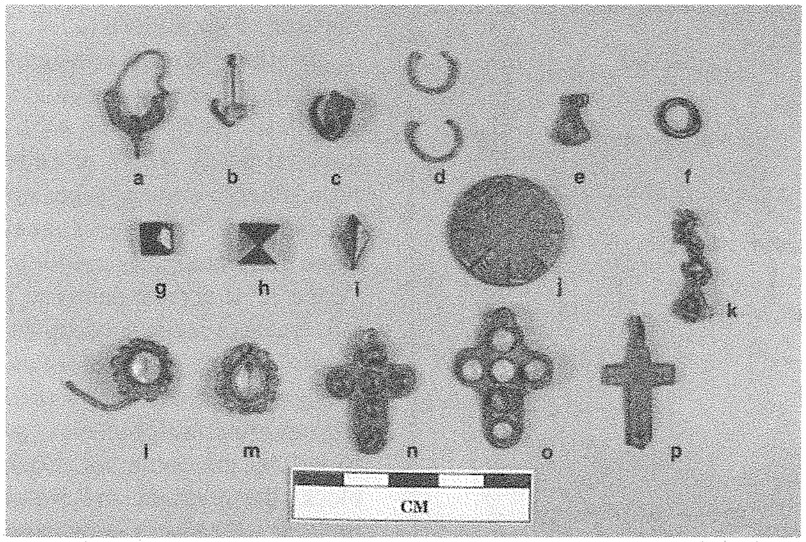


Figure 11. Items of personal adornment/dress: a, brass earring; b, brass earring dangle with glass bead; c, brass earring with hinged brass attachment; d, two brass earring loops; e, brass earring dangle; f, glass necklace ring; g-h, square faceted jet rosary beads; i, diamond-shaped faceted jet rosary bead; j, fancy gold-plated brass button cover; k, wound silver wire; l, copper brooch with faceted clear-glass inset; m, copper pendant with faceted clear-glass inset; n, copper cross with green faceted glass insets; o, copper cross with clear-glass faceted insets; p, brass crucifix. Specimens a-b, d, f, and i are from Espíritu Santo Mission (41GD1); all others are from Rosario Mission (41GD2).

Found throughout the midden matrices in both tested areas were 315 fragments of bivalve shell. The overwhelming majority (308 or 98 percent) were pieces of freshwater mussel shell of the species *Amblema plicata*, still commonly found in the San Antonio River (Howells et al. 1996). The remainder of the shell sample consists of six fragments of estuarine/marine shell (five bay scallop [*Argopectin irradians*] and one Atlantic cockle [*Laevicardium robustum*]).

## MACROBOTANICAL REMAINS

The fine water screening yielded a small sample of charred plant remains identified by Dr. Phil Dering of Texas A&M University, College Station. These include a maize cob fragment, a thin-shelled nut fragment (probably pecan), fragments of two fruits of indeterminate species, a dogwood (*Euphobis sp.*) seed, a copper mallow (*Abutilon sp.*) seed, and three pieces of mesquite (*Prosopis sp.*) wood (Dering 1998).

## INVESTIGATIONS AND FINDINGS AT ROSARIO MISSION (41GD2)

As at Espíritu Santo, our 1997-1998 investigations at Rosario Mission involved excavations outside the main mission compound wall. In contrast to Espíritu Santo, no restorations have been attempted at Rosario, and the stone compound wall and interior church and other buildings are in ruins, with only the lower parts of stone walls still standing. The reader may refer to Gilmore's (1974a, 1974b) reports on her 1973-1974 investigations in the interior of the mission compound for plans of known building foundations and various features, including extended burials, associated with the mission.

The area at Rosario selected for our investigations lies immediately south of the compound wall and south and southeast of the main gate, which is still visible as an approximately 5 m wide gap in the center of the south compound wall (Figure 12). In 1997, eight 1 $m^2$ test units were excavated: two directly grid south of the gate and the other six within 6-7 m of the main wall to the southeast of the gate. Because architectural remains were unexpectedly revealed by this work, the 1998 excavations focused on a block in the latter area in order to: (a) acquire additional artifact samples for analysis, and (b) better define the nature of the architectural remains. In total, 23 $m^2$ were excavated. As at Espíritu Santo, excavation was in 10 cm arbitrary levels, and all matrix was screened through 1/8-inch hardware cloth. Fifteen-liter soil samples were retained for fine water screening in the laboratory.

## MIDDEN STRATIGRAPHY

A colonial period midden covers virtually the entire area adjacent to and within at least 15-20 m

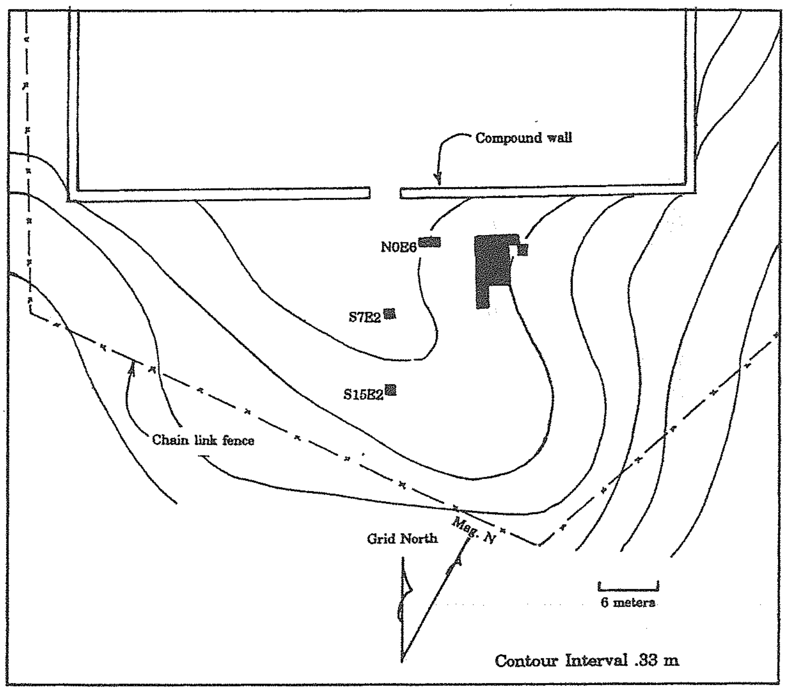


Figure 12. Southern part of Rosario Mission (41GD2), showing stone compound wall with gate and locations of 1997-1998 excavations (in black). Area within compound shown here was devoid of stone structures; early and later church and other stone structures were north of the area shown here (see Gilmore 1974b).

of the south compound wall, judging by surface indications of dark-stained, organically-enriched soil, animal bone fragments, chert flakes, pottery sherds, and occasional other artifacts. In fact, our excavations suggest that the lobe of high ground extending south and southeast from the gate (see Figure 12) is in large part the result of accumulation of anthrogenic debris and sediment during the period of mission occupation. The excavations in general revealed remarkably intact colonial deposits, almost entirely lacking in modern debris and exhibiting, in the area of the main excavation block, a clear stratigraphy and a series of architectural features at the base of the midden deposits.

In the two units directly grid south of the gate (S7E2 and S15E2), an essentially undifferentiated midden of dark brown silty soil containing numerous bone fragments and colonial period artifacts was found to be some 50-70 cm thick. The midden lay directly on a culturally sterile A-horizon brown silty soil, which in turn rested unconformably on red Pleistocene clay. No stratigraphy was discernible in these units, although a lens of charcoal-stained soil and large bone fragments was noted at the base of the midden in S7E2.

In the pair of contiguous units immediately southeast of the gate (N0E6 and N0E7), approximately 30 cm of midden rested directly upon a packed lime-caliche floor. Subsequent excavations indicated this midden is "Zone 1," a deposit dating to the later years of mission occupation.

By far the most informative stratigraphy, along with underlying architectural features, was found in the main excavation block, the northern and western limits of which were, respectively, along grid lines N1 and E12. From the surface downward, the following stratigraphic zones (Figure 13) were designated:

*Zone 1.* This was a dark brown silty soil containing profuse quantities of cultural debris in the form of Native and Spanish colonial artifacts, faunal remains, sandstone rubble (mostly small, with lengths of fragments 10 cm or less, but with scattered larger rocks), and bits of caliche. Zone 1 was generally about 30 cm thick. In the northern part of the block (and including N0E6 and N0E7), Zone 1 rested directly upon a stone wall foundation and/or associated artificial floors at the base of the colonial deposits. A dense bone bed marked the base of Zone 1, although the bone density decreased markedly in the southern part of the block excavation (Figures 14 and 15). As discussed below, time-diagnostic majolica types associated with Zone 1 suggest its deposition after ca. 1790.

*Zone 2.* This zone, comprised also of silty midden soil, was distinguishable on the basis of its slightly lighter color and more abundant small bits of caliche. It directly underlay Zone 1 within the block excavation, south of an east-west line running approximately along grid line S1. As may be seen in Figure 13, Zone 2 is thickest, up to 25-30 cm, in the southern part of the block and thins out to the north. A bone bed up to 10 cm thick was

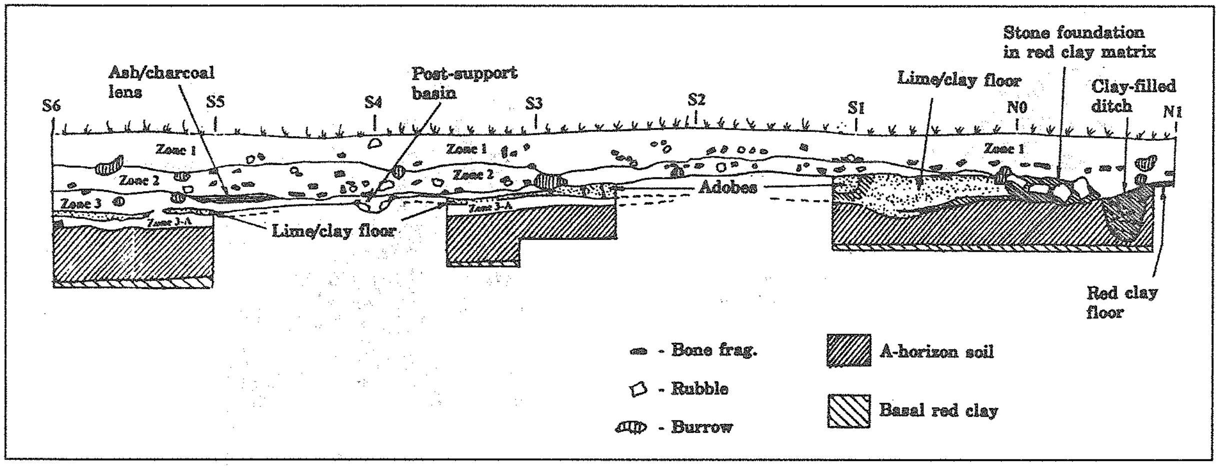


Figure 13. Profile drawing, Rosario Mission (41GD2) along grid line E12, looking west. Note Zones 1, 2, and 3 overlying stone foundation and artificial floors, and Zone 3-A immediately under caliche-clay floor and directly on top of natural A-horizon soil.

Figure 14. Northern part of main excavation block, Rosario Mission (41GD2), looking grid east. Note bone bed at base of Zone 1, overlying stone wall foundation and caliche floor (in right side of photo).

found within Zone 2 in the southern part of the excavation block (Figure 16). The late majolica types found in Zone 1 are absent in Zone 2, except for a single small sherd of early 19th century Tumacácori Polychrome that is probably intrusive.

*Zone 3.* This zone, which was generally no more than 10 cm thick, underlay Zone 2 in the southern part of the excavation block. It consisted, again, of a silty midden soil, but with a distinctly lighter/softer consistency than Zone 2, perhaps due to the inclusion of larger amounts of ash. Like Zone 2, Zone 3 was thickest at the southern end of the excavation and thinned out to the north; Zone 3 could not be detected north of grid line S3.

*Zone 3-A.* This was initially detected in unit S6E12. In parts of this unit, Zone 3-A was continuous with Zone 3, while in other parts of the unit, and in other units in general, it underlay the packed caliche floor that lay at the base of Zone 3 (and at the base of Zones 1 and 2 toward the north). Zone 3-A was quite thin (generally only about 5-8 cm thick) and contained only scattered cultural material. It is the only cultural zone that predates the architectural features described below; all other midden strata were found above these features.

*Zone 4.* This is the culturally sterile, brown silty A-horizon soil found to underlie the colonial period deposits everywhere in our excavations. It generally was approximately 30-40 cm thick, and rested unconformably on red Pleistocene clay.

## ARCHITECTURAL FEATURES

These consisted of a series of parallel features (Figures 17 and 18):

1. A wall foundation made of small-to-medium sized angular pieces of uncut sandstone embedded in a red clay mortar, and in places a lime-sand mortar. The foundation was

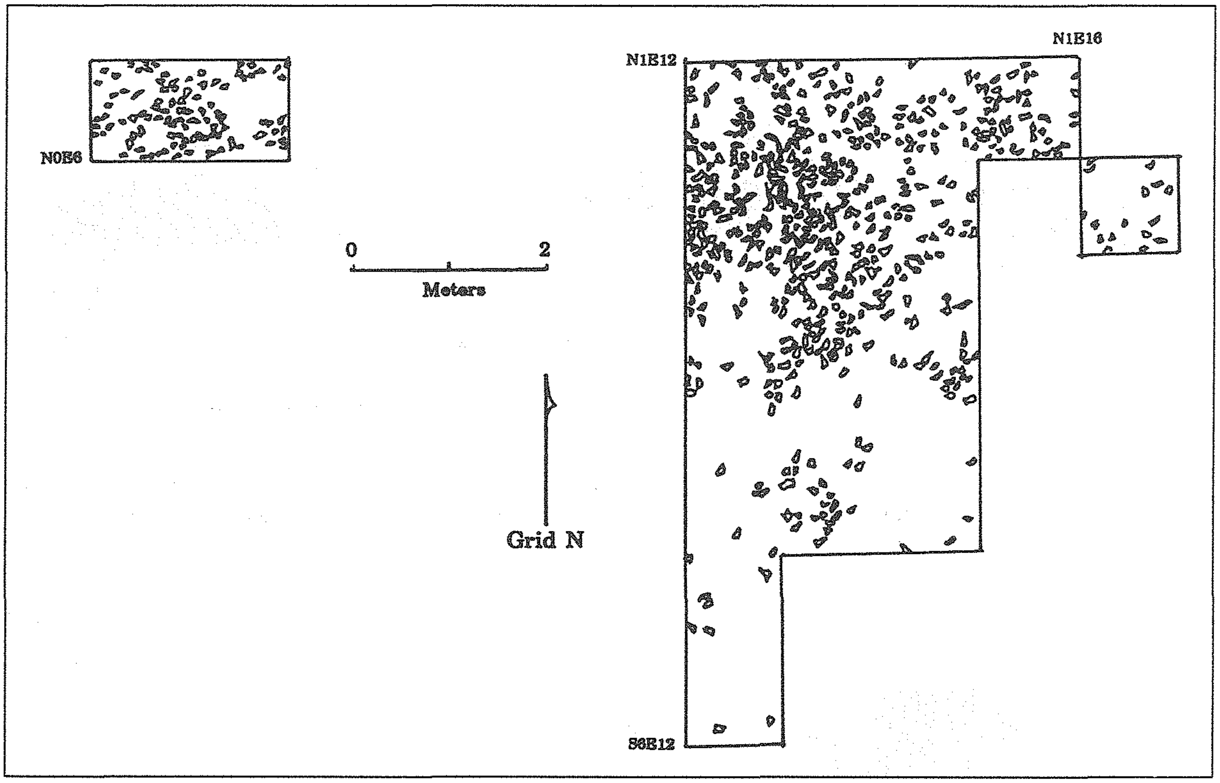


Figure 15. Locations of piece-plotted bone fragments in bone bed at base of Zone 1, Rosario Mission.

generally about 60 cm wide and only one stone thick. The top of the stones were quite level, suggesting that this feature is a complete foundation rather than the bottom of a dismantled higher stone wall. The relatively small size of the stones (compared to those seen in walls of the church and the compound enclosure at the site), and the thinness of the foundation, suggest that it was not designed to carry a heavy load; most likely it served to support some kind of wooden superstructure.

2. A packed caliche and red clay floor, apparently associated with the stone foundation, was adjacent to (and a few cm lower than the top of) the south edge of the stone foundation and extended to and apparently beyond the southern limits of our excavation block. For the most part, this floor was made of packed caliche, but it also contained patches of red clay throughout. The floor was thickest to the north near the stone foundation and thinner toward the south (see Figure 13). This floor dipped slightly to the south, following the slope of the buried soil surface (as may be seen in Figure 13, the present ground surface appears to be more or less level due to the thicker accumulation of midden toward the south).

3. A 2 m wide section of the same floor was made of adobe bricks set in a mortar of red clay; this is the same red clay found between the foundation stones and in the packed caliche floor, and doubtless it was dug from the Pleistocene clay deposit at the site. The surface of the adobe floor was flush with the surface of the adjacent packed caliche floor section, indicating that the same prepared living surface is represented. The adobes were rectangular, some 10-15 cm thick, and ranged in length from approximately 15 cm to as much as 40 cm. Most were made from a mixture of lime and native clay soil and were grayish-white in color. Others were made primarily of dark brown clay.

4. A series of shallow post support holes, all around 20 cm in diameter and no more than 5-7 cm deep from the surface of the caliche

Figure 16. Excavation in progress, Rosario Mission, looking grid north. Note bone bed in Zone 2 in foreground, Zone 2 lapping onto caliche-clay and adobe-brick floor in middle ground, and stone foundation in background.

floor. These were basin-shaped and filled with a dark-colored midden soil that was readily discernible in the grayish-white surface of the surrounding floor. All were found immediately to the south of, and aligned parallel to, the adobe brick floor section.

5. A narrow ditch, adjacent and parallel to the north edge of the stone foundation, filled with red clay containing bits of caliche and lime. This intruded into the underlying A-horizon silty soil (Zone 4), and had a U-shaped profile (see Figure 13).

6. A packed clay floor north of the stone foundation, some 8-15 cm thick and made of the same native red clay used in the foundation and other floors. This floor rested directly on the Zone 4 A-horizon brown silty soil.

The fact that all of these architectural elements run parallel to the nearby stone compound wall suggests a planned integration into the overall layout of the mission. The complete size and floor plan of the structure will only be determined by additional excavation in the area (an attempt to trace the stone foundation using ground-penetrating radar was unsuccessful, probably due to the thinness of the foundation and the presence of rubble within the overlying midden). It is likely, however, that the caliche/clay and adobe-brick floor south of the stone foundation was within a covered and perhaps enclosed space, given the presence of post supports arranged parallel to, and located some 4 m to the south of, the wall foundation. The presence of adobe-brick flooring in the area between the post supports and the foundation may indicate relatively intensive activity there, since the adobes presumably would have provided a stable surface resistant to treadage. The thinner caliche-clay floor to the south of the post supports may have been an unenclosed space (e.g., a ramada), given that the floor slopes to the south and would have drained rainwater and runoff in that direction.

The clay-filled ditch or trench along the north edge of the wall foundation may have served as a drainage ditch. This is suggested by its location along and parallel to the wall foundation, where it would have caught runoff from whatever form of roof covered the associated structure and channeled it onto the lower ground to the east. At some point in time, the ditch was filled with clay mixed with bits of caliche and lime mortar, possibly in conjunction with the construction of the packed red

Figure 17. Main excavation block, looking grid north, showing adobe-brick and caliche floors and stone foundation in background. Pit, Feature 5, in foreground.

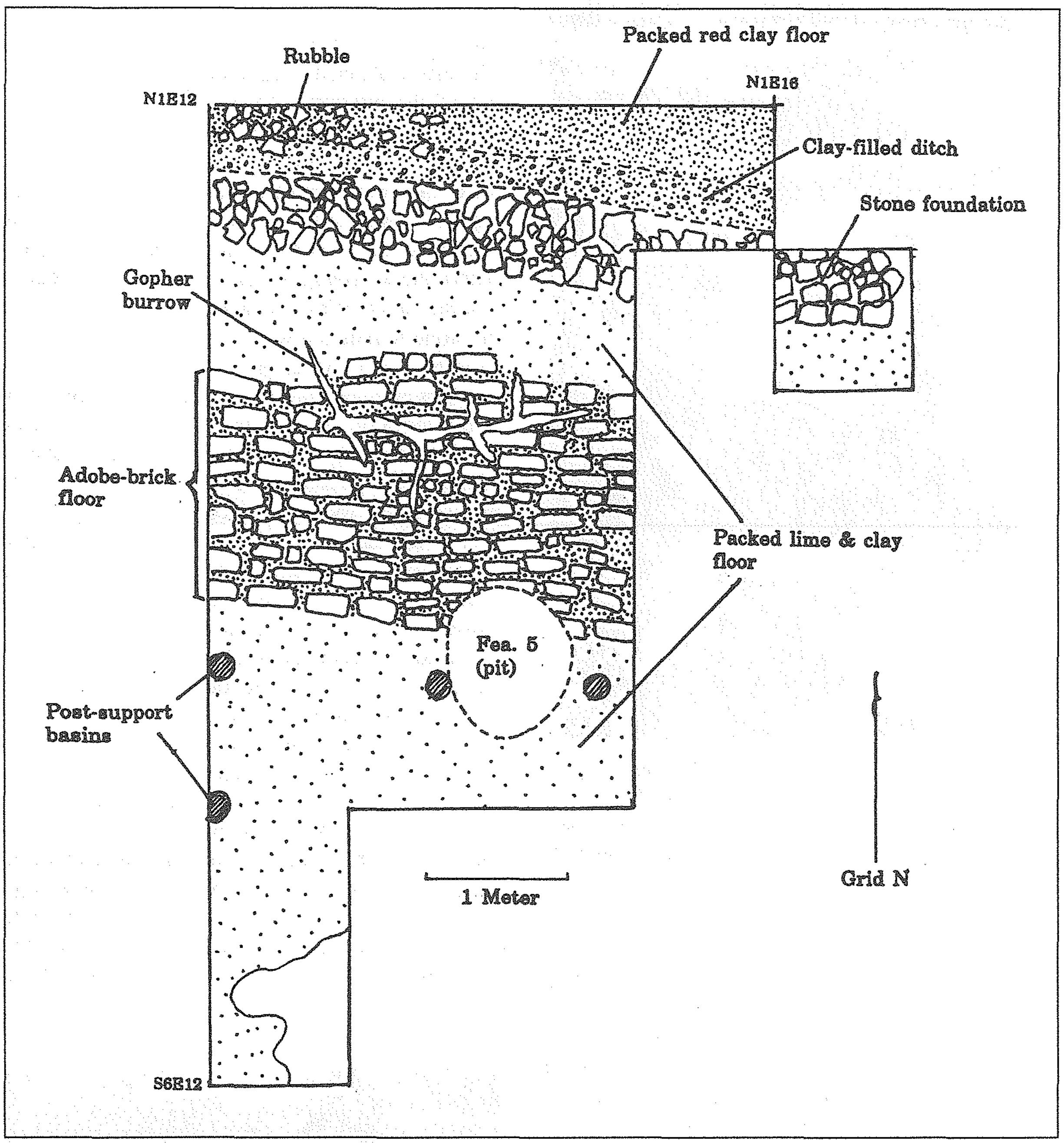


Figure 18. Plan view of various architectural features shown in Figure 17. Note that the red clay is packed between adobe bricks.

clay floor north of the wall foundation. If this was in fact the case, it is possible that the original structure then was abandoned, with the wall foundation and associated superstructure serving to partially enclose the space to which the red clay floor pertained. Thus, while speculative given our limited exposure of these features, the space between the wall foundation and the main stone compound wall may have been roofed over to form a new enclosed space. This at least makes sense in view of the fact that the distance between the two walls was approximately 5 m, which approximates the common width of Spanish colonial domestic dwellings (e.g., de la Teja 1995:46).

## DEPOSITIONAL CHRONOLOGY

The midden stratigraphy, and the distinct architectural floors, along with the presence/absence of certain time-diagnostic majolicas and data from historical records, permit a rather fine-tuned chronology for the depositional sequence in the main excavation block. Clearly, all colonial period deposits rest on the A-horizon soil of Zone 4. Aside from a probably brief initial deposition of cultural debris and anthrogenic soil represented by Zone 3-A, the first use of the area encompassing our excavation was for formal structures represented by the exposed architectural features. That these features represent a relatively early building phase in the mission's history is clear, given that the foundation and associated floors are completely covered by at least three strata of later colonial midden material. As noted above, the relatively small stones and thinness of the foundation suggest that it supported a wooden superstructure, which would be in keeping with records that indicate that the earliest structures at the mission were of wood construction (Kress and Hatcher 1931; Gilmore 1974b).

At some point, the structure(s) represented by the foundation and floors were abandoned, and the area was used for general trash disposal. This is indicated by the bone beds and the profusion of broken/discarded artifacts and small pieces of sandstone rubble found in the overlying Zones 1, 2, and 3. Feature 5, a pit oval in plan (see Figure 18) and possibly used for storage, originated from the base of Zone 1 and intruded through the adobe and lime-clay floor to penetrate the underlying A-horizon soil. The fill of this feature consisted of dark brown silty midden soil as well as artifacts and faunal bone fragments of the sorts found in the middens, but contained no materials which would offer clues to its specific function.

For the most part, the artifact samples from Zones 3 and 3-A are too small for statistically meaningful comparisons with other zones. On the other hand, the presence of late majolica types in Zone 1, and their absence in the underlying middens, justifies a bipartite separation between Zone 1 and the combined findings in Zones 2, 3, and 3-A; these divisions constitute two useful analytical units for chronological comparisons of material remains.

## MAJOLICA TYPES AND CHRONOLOGY OF THE ZONES

Zone 1 yielded 535 fragments of tin enamel-glazed Spanish colonial majolica, while a total of 164 fragments were recovered from combined zones 2 and 3 (see Figure 10 for selected examples). Of these, 190 fragments from Zone 1 and 47 from Zones 2/3 can be assigned to established types (Anne A. Fox, 1997-1998 personal communication; also see Dial [1992]; Hard et al. [1995]; and Texas Archeological Stewardship Network [1997] for type descriptions and estimated temporal ranges). As may be seen in Table 2, and as presented graphically in Figure 19, the type with the earliest estimated time range, San Agustín Blue-on-White, comprises 55 percent of the Zone 2/3 sample, but only 11 percent in Zone 1. Conversely, San Elizario Polychrome, with an estimated time range in the second half of the 18th century, comprises 36 percent of the Zone 2/3 sample and 52 percent of the Zone 1 sample. Perhaps most informative is the fact that 17 percent of the typable majolicas from Zone 1 are late types (San Diego, Monterey, and Tumacácori Polychromes plus untyped late majolicas) that are estimated to date to after 1790, or in the case of Tumacácori Polychrome, after the turn of the 19th century. Only a single small sherd of Tumacácori Polychrome came from Zone 2 and, given that this is the latest type found at the site, it is likely that it was intrusive from the overlying Zone 1. To these typological breakdowns can be added the fact that Zones 2 and 3 did not yield small untypable sherds bearing the color combinations (e.g., greens, yellow, orange, brown) commonly found on terminal 18th century/early 19th century types, and that Zone 1 yielded a few sherds of whiteware typical of the early 19th century.

These significant shifts in the proportional representation and presence/absence of time-diagnostic types indicate that some time span separates Zones 2/3 and Zone 1. As already noted, Rosario Mission was abandoned around 1780, as the resident Karankawa became dissatisfied with life at the mission, and the site was not reoccupied until the end of 1789. Given that only Zone 1 is characterized by a significant representation of post-1790 majolicas, it is likely that it pertains to the final years of mission operation between 1790 and 1806.

Zones 2 and 3 can be assigned, on the same basis, to the period prior to abandonment in 1780.

**Table 2. Percentages of Typed Majolicas in Zone 1 and Combined Zones 2 and 3, Rosario Mission (41GD2)**

| Type | Zone 1, n=190 | | Zones 2 & 3, n=47 | |
|---|---|---|---|---|
| Tumacacori Polychrome (early 19th century) | 7 | (4%) | 1 | (2%)* |
| Early 19th century, untyped | 5 | (3%) | 0 | |
| Monterery Polychrome (1790-early 19th century) | 13 | (7%) | 0 | |
| San Diego Polychrome (1790-early 19th century) | 6 | (3%) | 0 | |
| San Elizario Polychrome (1750-1800) | 99 | (52%) | 17 | (36%) |
| Puebla Blue-on-White II (late 18th century) | 22 | (12%) | 1 | (2%) |
| Huejotzingo Blue-on-White (18th century) | 17 | (9%) | 2 | (4%) |
| San Agustín Blue-on-White (early-mid 18th century) | 21 | (11%) | 26 | (55%) |

* This single small sherd is believed to be intrusive into Zone 2, given the post-1800 placement of the type and the absence of other relatively late types in that zone.

Note: The table includes polychromes which, though untyped, can be assigned to the early 19th century. Types are listed in chronological order with estimated time ranges in parentheses.

Precisely when these deposits began to form is unknown, but given that they overlie the earlier structural remains, they cannot pertain to the very earliest years of mission occupation. Only Zone 3-A is likely to represent initial colonial residence at the site, but too few materials were found in that zone for meaningful comparisons.

## GENERAL CHARACTERISTIC OF THE ARTIFACT ASSEMBLAGE

The midden deposits at Rosario yielded large samples of artifacts of both Native and non-Native origins (Table 3). By far the most abundant class of artifact was Native ceramic pottery sherds, which total 13,263. Sherd curvatures indicate that vessel forms included jars, ollas, bowls, and narrow-neck bottle-like pots. Asphaltum coating or typical Rockport design motifs are present on 43 percent of the sherds, linking the ceramics at Rosario to the Karankawa of the coastal zone. Other Native ceramic objects include four fragments of tubular smoking pipes, two small ground pottery sherd disks, part of a spoon or ladle (a non-Native form which presumably imitated Spanish colonial counterparts), and a modeled discoidal bead. Non-Native ceramics include Spanish colonial majolica sherds (n=756), fragments of Spanish colonial lead-glazed and burnished earthenwares typical of the 18th century (n=654), four fragments of Chinese porcelain, three sherds of whiteware (all from Zone 1 and diagnostic of the early 19th century at Texas sites), two sherds of stoneware, and a kaolin pipe bowl fragment bearing a molded floral design.

Flaked lithics artifacts consist of seven Guerrero type arrow points, three distal/medial arrow point fragments, three arrow point preform fragments, five scrapers (see Figure 7a-e, k-m), prismatic blades (see Figure 8), edge-retouched flakes, cores, 19 gunflints (see Figure 9), and 1,381 pieces of lithic debitage (mostly brown cherts but with a small amount of dense gray or purple quartzite and

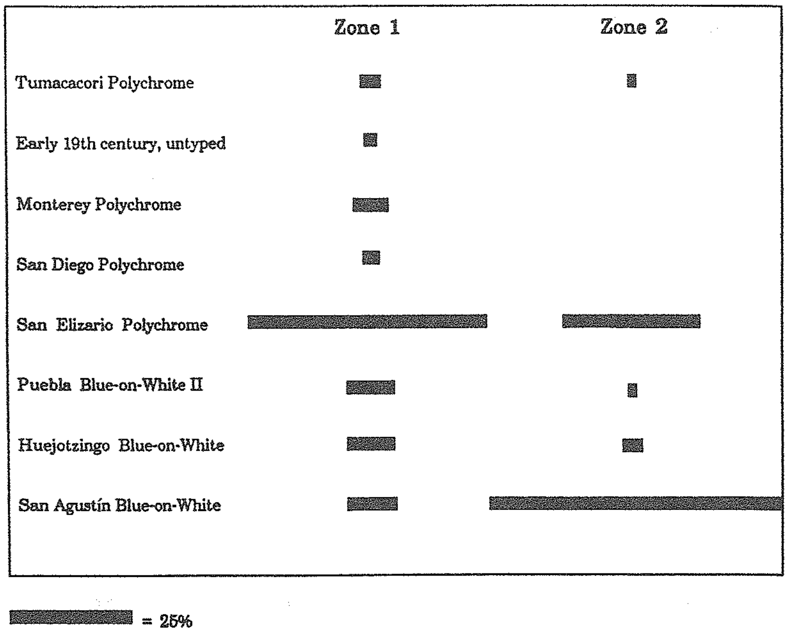


Figure 19. Relative percentages of various majolica types in Zone 1 and combined Zones 2 and 3, Rosario Mission (41GD2).

silicified wood). Rough and ground stone consist of two small, round quartzite cobbles (found in the same unit level in S15E2, and possibly bolas stones), four quartzite hammerstone fragments, a small sandstone disk fragment, and two small, hard sandstone whetstones.

Bone and shell artifacts are notably scarce, consisting of a single bone awl (made with a metal cutting tool) from a bovid rib fragment, two bird bone beads, two fragments of edge-utilized freshwater mussel shell, and two small freshwater mussel shell beads (one rectangular, the other diamond-shaped) with single perforations (Figure 20).

Glass artifacts are mainly bottle/container fragments of dark green, olive green, aquamarine, amber, and clear glass, and 266 glass beads (almost all small in size and of a variety of colors, typical of late 18th century trade bead assemblages). Worked glass artifacts include three scrapers, a bifacially retouched glass fragment, and 16 flakes (Figure 21).

Non-ornamental metal artifacts include various implements of iron (see Table 3 and Figure 22), copper/brass cut sheet fragments, a brass casing fragment, a brass door escutcheon, and a small copper coin with a central perforation. Two fragments of a silver imple-ment (spoon) were also recovered. Lead artifacts include four musket balls ranging in size from .30 to .50 cal, five smaller gun shot, two droplets of lead, and 16 small scraps.

A variety of non-Native items of personal adornment or dress (see Figure 11) were found at Rosario. These include brass earrings; brass and copper buttons; a small brass hawk bell; a copper brooch with faceted clear glass inset; a tear-drop shaped copper pendant with a faceted clear glass inset; two small copper crosses with faceted glass insets (in one case emerald-green and the other clear); a small stamped brass crucifix; a small brass sequin; fancy decorated stamped brass button covers including one that is gold-plated; a strand of finely wound silver wire; four square faceted jet rosary beads; and a glazed ceramic bead.

## FAUNAL REMAINS

Faunal bone was found in profusion throughout the midden deposits. Thin but particularly dense bone deposits or bone beds were found at the bottom of Zone 1 and within Zone 2 (see Figures 14-16). As at

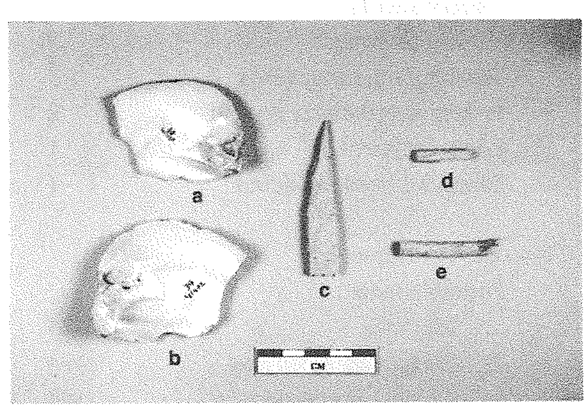


Figure 20. Shell and bone artifacts, Rosario Mission (41GD2): a-b, edge-utilized freshwater mussel shells; c, bone awl made from bovid rib bone fragment; d-e, bird bone beads.

**Table 3. Rosario Mission (41GD2), Artifacts by Classes and Zones***

| Class | Zone 1 | Zone 2 | Zone 3 | West |
|---|---|---|---|---|
| Flaked lithics | | | | |
| Arrow points | | | | |
| Guerrero | – | 1 | 2 | 4 |
| Medial fragments | – | 1 | – | 1 |
| Distal fragments | – | 1 | – | – |
| Preform fragments | 1 | 2 | – | – |
| Scrapers | – | 5 | – | – |
| Bifaces | 6 | – | – | – |
| Prismatic blades | 22 | 7 | 1 | 2 |
| Edge–retouched flakes | 23 | 1 | 1 | – |
| Cores | 7 | 1 | 1 | – |
| Gunflints | 13 | 3 | 1 | 2 |
| Debitage | 847 | 339 | 44 | 151 |
| Rough/Ground Stone | | | | |
| Bola (?) stones, quartzite | – | – | – | 2 |
| Hammerstone fragments, quartzite | 2 | – | 1 | 1 |
| Sandstone disk | 1 | – | – | – |
| Whetstones | 2 | – | – | – |
| Bone/Shell | | | | |
| Bovid–rib awl | – | 2 | – | – |
| Bird bone beads | 1 | 1 | – | – |
| Edge–utilized freshwater mussel | 1 | 1 | – | – |
| Freshwater mussel shell beads | 2 | – | – | – |
| Native Ceramics | | | | |
| Pottery sherds | 9685 | 2127 | 226 | 1209 |
| Handle fragments | 5 | 6 | 3 | 2 |
| Smoking pipe fragments | 3 | 1 | – | – |
| Pottery sherd disks, ground | 2 | – | – | – |
| Ladle fragment | 1 | – | – | – |
| Discoidal bead, modeled | 1 | – | – | – |
| Non–Native Ceramics | | | | |
| Pottery sherds | | | | |
| Majolica | 535 | 148 | 16 | 60 |
| Earthenware, various | 494 | 82 | 11 | 67 |
| Chinese porcelain | 3 | 1 | – | – |
| Whiteware | 3 | – | – | – |
| Stoneware | 2 | – | – | – |
| Kaolin pipe bowl fragment | 1 | – | – | – |

**Table 3.** *(Continued)*

| Class | Zone 1 | Zone 2 | Zone 3 | West |
|---|---|---|---|---|
| Glass (excluding beads) | | | | |
| Bottle/container fragments | 149 | 68 | 14 | 35 |
| Reworked glass fragments | | | | |
| Scrapers | 2 | 1 | – | – |
| Biface | 1 | – | – | – |
| Flakes | 12 | 3 | 1 | – |
| Iron | | | | |
| Nails | 19 | 9 | 2 | 4 |
| Tacks | 2 | – | – | 1 |
| Straight pin | 1 | – | – | – |
| Chain links/hooks | 5 | 2 | – | 1 |
| Rings | 1 | 2 | – | 1 |
| Wire pieces | 1 | – | – | 1 |
| Bridle jangles | 2 | 3 | – | 1 |
| Pointed implement | 1 | – | – | – |
| Jew's harp | 1 | – | – | – |
| Powder spoon | 1 | – | – | – |
| Latch hook | 1 | – | – | – |
| Wrought fish hook | 1 | – | – | – |
| Flint lock | 1 | – | – | – |
| Drawer pull | 1 | – | – | – |
| Knife blade fragment | 1 | – | – | – |
| Kettle handle | 1 | – | – | – |
| Cast iron kettle fragments | 5 | – | – | – |
| Arrow points | 1 | 1 | – | – |
| Flatware fragments | 1 | – | – | 1 |
| Hinge pieces | – | 2 | – | – |
| Strap/flat bar fragments | – | 2 | – | 1 |
| Small gun shot | 3 | – | – | 1 |
| Copper/Brass | | | | |
| Cut sheet fragments | 24 | 3 | – | 6 |
| Casing fragment, brass | 1 | – | – | – |
| Escutcheon, brass | 1 | – | – | – |
| Small coin, copper | 1 | – | – | – |
| Arrow point (?) | 1 | – | – | – |
| Silver | | | | |
| Spoon fragments | – | 2 | – | – |

**Table 3.** *(Continued)*

| Class | Zone 1 | Zone 2 | Zone 3 | West |
|---|---|---|---|---|
| Lead | | | | |
| Musket balls, .30–.50 cal | 3 | 1 | – | – |
| Small gun shot | 4 | 1 | – | – |
| Droplets | 2 | – | – | – |
| Scraps | 12 | 3 | 1 | – |
| Non–Native Ornamental/Dress | | | | |
| Earring loops, brass | 2 | – | – | 1 |
| Earring dangle, copper | – | 1 | – | – |
| Decorated buttons, brass | 2 | – | – | – |
| Buttons, copper | 4 | – | 2 | – |
| Buttons, brass | 1 | 2 | – | – |
| Hawk bell | 1 | – | – | – |
| Jeweled brooch, copper | – | 2 | – | – |
| Jeweled crosses, brass | 2 | – | – | – |
| Crucifix, brass | 1 | – | – | – |
| Sequin, brass | 1 | – | – | – |
| Gold–plated button, brass | – | 1 | – | – |
| Silver wire | – | 1 | – | – |
| Jet rosary beads | 1 | 2 | 1 | – |
| Ceramic bead | – | 1 | – | – |
| Glass beads | 149 | 68 | 14 | 35 |

*Zones do not include westernmost 1 x 1 m units S7E2 and S15E2, in which zone stratigraphy was not discernible. Zone 3 totals include statistically insignificant numbers of material from Zone 3–A.

Espíritu Santo, the overwhelming bulk of the bone was bovid, presumably cattle. The presence of numerous head and foot elements suggests on-site butchering (deFrance, this volume). Other domestic taxa include pig, horse, burro, and chicken. Wild taxa include white-tailed deer, opossum, rabbit, aquatic turtles, and three kinds of fish (gar, catfish, and bass).

## MACROBOTANICAL REMAINS

Fine-screen samples yielded a number of charred plant parts plus well-preserved pieces of wood charcoal. Identified wood species (Dering 1998) include mesquite, hackberry, buckthorn, lotebush, and huisache. Surprisingly absent, considering its present abundance in motts on the nearby uplands, is live oak, which may accord with an unexpectedly low incidence of oak pollen in samples from the middens analyzed by Albert (this volume). Cultigens are represented by a single maize cupule and two legumes, probably domesticated beans. Identified wild plant remains include seeds of mesquite, scurfpea, thistle, and hackberry.

## PATTERNS OF ACCULTURATIVE CHANGE AT ROSARIO: EXPECTED VS. ACTUAL REPRESENTATION OF NATIVE VS. NON-NATIVE ARTIFACT CLASSES

The chronological indicators in the artifact assemblages summarized above allow a consideration of diachronic change in the material culture at Rosario. The springboard for analysis is the kinds and relative quantities of Native and imported Spanish colonial materials at the site, as measured in terms of expected and actual percentages in the two time periods represented by Zone 1 and Zones 2/3.

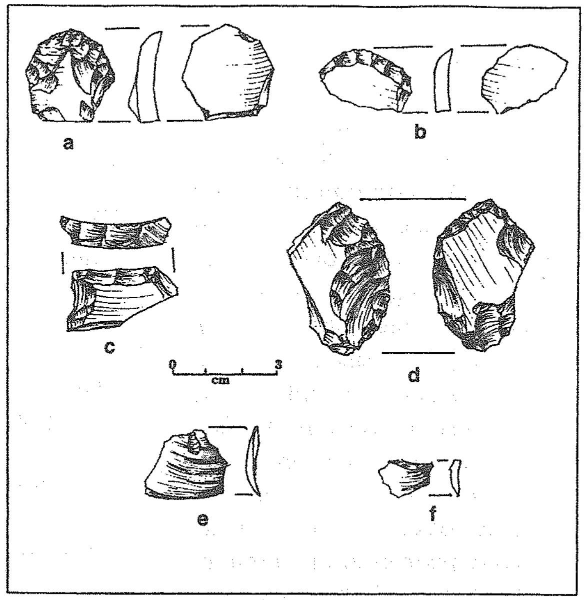

Figure 21. Artifacts of worked bottle glass fragments from Rosario Mission (41GD2): a-c, scrapers, d, bifacially worked fragment, e-f, flakes.

For the present purposes, the "expected" representation of a given artifact class is based on the relative quantities of excavated matrix in each zone (treating combined Zones 2/3 as a single zone or analytical unit). That this is a legitimate procedure is indicated by the very close correspondences in the relative percentages of some of the most abundantly represented artifact classes (such as Native pottery sherds, Spanish colonial pottery sherds, and glass fragments) and the percentage of excavated matrix represented for each zone. Thus, for example, of the 12,052 Native pottery sherds recovered in the three zones combined (excluding the two westernmost units, where zone stratigraphy was not discernible), 80 percent came from Zone 1 and 20 percent from Zones 2/3, while the percentages of excavated midden for each zone are 78 percent and 22 percent, respectively. Similarly, 80 percent of the Spanish colonial ceramics and 77 percent of the glass fragments came from Zone 1, with 20 percent and 23 percent, respectively, from Zones 2/3. With a few notable exceptions, the percentage breakdowns of other artifact classes are more or less similar (Table 4 and Figure 23). These data indicate that the middens in both analytical units—Zone 1 and Zones 2/3—reflect essentially the same depositional processes. In other words, both analytical units appear to represent general trash disposal and a correspondingly more or less broad range of materials and activities at the site. It is unlikely that divergences from the expected percentages of the zones represent significant shifts in specific, localized activities.

With the available information, it is impossible to estimate the proportional input of debris from activity/residence by Native Americans as opposed to Spanish personnel. However, given the profusion of Native ceramics in all zones and the presence of a range of Native-made implements, it seems likely that most of the debris represents a Native occupation. This accords

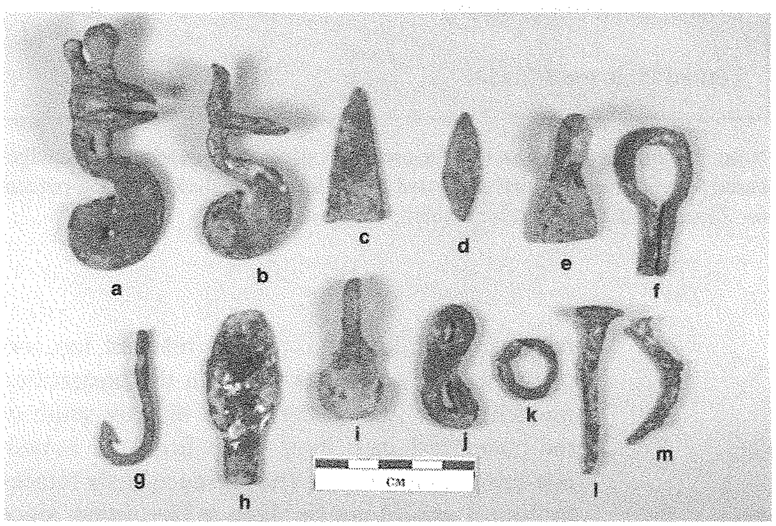

Figure 22. Iron artifacts, Espíritu Santo and Rosario missions: a-b, flintlocks; c, tip of knife blade; d, bi-pointed arrow point; e, horse bridle jangle; f, Jew's harp; g, wrought fish hook; h, flatware (spoon?) handle fragment; i, gunpowder measuring spoon; j, chain links; k, ring, l-m, wrought nails. Specimens a, l, and m are from Espíritu Santo, all others are from Rosario.

with the location of the middens outside the main wall compound, since in general Native people lived either along the interior of mission compound enclosures or outside the compound, while priests and other colonial personnel presumably resided in substantial buildings well within the compound. Thus, while caution is in order, it is reasonable to assume that significant shifts in the proportions of various artifact classes between zones are likely to reflect, at least in large part, changing patterns of material use by Native peoples at the mission.

As shown in Table 4 and presented graphically in Figure 23, the actual percentages of most artifact classes fall within 10 percent of the expected percentages for Zone 1 and Zones 2/3. Notably divergent are edge-retouched flakes, ornamental artifacts, including glass beads, and formal lithic tools (arrow points, scrapers, thin biface fragments). Of the total sample of glass beads, which are quite abundant, only 65 percent come from Zone 1, while 35 percent are from Zones 2/3. Artifacts of personal adornment, including non-Native items of dress such as copper and brass buttons, diverge even more, with 50 percent of the total coming from each of the zones.

**Table 4. Percentages of Total Artifact Classes by Analytical Units (Zone 1 and Combined Zones 2 &3), Rosario Mission, 41GD2**

| Class | Zone 1 | Zones 2 & 3 |
|---|---|---|
| Glass fragments (n=123) | 77% | 23% |
| Native pottery sherds (n=12,038) | 80% | 20% |
| Spanish Colonial pottery sherds (n=1,029) | 80% | 20% |
| Gunflints (n=17) | 76% | 24% |
| Prismatic blades (n=30) | 73% | 27% |
| Gun shot (lead and iron) (n=12) | 83% | 17% |
| Iron implements (n=69) | 70% | 30% |
| Lithic debitage (n=1,230) | 69% | 31% |
| Sheet copper/brass fragments (n=28) | 89% | 11% |
| Edge-retouched flakes (n=25) | 92% | 8% |
| Glass beads (n=231) | 65% | 35% |
| Ornamental artifacts (n=28) | 50% | 50% |
| Formal lithic tools (n=14) | 21% | 79% |

Note: The artifact classes are listed in order of conformity to expected percentages based on percentages of total excavated matrix for each analytical unit (78 percent for Zone 1, and 22 percent for combined Zones 2 & 3).

## CHANGES IN LITHIC TECHNOLOGY AND TOOL USE AT ROSARIO

The greatest divergence between Zone 1 and Zone 2/3 is seen in formal lithic tools, with only 21 percent from Zone 1 and 79 percent from Zones 2/3. While the sample is small, the nearly complete absence of arrow points and scrapers from Zone 1, which yielded only a single arrow point preform fragment, is striking. It is perhaps relevant, too, that of the five arrow points found in the unstratified midden in the two western units directly south of the compound gate, four came from the bottom one-third of the deposit. The presence of six bifaces in Zone 1 should not be taken at face value, since three specimens are thick flakes with bifacial edge retouch (suggesting expedient rather than formal tool production), while two may be distal fragments of Archaic dart points that were curated/recycled during the mission period. Only a single specimen is a good candidate for the kind of thin bifacial

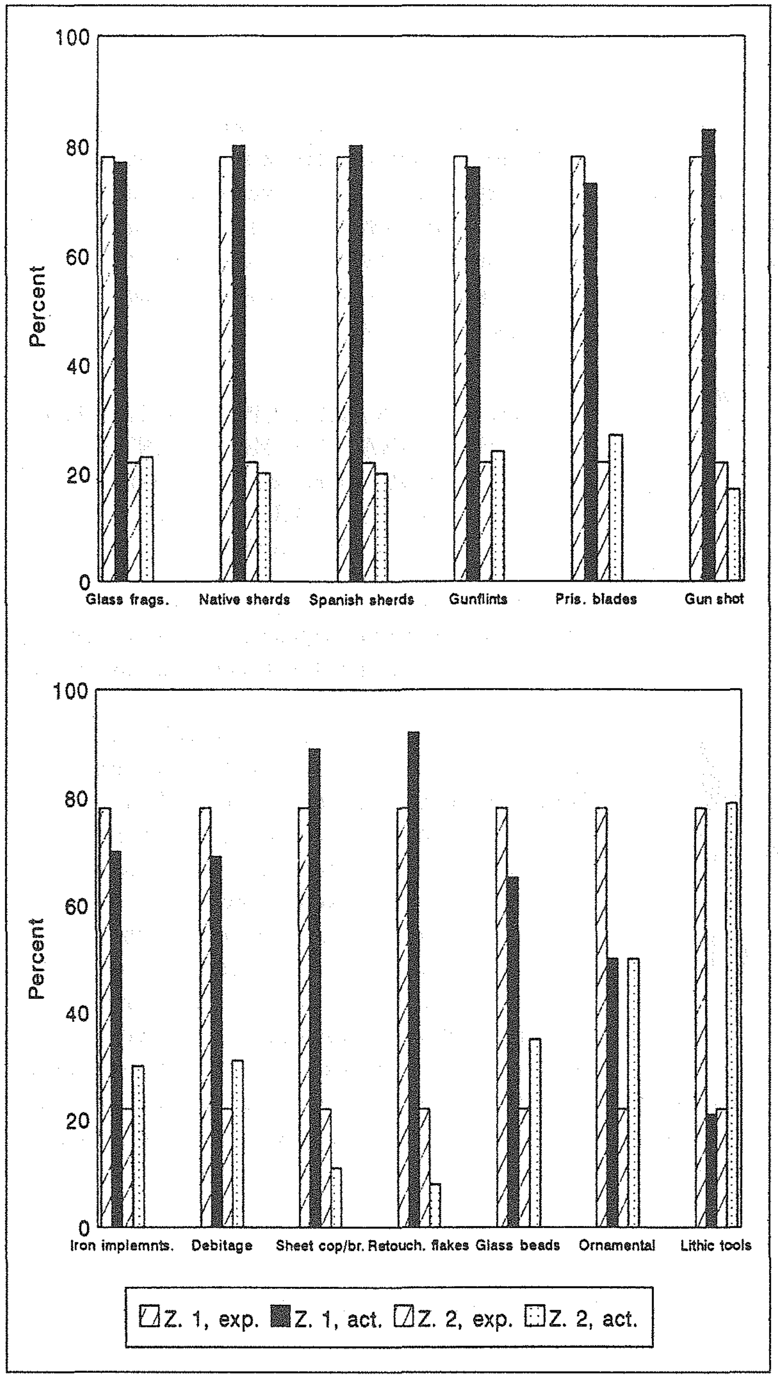


Figure 23. Expected vs. actual percentages of various artifacts classes found in Zone 1 and combined Zones 2 and 3. The expected percentage is based on the relative volumes of midden matrix excavated for the zones (Zone 1, 78 percent; Zones 2/3, 22 percent).

knife found on aboriginal sites of the Late Prehistoric/Protohistoric periods that can be linked culturally with Native mission residents. The dearth of lithic knives in the sample accords with the absence of stone tool cut marks in the analyzed faunal sample from the site; all observed cut marks appear to have been made by metal tools (see deFrance, this volume).

The preponderance of formal lithic tools in the lower midden deposits suggests that the manufacture and use of flaked stone tools was declining during the second half of the 18th century. Presumably, cutting and scraping tasks were increasingly carried out using imported metal tools and/or tools fashioned from imported metals. The relatively high percentage of cut sheet copper/brass pieces, probably derived from kettles (Figure 24a-b), may also reflect a shift to metal for making various tools, although the limited sample includes only one possible small triangular arrow point from Zone 1.

A reduction in formal stone tool manufacture in the later years of occupation at Rosario may also be reflected in the percentages of the total debitage sample from each zone. Zone 1 produced 69 percent of the total while 31 percent came from Zones 2/3, compared to the expectation of, respectively, 78 and 22 percent based on the excavated volume from Rosario. The debitage sample from the zones also shows informative differences in proportions of flake types (Table 5). The percentage of biface thinning flakes in Zone 1 (7 percent) is slightly less than half that of Zones 2/3 (15 percent), suggesting a decrease in thin bifacial lithic reduction.

A final point to be noted concerning changes in lithic technology is the high representation of edge-retouched flakes in Zone 1 (92 percent of the sample) as opposed to Zones 2/3 (8 percent of the sample). The higher-than-expected representation of these items in Zone 1 suggests that lithic material was increasingly used to make expedient, as opposed to formal, stone tools. Similarly, the percentages of utilized flakes, which comprise 30 percent of the flake sample from Zone 1 and only 17 percent from Zones 2/3, points to an increased use of stone as expedient tools, possibly as a compensation for a lack of formal lithic tools. These findings essentially parallel those of Inman (1997, this volume) in her analyses of lithic materials from the Spanish colonial missions at Guerrero in northeastern Mexico.

In sum, it appears that while a lithic technology continued to exist throughout the time span of occupation at Rosario, there was a decrease in the manufacture of aboriginal tool forms as Native peoples increasingly incorporated implements of non-Native origins/materials into their daily lives at the mission. As a possible corollary, more reliance was placed on the use of expedient lithic tools in the form of utilized and edge-retouched flakes, as well as prismatic blades. Furthermore, given that some fraction of the debitage in the middens probably represents local manufacture of gunflints (found in approximately the expected percentages in the respective zones), the near absence of formal lithic tools in Zone 1 may actually reflect an even greater reduction of traditional lithic technology than is suggested by the quantities of debitage in each zone.

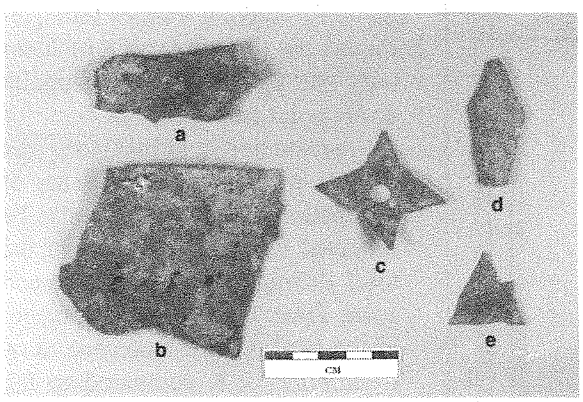


Figure 24. Artifacts of sheet brass and copper: a-b, cut copper kettle fragments; c, copper door escutcheon; d, brass arrow point; e, copper arrow point. Specimens d and e are from Espíritu Santo, all others from Rosario.

## CHANGES IN THE REPRESENTATION OF NON-NATIVE ORNAMENTAL ITEMS: THE EFFECTS OF CHANGING SOCIO-POLITICAL RELATIONS?

In contrast to the likely increase in the use of metal for utilitarian purposes, there is a reduction over time in the proportional representation of non-Native ornamental artifacts. Zone 1 produced 65 percent of the total number of glass beads, in contrast to the expected 78 percent. Of all other non-Native ornamental artifacts (see Table 4), only 50 percent are from Zone 1. While intuitively it may be suspected that Native use of imported items of personal adornment would have increased at the expense of Native-made ornaments, other factors help to understand the actual empirical data. Historical documentation shows that prior to 1790, the Karankawan groups had only a tenuous link to the mission and Spanish colonial culture; as noted above, by 1780 relations had deteriorated to the point that the Indians abandoned Rosario Mission. By contrast, after 1789, when the Karankawa made

**Table 5. Debitage Types by Zones in Main Excavation Block, Mission Rosario (41GD2)**

| | Whole Flakes | | | | No./Percent | Flake Fragments | | | Average Length, |
|---|---|---|---|---|---|---|---|---|---|
| Zone | P* | S | T | Thinning | Utilized | P | S | T | Whole flakes |
| 1 | 27<br>9% | 132<br>38% | 163<br>47% | 24/7% | 105/30% | 21<br>18% | 15<br>13% | 78<br>68% | 23.34 mm |
| 2/3 | 19<br>9% | 54<br>25% | 112<br>51% | 33/15% | 37/17% | 2<br>2% | 25<br>28% | 62<br>70% | 19.24 mm |

P=primary; S=secondary; T=tertiary

formal peace with the Spaniards, relations became increasingly stable, so that by the first decade of the 19th century the Karankawa were perceived by colonial authorities as peaceful and useful allies (Ricklis 1996). Since clothing, blankets, beads and other trinkets were commonly offered to Native peoples by missionaries to establish viable relations (e.g., Silva 1791, 1793), it follows that the custom of gift-giving was actually more commonly employed during the earlier period of tension than during the later years of relatively stable and peaceful interaction. While this interpretation of the data is at best tentative, it conceivably provides one basis for future archeological/archival research into the material culture effects of changing socio-political relations during colonial times.

## NATIVE CERAMICS AT THE MISSIONS: PATTERNS OF ETHNICITY AND INTERACTION

In the preceding pages, the key attributes of the Native pottery at Espiritu Santo and Rosario have been briefly summarized. Even a cursory examination of the pottery clearly shows that two distinct ceramic traditions are represented by the respective samples from these sites. At Espíritu Santo, virtually all pottery recovered during our investigations was plainware containing large quantities of crushed bone temper. The similarity of this material to pottery from Late Prehistoric inland coastal prairie sites of the Toyah horizon, as well as to the ceramics from the earlier location of Espíritu Santo Mission (41VT11; see Walter, this volume), leaves little doubt that it represents the later end of a long continuum in ceramic technology and style.

By contrast, the pottery from Rosario shows clear affiliation with the coastal Rockport ware series, as should be expected if the Native people at that mission were predominantly of Karankawan ethnicity. Diagnostic attributes of Rockport ware—a sandy paste clay body, smooth vessel surfaces that were commonly coated with asphaltum or decorated with characteristic asphaltum designs such as narrow bands on vessel lips and vertical squiggles or wavy lines (Figure 25)—are abundantly represented at Rosario. Key attributes, as quantified for rim sherd samples from the two sites, are shown in Table 6.

### Aplastic Inclusions: Crushed Bone and Sand

While crushed bone is common in sherds from both sites, it is more frequently present, and in greater quantities, in sherds from Espíritu Santo. In the sample from that site, there are no sherds without bone temper, and only 11 percent have sparse bone temper, while moderate and profuse bone temper are found in 39 and 50 percent of the sherds, respectively. At Rosario, 9 percent of the sherds contain no bone, while sparse bone temper is found in 43 percent of the sherds, moderate bone is in 41 percent, and profuse bone is in only 6 percent of the sherds (Figure 26).

An even greater contrast is seen in the presence/absence and quantities of sand inclusions in the sherd samples from the two sites. At Espíritu Santo, 96 percent of the sherds are devoid of sand inclusions, while sparse and moderate sand is found in three and one percent of the sherds, respectively. At Rosario, only eight percent of the sherds are without sand inclusions, while sparse, moderate, and profuse sand is found, respectively, in 22, 38, and 33 percent of the sherds (Figure 27).

The data on aplastic inclusions indicate significant differences in the technology of clay selection/preparation at the two sites. At Espíritu Santo, tempering was almost always accomplished by adding crushed bone to the clay body, and the great majority of vessels were made from clay devoid of sand inclusions. At Rosario, the overwhelming majority of pots were made with clay selected for natural sand inclusions (or with clay to which sand was added as an intentional tempering agent; at this time, without knowledge of the clay sources used, it cannot be determined if sand was an intentional additive). Bone was commonly employed as a tempering agent, but in smaller quantities than at Espíritu Santo. At Rosario, ceramic technology more closely approximates the sandy paste tradition of the coastal Rockport phase, insofar as the great majority of vessels contained sand, and profuse bone tempering is found in only a small minority (5 percent) of the vessels. Still, bone tempering was employed in most vessels (90 percent), in contrast to non-mission Rockport phase sites, where it is found in only about 20-40 percent of vessels (Ricklis 1995a, 1996:Appendix A).

The high incidence of bone tempering at Rosario may reflect an influence (through as yet

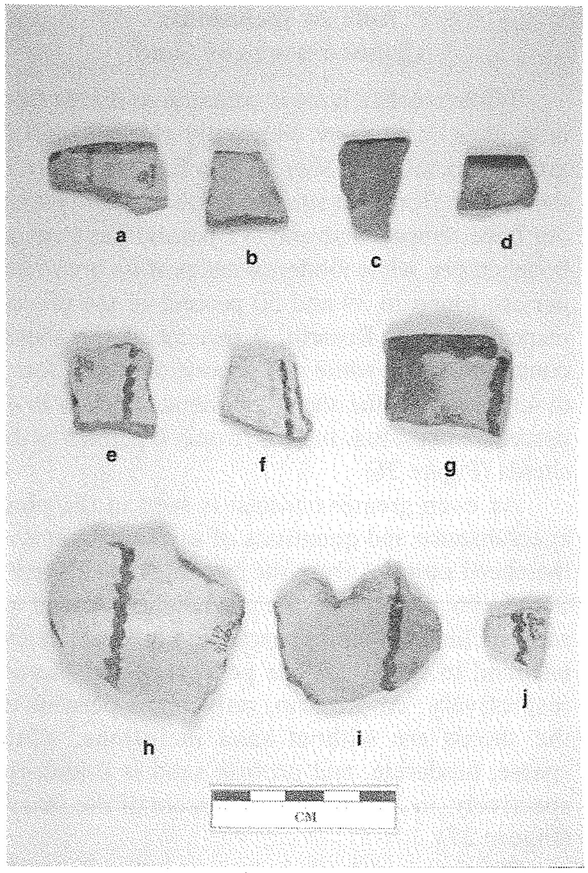


Figure 25. Selected pottery sherds from Rosario Mission (41GD2) showing typical Rockport Black-on-Gray decorative motifs painted with asphaltum: a, g, rim sherds with lip band and vertical squiggle; b-d, rim sherds with lip bands, e-f, h-j, body sherds with squiggles. Vessel exterior surfaces shown in all cases.

obscure social and/or economic mechanisms) upon the largely Karankawan potters at Rosario coming from the distinctly different ceramic tradition established at Espiritu Santo. There is, in fact, some evidence that the common inclusion of crushed bone in the Rosario pottery increased through time, suggesting an ongoing process of modification of traditional Rockport (Karankawan) ceramic technology. As shown in Table 7, the quantity of crushed bone is greater in Zone 1 than in the earlier combined Zones 2/3. In the Zone 2/3 sample, 12 percent of the analyzed rim sherds contained no bone, as compared to nine percent in Zone 1. Sparse bone temper declines from 60 to 43 percent, while moderate and profuse bone temper increase, respectively, from 27 to 41 percent and from two to six percent. Conversely, sand inclusions in clay bodies decreases between Zones 2/3 and Zone 1: sherds with no sand represent only three percent of the sample in Zones 2/3 and 10 percent in Zone 1. By contrast, 66 percent of the sherds in the Zones 2/3 sample contain profuse sand inclusions, while the percentage for the Zone 1 sample is only 16 percent.

## Asphaltum Decoration/Coating

Aside from a single sherd from Rosario bearing two parallel, dark brown straight lines painted in some substance (mineral paint?) other than asphaltum, all applied decoration in our Native ceramic sample was accomplished by painting asphaltum onto fired vessel surfaces. Asphaltum surface treatment was almost non-existent at Espíritu Santo (Figure 28; see also Table 6); only a single rim sherd bore asphaltum in the form of a narrow band around the vessel lip.

In marked contrast, 43 percent of the analyzed rim sherds from the Rosario sample bear asphaltum. Most commonly, this consists of a band painted on the vessel lip, a common decorative element of the Rockport Black-on-Gray ceramics of the coastal Rockport phase (e.g., Campbell 1961; Suhm and Jelks 1962; Ricklis, 1992a, 1995a, 1996). Also present in the rim sherd sample are 20 specimens bearing vertical painted squiggles, a highly diagnostic design element in Rockport ware. The limited number of sherds bearing this element is consistent with non-mission Rockport phase ceramic samples, and can be attributed to the fact that: (a) generally only a minority of vessels at any given site bear this design, and (b) the vertical squiggles were placed at fairly wide intervals on vessel exteriors (see Ricklis 1995a), so that the element will not be present on many sherds from a pot with this decoration.

To these data from Rosario, derived from the analysis of rim sherds, can be added information from a select sample of 768 body sherds from units N0E6 and S1E12. In this sample, 333, or 43.4 percent, bore asphaltum coating and/or decoration. Also, there is a correlation between the presence of exterior asphaltum decoration (wavy lines, squiggles) and interior asphaltum coating, as is the case in ceramic samples from non-mission, Rockport phase sites (see Ricklis 1995a, 1996:Appendix A).

**Table 6. Numbers and Percentages of Key Attributes on Rimsherds, Espiritu Santo (41GD1) and Rosario (41GD2) Missions**

| Key Attributes | Espiritu Santo (n=230) | Rosario (n=379) |
|---|---|---|
| Crushed Bone Temper* | | |
| None | 0 | 39 (10%) |
| Sparse | 25 (11%) | 184 (48%) |
| Moderate | 90 (39%) | 139 (37%) |
| Profuse | 115 (50%) | 18 (5%) |
| Sand Inclusions* | | |
| None | 219 (96%) | 24 (6%) |
| Sparse | 8 (3%) | 84 (22%) |
| Moderate | 3 (1%) | 143 (38%) |
| Profuse | 0 | 124 (33%) |
| Asphaltum Decoration | 1 (0.4%) | 164 (43%) |

* Sparse=<5%; Moderate=5-25%; Profuse=>25% of clay body.

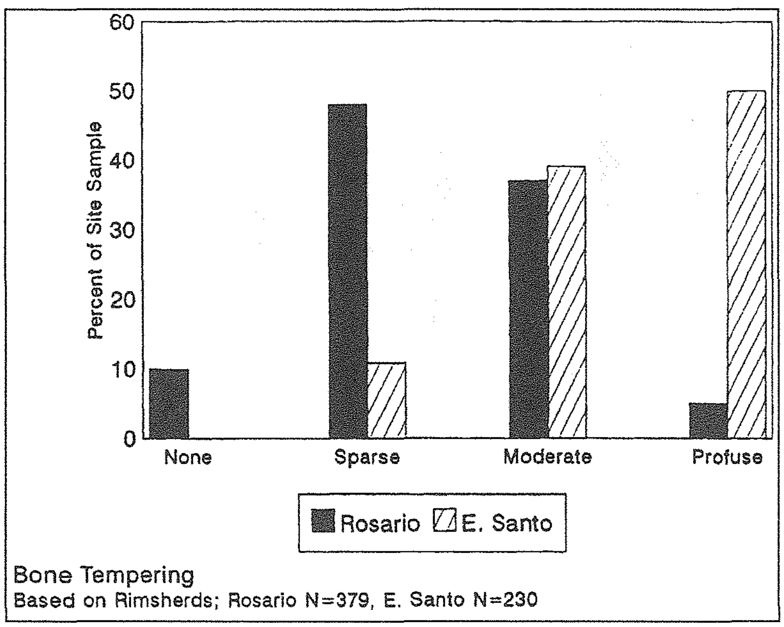


Figure 26. Percentages of analyzed rim sherds from Espíritu Santo and Rosario with no bone temper and sparse, moderate, and profuse bone temper.

In sum, in terms of the specific decorative elements, as well as the percentage of vessels bearing asphaltum surface treatment, the ceramics from Rosario compare well with samples from Rockport phase sites: at Rosario, 43 percent of the analyzed rim sherds bear asphaltum, while the analyses of ceramics from seven Rockport phase sites (Ricklis 1995a) show asphaltum on between 38 and 65 percent of vessels, with an average of 53 percent. Given that the Rockport phase is largely, if not entirely, the archeological correlate of the historically documented Karankawan groups (Campbell 1960; Newcomb 1961, 1983; Ricklis 1996), these ceramic data strongly suggest that Karankawan peoples were the primary, if not virtually the only, Native residents at Mission Rosario (at least among those responsible for the midden debris outside the south compound gate).

The contrasting quantities of asphaltum surface treatment on vessels from the two mission sites are shown graphically in Figure 28, with comparisons to non-mission Rockport phase sites and Toyah sites located on the South Texas coastal prairies. The similarities between Rosario and Rockport ceramic samples on the one hand, and Espíritu Santo and Toyah pottery on the other, are clear. Interestingly, the coastal prairie Toyah sites have a significantly higher average percentage (15 percent) of vessels bearing asphaltum surface treatment than does Espíritu Santo (0.4 percent). While analyses have shown that the use of asphaltum for decoration on Toyah vessels involved non-Rockport decorative elements (Ricklis 1995a, 1996), it is apparent that Toyah potters on the coastal prairies did have limited access to asphaltum as a ceramic decorative material. The contrasting percentages of asphaltum surface treatment on non-mission Toyah sites and at Espíritu Santo suggests that non-/pre-mission inland groups had greater access to asphaltum, perhaps through trade with coastal peoples, than did the Native occupants at Espíritu Santo. This in turn may indicate that life at the missions was more restrictive regarding interaction between Native peoples than was the case under aboriginal conditions.

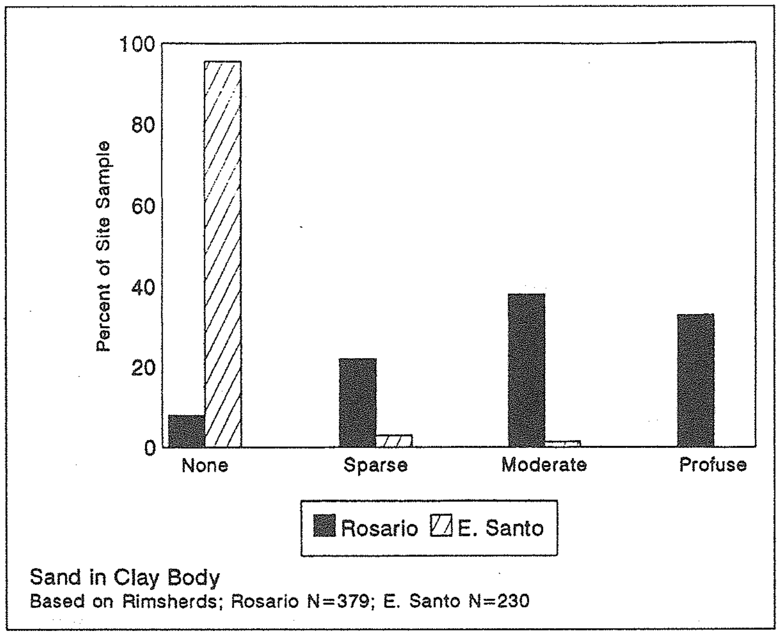


Figure 27. Percentages of analyzed rim sherds from Espíritu Santo and Rosario with no sand inclusions and sparse, moderate, and profuse sand inclusions.

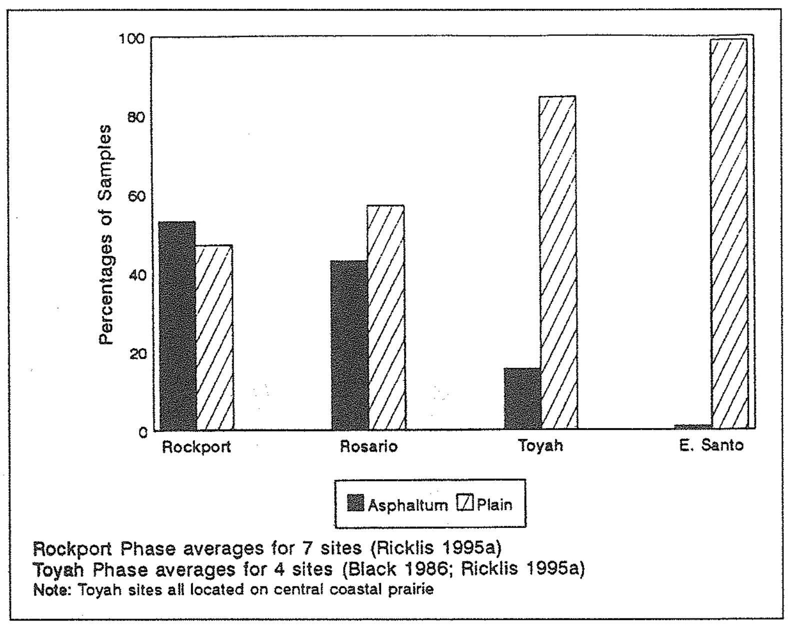


Figure 28. Comparison of percentages of rimsherds from Espíritu Santo and Rosario with asphaltum surface treatment (decoration and/or coating), as well as percentages of ceramics with asphaltum surface treatment from Rockport phase and coastal prairie Toyah horizon sites.

## Handles

Ceramic handles fragments recovered from both sites are simple loops made of ropes of clay (ranging in thickness from 12 to 18 mm) that were attached to vessel necks/shoulders at both ends (examples from Espíritu Santo are shown in Figure 6f-h). Examination of the ends of handle fragments as well as vessel wall sherds from which handles have broken off clearly shows that the handles were attached to the jars and/or ollas by putting the ends through holes in the unfired vessel wall and smoothing over the interior and exterior walls (the so-called "riveting" technique).

Handles, including vessel wall fragments from which handles have broken off, are not particularly abundant in the ceramic samples. However, they are considerably better represented at Espíritu Santo than at Rosario. The Espíritu Santo sample contains 25 specimens, representing 0.9 percent of all recovered sherds, while the Rosario sample contains 16 fragments, comprising only 0.1 percent of the sherds. Thus, relative to all sherds in the respective samples, handles are nine times more abundant at Espíritu Santo than at Rosario. To this can be added the observation that five of the handle fragments from Rosario are probably Goliad ware from Espíritu

**Table 7. Numbers and Percentages of Selected Attributes, Native Ceramic Rimsherds, Zone 1 and Zones 2/3, Rosario Mission (41GD2)**

| Attribute | Zone 1 (n=255) | | Zones 2/3 (n=124) | |
|---|---|---|---|---|
| Aplastic Inclusions* | | | | |
| Crushed Bone | | | | |
| None | 24 | (9%) | 15 | (12%) |
| Sparse | 110 | (43%) | 74 | (60%) |
| Moderate | 105 | (41%) | 33 | (27%) |
| Profuse | 16 | (6%) | 2 | (2%) |
| Sand | | | | |
| None | 25 | (10%) | 4 | (3%) |
| Sparse | 79 | (31%) | 5 | (4%) |
| Moderate | 109 | (43%) | 33 | (27%) |
| Profuse | 42 | (16%) | 82 | (66%) |
| Asphaltum Surface Treatment | | | | |
| Lip band | 102 | (40%) | 35 | (28%) |
| Lip band with vertical squiggle** | 6 | (2%) | 11 | (9%) |
| Coating only | 5 | (2%) | 3 | (2%) |
| Vertical squiggle without lip band | 1 | (0.4%) | 1 | (1%) |
| Total with Asphaltum | 114 | (44%) | 50 | (40%) |

* Sparse =< 5%; Moderate =5-25%; Profuse => 25% of clay body.

** Usually accompanied by interior asphaltum coating

Note apparent trends toward greater quantities of bone temper and lesser quantities of sand between Zones 2/3 and Zone 1.

Santo, considering that they contain profuse bone temper, no sand, and bear the pinkish oxidized exteriors characteristic of the ceramics from that site.

These data are significant indicators of the respective ceramic traditions at each site. Simple loop handles, while never abundant, are nonetheless a recurrent trait in the ceramics of the Toyah horizon (e.g., Suhm and Jelks 1962; Highley 1986; Hester 1995), but are not an element of the Rockport ceramic tradition (Ricklis 1995b, 1996). Therefore, the relatively greater representation of handles at Espíritu Santo is in accord with other attributes that relate the ceramics from that site to the bone-tempered plainware tradition of the Toyah horizon. The dearth of handles at Rosario, on the other hand, is in keeping with other attributes, such as a sandy paste clay body and asphaltum surface treatment, that link the ceramics there to the Rockport tradition of the coastal zone.

## SHELL SPECIES AND INFERENCES CONCERNING MOBILITY PATTERNS AMONG NATIVE GROUPS

Another comparison that can be made with our present data base is the marked difference in the proportion of coastal marine/estuarine species in the shell samples from Espíritu Santo and Rosario. As noted earlier, freshwater mussel of the species *Amblema plicata* dominates both samples. This bivalve is common in the San Antonio River (Howells et al. 1996), and presumably was readily available locally to people living at both Espíritu Santo and Rosario. Marine/estuarine shells would have been transported from the coastal bays and lagoons, located some 60-80 km from the missions.

At Espíritu Santo, 98 percent of the shell specimens are freshwater mussel, the remainder being fragments of estuarine shell species. At Rosario, 20.6 percent of the shell are marine/estuarine bivalves, the most common species being giant Atlantic cockle (*Laevicardium robustum*) and sunray venus (*Macrocallista nimbosa*).

The contrasting percentages of coastal vs. freshwater mussel shells suggest that Native peoples at Rosario had greater access to coastal resources. Again, this accords with the historical and ceramic data indicating that the Native groups at Rosario were primarily if not exclusively coastal Karankawans. The presence of the sizable number of estuarine shells (plus two shark teeth) suggests that these people had some degree of ongoing access to their coastal territories. This, in turn, would seem to agree with other historical and archeological information suggesting that the Karankawa tended to incorporate the mission into their seasonal rounds as a basic ecological resource that provided beef and maize as substitutes for the bison and plant resources traditionally gathered on the coastal prairies (see discussion in Ricklis 1996:159-168).

## SUMMARY OF KEY POINTS

The several points that emerge from the foregoing analyses can be summarized as follows:

1. Both the Espíritu Santo and Rosario Mission sites retain essentially intact and highly productive colonial period extramural middens. The preponderance of artifacts from these deposits are of Native American manufacture, suggesting that they preserve highly significant archeological records of the Native occupations of these sites.

2. Differences in the relative quantities of various Native and Euro-American artifacts at Espíritu Santo suggest as yet poorly understood spatial variability in the extramural middens; the differences may reflect: (a) different degrees of access to imported non-Native artifacts by resident Native peoples, (b) greater input of debris from non-Native people in some midden areas, or (c) a combination of these factors.

3. At both Espíritu Santo and Rosario, the abundance of bovid bone doubtless reflects subsistence based on the large cattle herds associated with these missions. At the same time, the presence of non-domesticated taxa indicates a continuing partial reliance on wild game, reptiles, fish, and freshwater mussel.

4. The macro-botanical identifications indicate the use of both plant domesticates (maize and beans) and wild plants such as mesquite beans and various other seeds, as well as pecans. The lack of oak in the identified wood charcoal samples is somewhat surprising, and may indicate that live oak motts, abundant in the area today, were less common on the coastal prairies during the 18th century (see Albert, this volume).

5. The ceramic assemblages from the two sites are clearly distinct, with the Goliad ware from Espíritu Santo derived from the earlier bone-tempered plainware tradition of the Toyah horizon and the pottery at Rosario linked to the coastal ceramics of the Rockport phase. Given the marked technological and stylistic differences, it would be erroneous to subsume the Rosario assemblage under the rubric of Goliad ware, since this would mask the fundamental differences in the two ceramic traditions. While the common use of bone temper at Rosario suggests technological influence from Espíritu Santo, the pottery from this site generally contains less bone temper and an abundance of sand. There appear to be temporal trends in the Rosario pottery in increasing quantities of bone temper and decreasing amounts of sand in clay bodies, suggesting a time-dependent acceptance of technological aspects of the inland bone-tempered ceramics, at least within the mission context at Rosario. Significantly, typical Rockport asphaltum decoration is common at Rosario, suggesting adherence by resident Karankawans to traditional styles and, to the extent that these unique stylistic features are ethnic markers (see Ricklis 1992a, 1995a), a significant retention of Karankawan ethnic identity within the novel milieu of mission life.

6. The extreme scarcity of asphaltum decoration at Espíritu Santo, as well as a dearth of vessels with sand inclusions, suggests that there was little influence on potters at that site from the Karankawan peoples at Rosario, and also that few Karankawan vessels were traded or otherwise transported to Espíritu Santo. The use of asphaltum for decorating vessels at Espíritu Santo is in fact markedly less than at Late Prehistoric Toyah horizon sites on the South Texas coastal prairie, indicating that interaction among Native ethnic groups was probably more restricted than during aboriginal times. This may reflect social constraints imposed by the organizational structure of the Spanish colonial system, and is not necessarily incongruent with the fact that the Karankawan potters at Rosario were influenced by the ceramic tradition practiced

at Espíritu Santo. At the latter mission, the ceramic tradition was already an established institution within the regional Spanish colonial system as the Native-made Goliad ware pottery was incorporated into daily life as a common utilitarian ware, including its use by Spanish personnel (e.g., it is found in abundance at Presidio de la Bahía, Anne A. Fox, 1998 personal communication). In other words, while the dearth of Karankawan ceramic influence at Espíritu Santo may reflect constraints upon the relations between Native peoples, the adoption by Rosario Native potters of certain traits (common use of bone temper, vessel handles) of the inland pottery tradition may have been a response to the dissemination of stylistic and technological information that had become an integral aspect of technological behavior and material culture within the Spanish colonial community.

7. The diachronic analyses at Rosario suggest two additional points. First, it is apparent that the aboriginal lithic technology was modified during the second half of the 18th century, as traditional tool forms gave way to a greater use of flaked stone "expediency" tools (e.g., retouched and utilized flakes). Presumably, the decline in the use of formal lithic tools reflects the availability and perhaps increasing accessibility of imported metal implements. Second, there is a reduction in the proportional representation of glass beads and other non-Native items of personal adornment/dress between Zones 2/3 and Zone 1. Speculatively, this is thought to reflect a corresponding reduction in gift giving as a mechanism for facilitating inter-group relations, once socio-political relations between Spaniards and Karankawans improved after 1790; and

8. The architectural features found at Rosario show that there was at least one heretofore unknown formal building outside the main compound wall. Our data do not indicate the overall size or plan of the building, its function, or who occupied or otherwise used the structure. However, the fact that the structural remains underlie a series of later colonial middens indicates that it pertains to the early years of occupation at Rosario, and the alignment of the wall foundation, floors, and post support holes parallel to the main wall compound suggest that the building was a planned component in the overall layout of the mission. Further, the use of non-Native building techniques (stone foundation, packed caliche floors, adobe bricks) indicates that the structure was built by Spanish colonial personnel or perhaps by Native workers operating with novel technology directed by or learned from Spaniards. The presence of a packed caliche floor to the west of the main block, in units N0E6 and N0E7, suggests the existence of a second structure, and it is entirely possible that a complex of outbuildings existed in the area south of the main compound gate.

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# Zooarcheological Evidence of Colonial Culture Change: A Comparison of Two Locations of Mission Espiritu Santo de Zuñiga and Mission Nuestra Señora del Rosario, Texas

*Susan D. deFrance*


## ABSTRACT

Excavation of three 18th century missions on the South Texas coastal prairie produced an abundance of faunal remains. These remains are associated with two different Native American populations that were undergoing missionization by Franciscan missionaries. The Aranama and Tamique Indians inhabited the Espiritu Santo de Zuñiga missions along the Guadalupe, 41VT11, and later they resided in Goliad, 41GD1. A population of Karankawa Indians resided at Mission Nuestra Señora del Rosario, 41GD2. The zooarcheological remains indicate that cattle ranching was an economic mainstay at all three sites; however, evidence for variation in the use of local resources strongly relates to the ethnic composition of the missions. Analysis of the faunal assemblages included the collection of empirical data on butchering patterns and size characteristics of the bovid remains represented in the archeological record and comparisons with other geographic areas of Spanish settlement.


## INTRODUCTION

Recent excavations at three Spanish colonial missions on the south coastal plain of Texas have expanded our understanding of the nature of colonial interaction between the indigenous populations of the region and Catholic missionaries during the 18th and early 19th centuries (Ricklis 1998, this volume; Walter 1997, this volume). One component of Spanish colonial missionization was the introduction of Old World domesticates to mission settings to provide both food resources and economic opportunities for the friars and native peoples undergoing religious conversion. Both populations had the ability to modify their diets to include new subsistence items as well as the ability to exploit new economic opportunities. Accommodation by either parties would have constituted an alteration of traditional foodways. Native populations could have consumed barnyard domesticates from the Old World, while the Franciscan friars would have been able to consume a variety of wild fauna.

This article compares the patterns of faunal use that characterize three archeological mission contexts (Figure 1). Excavations at the missions of Espiritu Santo de Zuñiga at Goliad (1749-early 19th century) and Nuestra Señora del Rosario (1748-early 19th century) by Ricklis (1998, this volume) produced a substantial quantity of faunal remains. On-going research at a prior location of the Espiritu Santo mission (1726-1749) on the Guadalupe River (41VT11) also produced abundant faunal remains. I analyzed, and include herein, a portion of the faunal material that was recovered from the 1995 excavation of a large bone bed at the Guadalupe River location. The history and archeological investigations of these missions are only briefly reviewed here as they relate to the faunal remains. The reader is referred to Ricklis (1998) and Walter (1997) for additional contextual information. Since two of the contexts are from the Espiritu Santo Mission, the sites will be referred to as Espiritu Santo (41VT11) and Goliad or Espiritu Santo at Goliad.

This zooarcheological analysis consisted of the selection of a range of archeological contexts from which faunal remains would be examined. A variety of measures of relative abundance were used to

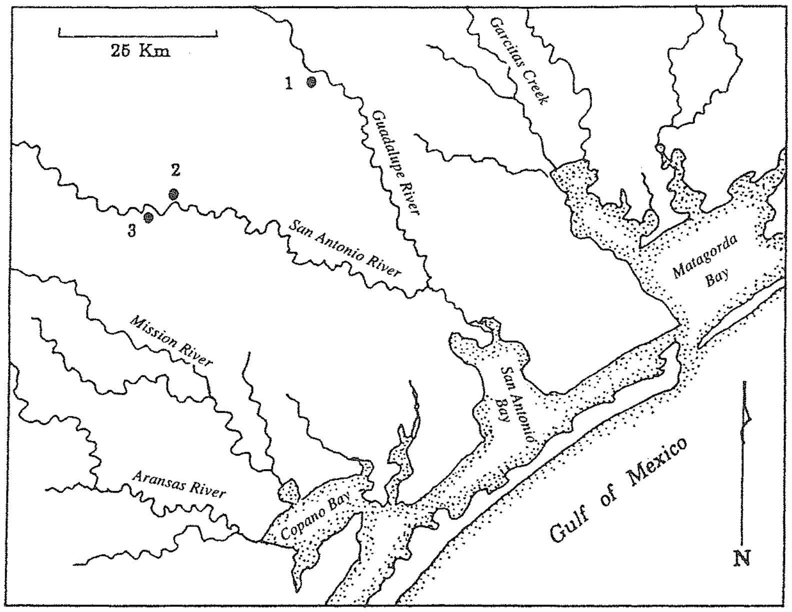


Figure 1. Location of missions Espiritu Santo de Zuñiga, 1726-1749, 41VT11 (1); location of Espiritu Santo at Goliad from 1749, 41GD1 (2); and Nuestra Señora del Rosario, established in 1754, 41GD2 (3).

determine which taxa were the most important food resources. Additional information on the characteristics of the faunal assemblage—including bone modifications and skeletal element representation—were obtained to provide information on how animals were processed and consumed by the mission inhabitants. Dimensional measurements of individual bone elements were taken to determine the size range of the large bovids present in the assemblage. These data are compared with other Spanish colonial assemblages from different geographic areas to assess the effects of environmental variability on the size of Spanish-introduced livestock.

One of the goals of the faunal analysis is to determine if the ethnic variability among the missions resulted in different patterns of animal use and discard. Comparisons of the three assemblages are made to assess the effects that ethnic background had on the composition of the assemblage. At both locations of Espiritu Santo, populations of Aranama and Tamique Indians or inland groups resided in the mission compounds. At mission Rosario, a program of conversion was instituted for the coastal Karankawa Indians.

## MATERIALS AND METHODS

The excavation strategies at the three sites were aimed at uncovering undisturbed archeological deposits dating to either the 18th and/or early 19th century mission occupations. All three sites contained in situ deposits with large quantities of faunal material. Criteria for the selection of samples for analysis were the quantity of faunal material recovered, the type of archeological context, and the temporal range of mission occupation represented by the faunal remains.

### Analyzed Contexts from Espiritu Santo de Zuñiga, 41VT11

A University of Texas at Austin field school was conducted at this site during the 1995 summer with additional excavations in November 1995. Excavations were concentrated in an area of an exposed knoll overlooking the Guadalupe River. This area was to be impacted by bulldozer activity for the preparation of the construction of a driveway by the property owners. Uncovered and excavated as a single cultural level was a dense bone bed that was designated Feature 3.

Several contiguous units were excavated to recover the bone refuse. Faunal material from three excavation units (95-6, 95-9, and 95-14) were selected for analysis. These units contained dense deposits of bone. At 41VT11, non-volumetric samples were also screened with 1/16-inch (2.0 mm) mesh screen to determine if small-sized remains were not being recovered in the 1/8-inch mesh. Fine-screened samples from units 95-6 and 95-9 are included in the analysis. All of the bone recovered in the 1/8-inch mesh from the three units was combined analytically for quantification purposes.

Vertebrate remains from six excavation units in the area of probable indigenous settlement near an anaqua grove were examined to determine if additional species not identified from Feature 3 were present. Both the 1/8-inch and the 1/16-inch material were examined from these units. Although the remains from these units were not quantified, they include species not represented in Feature 3.

### Analyzed Contexts from Espiritu Santo de Zuñiga at Goliad, 41GD1

Excavations at Espiritu Santo at Goliad were concentrated in two areas of the site (Ricklis 1998, this volume). The first was located on the wooded hill slope west of the mission compound wall. The four 1x1 m units excavated in this area all contained dense mission refuse dating to the mid-18th century. One of the excavation units, S8E0, contained over 1 m of midden refuse. Although some stratigraphic change was observed in the fill, the material culture indicates that the deposit is chronologically undifferentiated mission-period refuse. All of the faunal material from this unit was selected for analysis.

A second area where test excavations were completed is in the wooded area on the north slope outside of the northeast corner of the mission compound. Two test excavations in this area indicated that the midden deposit was very shallow with deposits not greater than 35 cm below the surface. In Test Unit 6 a dense quantity of bovid bone was uncovered. This deposit was dense enough to constitute a "bone bed." The faunal material from this unit was selected for analysis.

### Analyzed Contexts from Mission Nuestra Señora del Rosario, 41GD2

The excavation strategy for Rosario mission was also aimed at uncovering undisturbed deposits. Surface exposure of archeological material and shovel testing indicated that intact midden was present south of the mission compound wall. A series of excavations in 1997 were placed south of the compound wall near the gateway to the complex (Ricklis 1998, this volume). The initial excavations uncovered two zones of intact mission deposits dating to the late 18th century. Also uncovered in two adjacent squares (N0E12 and S1E12) were a rock and mortar wall foundation to a previously unknown structure and a hard-packed caliche floor. Dense faunal refuse was present in both zones. These units were selected for faunal analysis.

Additional excavations were completed at the site during 1997 and during the summer of 1998 in the area of the floor and wall foundation. These excavations uncovered additional midden from the two stratigraphic levels (Zones 1 and 2) as well as a deeper deposit of undisturbed midden (Zone 3) below the caliche floor dating to the initial occupation of the mission during the 18th century. Faunal material from the three zones present in S4E13, S4E12, and S5E12 were analyzed to augment the zooarcheological sample.

### Zooarcheological Methods

Several methods are used to characterize the relative abundance of the vertebrate faunal remains from the mission sites. The majority of the faunal remains were dry-screened with 1/8-inch (4.0 mm ) mesh in the field. Additionally, volumetric bulk soil samples of 15 liters were taken from various levels and excavation units from both Goliad and Rosario to assess whether remains from small-sized taxa were excluded with the use of 1/8-inch mesh. The volumetric samples were water-screened with 1/16-inch (2.0 mm) mesh.

The faunal remains were identified using modern comparative skeletal collections at the University of Montana Natural History Museum, the Corpus Christi Museum of Science and History, and the Florida Museum of Natural History. All of the remains were identified to the lowest taxonomic level. A large quantity of the remains are bovid elements that could not be identified to a specific species due to the similarity in skeletal elements. The genus designations *Bos/Bison* are used.

The faunal material from the bulk samples was identified, but was not quantified in terms of relative abundance. Although the remains are not quantified, the identification of several additional taxa that are represented by small-sized individuals provides some insights into procurement strategies employed by the mission inhabitants.

The majority of the faunal remains (i.e., those recovered with 1/8-inch mesh) were quantified using three measures of relative abundance. Number of Identified Specimens (NISP) were determined for all taxa with the exception of unidentified vertebrate fragments. Estimates of the Minimum Number of Individuals (MNI) were determined using age, sex, paired elements, and size. Bone weight was recorded for all of the categories of vertebrates from Goliad and Rosario. Bone weights were not recorded for 41VT11. A large portion of the mission assemblages are bone fragments that could not be identified to other than the class Mammalia. The use of NISP in combination with the estimates of MNI and bone weight are used in conjunction to identify the economically most important taxa.

Bone modifications were recorded for the assemblages. Modifications include butchering, polish, and rodent or carnivore gnawing. Butchering evidence includes hack marks, presumably with larger implements, and cuts or smaller incisions. One hypothesis concerning the use and processing of animals in the mission setting is that metal tools were adopted rapidly by the mission inhabitants. Although a variety of lithic tools are present in the assemblages, the use of stone tools in the mission setting for animal processing may have been abandoned following the introduction of superior metal cutting tools by the Spaniards. In order to test this hypothesis, all butchering evidence was examined to determine if metal or stone tools were used to produce the butchering marks present on the skeletal elements. Walter (1997) examined the 41VT11 material to distinguish metal from stone tool cuts. Cuts made with metal tools are very smooth and uniform the length of the cut. They also tend to occur at an angle to the bone rather than parallel to the bone cortex. In contrast, stone tools will often produce multiple V or U-shaped incisions that are wide in the middle and taper near the ends (Fisher 1995; Walter 1997). The majority of metal hacks could be identified without additional magnification. A binocular microscope was used to distinguish metal versus stone tool cut marks.

The representation of mammalian skeletal elements can be used to determine if complete carcasses were present at a site, and therefore, that on-site processing took place. Alternatively, the presence of only select skeletal elements suggests that some type of off-site processing occurred. Typically, the field dressing of large mammals results in the transport to the occupation site of only the meatiest portion of the carcass (i.e., the axial elements), and the exclusion of the less meaty skull and distal limb elements and feet. One question related to mission occupation is whether the inhabitants relied on Spanish-introduced cattle or did the inhabitants instead hunt bison at some distance from the missions? Presumably, hunted bison would have been field dressed while cattle would have been raised near the mission and processed on-site. In order to determine if whole animals were processed at the missions or if animals were obtained through off-site hunting and subsequently transported to the mission compounds, the frequencies of skeletal elements of all bovid remains was determined. The skeletal portions used are cranial, axial, forelimb, forefoot, hindlimb, hindfoot, and foot.

Cattle and bison are extremely difficult to distinguish on morphological features alone (Brown and Gustafson 1979; Olson 1960). Despite sexual dimorphism and age variation, bison are generally larger-sized than cattle; therefore, size estimates can help determine if bison remains are present in the faunal assemblages. The size of Spanish-introduced cattle can also provide insights into the effects of environmental variability on cattle in various New World settings. In order to determine the size range of the bovids represented at the mission sites, dimensional measurements were taken of all complete and fused bovid skeletal elements; measurements followed von den Driesch (1976).

## ANALYSIS RESULTS

### Espiritu Santo de Zuñiga (41VT11)

The vertebrate faunal sample from the Feature 3 sample consists of 2607 elements representing a minimum of 27 individuals. Table 1 provides information on the taxa identified, NISP, and estimates of the MNI. The sample consists of at least nine mammals, unidentified bird remains, two species of freshwater turtles, and one element of freshwater catfish.

In regard to mammalian taxa, the greatest number of identifiable fragments (n=248) are those of bovids, either cow (*Bos*) or bison (*Bison*). The second most common mammalian remains are those of white-tailed deer (n=41). The other mammalian faunal remains are small or medium-sized individuals that were probably hunted in the vicinity of the mission. These include opossum, rabbit, and gray fox. Also present is a single element (third rear phalanx) of a bear, probably a black bear. The domestic non-native fauna include remains of either sheep or goats. At least one burro is represented by

**Table 1. Vertebrate Faunal Material from Espiritu Santo, 41VT11, Feature 3, Units 95-6, 95-9, and 95-14**

| Taxon | Common Name | NISP | MNI |
|---|---|---|---|
| *Didelphis virginianas* | opossum | 20 | 2 |
| *Sylvilagus* sp. | rabbit | 3 | 2 |
| *Urocyon cinereoargenteus* | gray fox | 1 | 1 |
| *Ursus* cf. *americanus* | black bear | 1 | 1 |
| *Equus asinus* | burro | 1 | 1 |
| Artiodactyl | even-toed ungulates | 1 | 1 |
| cf. *Sus scrofa* | pig | 1 | 1 |
| *Odocoileus virginianus* | white-tailed deer | 41 | 3 |
| Caprinae (*Capra/Ovis*) | sheep/goat | 11 | 2 |
| Bovidae (*Bos/Bison*) | cow/bison | 248 | 4 |
| Mammalia UID | unidentified mammal | 2161 | – |
| Total Mammalia | total mammal | 2489 | 18 |
| Aves | unidentified birds | 13 | 2 |
| *Apalone ferox* | soft-shelled turtle | 33 | 3 |
| Emydidae | box and pond turtles | 52 | 3 |
| Testudines | turtles | 19 | – |
| Total Testudines | total turtles | 104 | 6 |
| Ictaluridae | bullhead catfishes | 1 | 1 |
| SAMPLE TOTAL | | 2607 | 27 |

a tibia fragment. Although primarily used as beasts of burden, this burro may represent food refuse since a small cut is present on the shaft. A possible domestic pig is also present in the faunal sample.

All other classes of vertebrates are poorly represented in the assemblage. Unidentified bird shafts were present. Reptiles include a least two species of turtles: soft-shelled turtles and pond turtles. The only identified fish remains are those of bullhead catfishes.

One non-volumetric sample of fine-screened material contained additional faunal elements of a song bird and non-poisonous snake remains, both non-food items (Table 2). The excavation units in the area of presumed indigenous settlement contained the remains of at least three taxa not present in Feature 3. These species are armadillo, an unidentified species of medium-sized bird, and gar fish. Although there is far less faunal material from these excavation units than from Feature 3, remains of Bovidae, deer, several small-sized mammals, and some snake and turtle remains, are present in these units. These remains were not quantified and only species identifications were made.

## Espiritu Santo de Zuñiga at Goliad (41GD1)

The faunal sample from two selected test units at Espiritu Santo at Goliad consists of 6019 vertebrate elements representing a minimum of 55 individuals. The identified taxa include six species of mammals, six species of birds, two turtles, and three bony fish. A summary of the faunal material from the two excavation units is presented in Table 3. All of the remains from the two units were analytically combined to characterize faunal use during the 18th century occupation.

The identified mammals are opossum, rabbit, dog, white-tailed deer, cow/bison, and sheep/goat. The greatest number of identifiable fragments and MNI are of cattle/bison (NISP=237; MNI=9). At least five adults and four sub-adults (including remains of juvenile individuals) are represented in the sample. Non-domesticated animals that were hunted are the opossum, rabbit, and deer. Several immature specimens may represent sheep/goat or deer; however, these remains could not be distinguished. Remains of one dog are also present at the Goliad mission.

The birds are represented by domestic species of chicken, and possibly turkey. One femur from unit S8E0 contained medullary bone indicating that at least one laying hen was present. Also present is at least one duck, a black vulture, a hawk, and a crow. With the exception of the duck,

**Table 2. Vertebrate Taxa Identified in Bulk Soil Samples at Espiritu Santo (41VT11 and 41GD1) and Mission Rosario (41GD2), Exclusive of Species Present in the Coarse Fraction**

**Espiritu Santo, Mission Valley, 41VT11**

| Taxon | Common Name |
|---|---|
| Passeriniformes | song birds |
| Colubridae | non-poisonous snakes |

**Espiritu Santo at Goliad, 41GD1**

| Taxon | Common Name |
|---|---|
| *Dasypus novemcinctus* | common armadillo |
| *Sylvilagus* sp. | rabbit |
| Canidae (small) | small dog |
| Small Mammal UID | unidentified small mammal |
| Small Aves UID | unidentified small bird |
| Serpentes | snakes |
| Viperidae | poisonous snake |
| Anura | frog |
| *Lepisosteus* sp. | gar |
| Cyprinidae | minnows |

**Mission Rosario, 41GD2**

| Taxon | Common Name | Zone |
|---|---|---|
| *Lepisosteus* sp. | gar fish | Zone 1 |
| Serpentes | snakes | |
| Rodentia UID | rodent | Zone 2 |
| *Lepisosteus* sp. | gar fish | |
| Clupeidae | shad, herring | |
| Clupeidae | shad, herring | Zone 3 |

these non-domestic birds probably do not represent food refuse.

Freshwater species include turtles and fish. Two aquatic turtles are present. Remains of soft-shelled turtles are more common than those of the smaller-sized mud/musk turtles. The remains of at least three bony fishes are present in the samples. Catfish is the most common fish, while remains of gar fish and bass are represented by single elements. At least one other unidentified species of sunfish is present in the Goliad faunal assemblage.

The bulk soil samples from three excavation units contained several species not present in the 1/8-inch mesh samples (see Table 2); however, only the fish taxa probably represent food refuse. Mammals present in the bulk samples include armadillo, unidentified small mammals, and a small breed dog. No additional bird taxa are present in the bulk samples. Reptiles and amphibians include snakes and frogs. The fish taxa include the addition of small-sized minnows and buffalo fish. Also represented are smaller-sized individuals of catfish and sunfishes than were identified in the 1/8-inch samples. These data indicate that freshwater fishing was somewhat more important than the 1/8-inch samples suggest and that the fishing strategies employed by the mission inhabitants included the use of relatively fine-meshed nets for at least some of the fishing activities.

## Mission Rosario (41GD2)

The faunal material from Rosario consists of 6494 vertebrate elements representing a minimum of 80 individuals. The quantity of faunal material is greatest for Zone 1 (n=4581; MNI=36). Zone 1 also contains the greatest diversity of taxa. At least nine mammals are present, along with four species of birds, five reptiles, and two species of bony fishes. Zone 2 contains 1537

**Table 3. Faunal Material from Espiritu Santo at Goliad (41GD1), Test Unit #6, 0-20 cm and S8E0, 0-120 cm**

| Taxon | Common Name | NISP | MNI | Weight (g) |
|---|---|---|---|---|
| *Didelphis virginiana* | opossum | 5 | 2 | 6.1 |
| Leporidae | rabbit | 1 | 1 | 0.7 |
| *Canis familiaris* | dog | 25 | 1 | 50.0 |
| Canidae | dog | 3 | 1 | 2.1 |
| *Odocoileus virginianus* | white-tailed deer | 35 | 3 | 254.6 |
| *Bos/Bison* | cow, bison | 237 | 9 | 4319.7 |
| Caprinae (*Capra/Ovis*) | sheep, goat | 12 | 2 | 55.7 |
| Caprinae/Cervidae | sheep, goat/deer | 59 | – | 100.6 |
| Mammal UID | unidentified mammal | 1042 | 2 | 289.0 |
| Small Mammal UID | unidentified small mammal | 6 | 3 | 1.9 |
| Large Mammal UID | unidentified large mammal | 4446 | – | 11502.7 |
| Total Mammalia | total mammal | 5871 | 24 | 16583.1 |
| Anatidae | ducks | 1 | 1 | 0.2 |
| *Gallus gallus* | chicken | 6 | 3 | 4.8 |
| *Meleagris gallopavo* | turkey | 7 | 2 | 11.7 |
| *Coragyps atratus* | black vulture | 1 | 1 | 3.6 |
| Accipitridae | hawks | 1 | 1 | 1.1 |
| *Corvus* sp. | crow | 1 | 1 | 0.5 |
| Small Aves UID | unidentified small bird | 1 | 1 | 0.9 |
| Aves UID | unidentified birds | 46 | 4 | 36.6 |
| Total Aves | total birds | 64 | 14 | 59.4 |
| Kinosternidae | mud, musk turtles | 1 | 1 | 0.8 |
| *Apalone ferox* | soft-shelled turtle | 11 | 3 | 19.8 |
| Testudines | turtles | 17 | 2 | 10.2 |
| Total Testudines | total turtles | 29 | 6 | 30.8 |
| *Lepisosteus* sp. | gar | 1 | 1 | 1.1 |
| *Ictalurus* sp. | catfish | 25 | 5 | 21.9 |
| *Micropterus salmoides* | large-mouth bass | 1 | 1 | 0.4 |
| Centrachidae | bass, sunfishes | 1 | 1 | 3.0 |
| Osteichthyes UID | unidentified bony fish | 27 | 3 | 7.6 |
| Total Osteichthyes | total bony fish | 55 | 11 | 34.0 |
| Vertebrata UID | unidentified vertebrates | n/a | – | 130.4 |
| SAMPLE TOTAL | | 6019 | 55 | 16837.7 |

elements representing 25 individuals. The identified taxa are three species of mammals, five species of birds, three reptiles, and one species each of cartilaginous and bony fish. The sample from Zone 3 is small (n=376, MNI=19); however, a distinct pattern of faunal use is evident. The Zone 3 sample consists of at least three mammals, four species of birds, three reptiles, and one bony fish. Tables 4-6 indicate the identified taxa and measures of relative abundance for the three midden zones.

The identified mammals that are of economic importance from the three midden zones are the burro, horse, pig, peccary, white-tailed deer, cow/bison, and sheep/goat. Cattle/bison are the most abundant remains in all three zones. Both sub-adults and adults are present in the faunal samples. Other domestic mammals that were used for food are the sheep/goat and domestic pig, but neither of these are common. The caprines are represented by both adult and sub-adult individuals. At least two individual *Equus* are present, both horse and burro. The non-domestic mammals are the white-tailed deer and the peccary. White-tailed deer is the second most common mammal in both Zones 1 and 2. One element of a peccary is present in Zone 1. Also present is an unidentified species of rodent and a skunk. Neither of these are considered to have been food refuse.

The birds include mallard or duck, two species of goose, swan, chicken, turkey, the greater prairie chicken, and a plover. At least one laying hen is present in the Zone 1 midden. Although domestic fowl is represented by the remains of chicken and possibly the turkey and domestic duck, the avian fauna indicate that hunting for waterfowl added some diversity to the diet. The presence of the greater prairie chicken also indicates that hunting took place in the tall grass prairie along the coast. The small-sized plover probably does not represent food refuse.

Reptiles in the faunal assemblage include snakes, alligator, two species of aquatic turtles, and gopher tortoise. Freshwater hunting is indicated by the alligator, pond slider, and the soft-shelled turtle. Remains of at least one gopher tortoise are present in Zone 1.

The fishes are represented by one cartilaginous fish and two species of bony fish. Interestingly, the cartilaginous fish is a marine requiem shark represented by a single tooth. The bony fish are freshwater catfish and suckers.

The bulk samples from the three midden zones include the remains of additional species not present in the coarse fraction (see Table 2). The soil samples from Rosario are similar to those from Espiritu Santo in that only the previously unidentified fish taxa probably represent food refuse. Fishes present in the bulk samples include shad or herring and gar fish. Also present are small rodents, unidentified small birds, and snakes. Remains of smaller-sized catfish are also present in the bulk samples. The bulk samples indicate that the mission inhabitants employed some capture techniques that allowed for the collection of some small-sized fish individuals.

## DISCUSSION

The faunal samples from the three missions provide insights into the patterns of animal use by two Native American populations in mission settings in South Texas. In addition to the specific patterns that characterize the Texas coastal prairie, these data can be compared to other areas of Spanish colonial mission settlement to identify the effects of ethnic and geographic variability on faunal use within the Spanish empire.

One issue concerning the Native American populations that were incorporated into mission life on the Texas coastal plain is the degree to which these populations adopted Spanish-introduced faunal resources as food items versus their reliance on native fauna for their subsistence needs. Herds of Spanish cattle were established along the coastal plain in the early 18th century (Jackson 1986; Ramsdell 1949; de la Teja 1995). By the 1730s, significant herd growth had taken place from cattle introduced by the Alarcon and Aguayo expeditions of 1718 and 1721. Two rival centers of herd rearing along the San Antonio River were the string of five missions in San Antonio and the southern coastal mission at the earlier location of Espiritu Santo, at Goliad, and at the neighboring Rosario mission. The tall grass prairies near Goliad and the oak savannas near San Antonio were particularly conducive to the growth of cattle herds. By the 1760s the missions at Espiritu Santo at Goliad and Rosario possessed greater than 20,000 branded head of cattle (Jordan 1993). It is estimated that an equal or greater number of unbranded cattle inhabited the area (Ramsdell 1949:21). At Espiritu Santo cattle ranching was the primary economic activity, with little

**Table 4. Faunal Material from Rosario Mission, 41GD2, S1E12, 0-30 cm, and N0E13, 0-40 cm, Zone 1**

| Taxon | Common Name | NISP | MNI | Weight (g) |
|---|---|---|---|---|
| Rodentia | rodent | 1 | 1 | 0.5 |
| *Mephitis mephitis* | striped skunk | 1 | 1 | 1.3 |
| *Equus asinus* | burro | 2 | 1 | 30.5 |
| *Equus caballus* | horse | 1 | 1 | 29.8 |
| *Sus scrofa* | pig | 2 | 1 | 6.7 |
| *Tayassu tajacu* | collared peccary | 1 | 1 | 1.9 |
| *Odocoileus virginianus* | white-tailed deer | 45 | 2 | 358.5 |
| *Bos/Bison* | cow, bison | 172 | 4 | 4677.5 |
| Caprinae | sheep, goats | 5 | 3 | 27.0 |
| Bovidae/Cervidae | cow, bison/deer | 2 | – | 1.9 |
| Small Mammal UID | unidentified small mammal | 1 | 1 | 0.3 |
| Mammal UID | unidentified mammal | 1478 | – | 503.0 |
| Large Mammal UID | unidentified large mammal | 2731 | – | 6875.5 |
| Total Mammal | total mammal | 4442 | 16 | 12514.4 |
| *Anser* sp. | goose | 1 | 1 | 3.0 |
| *Cygnus* sp. | swan | 1 | 1 | 5.0 |
| *Gallus gallus* | chicken | 2 | 1 | 1.7 |
| *Meleagris gallopavo* | turkey | 7 | 2 | 19.6 |
| Aves UID | unidentified birds | 18 | – | 10.2 |
| Total Aves | total birds | 29 | 5 | 39.5 |
| Serpentes | snakes | 1 | 1 | 0.1 |
| *Alligator mississippiensis* | American alligator | 9 | 2 | 18.2 |
| *Chrysemys* sp. | slider | 3 | 3 | 12.4 |
| *Pseudemys* sp. | slider | 9 | 1 | 7.4 |
| *Gopherus berlandieri* | Texas tortoise | 5 | 1 | 7.9 |
| *Apalone ferox* | soft-shelled turtle | 11 | 2 | 14.0 |
| Testudines | turtles | 35 | – | 22.4 |
| Reptilia UID | reptile | 1 | 1 | 0.2 |
| Total Reptilia | total reptile | 74 | 11 | 82.6 |
| *Ictalurus* sp. | catfishes | 6 | 3 | 3.9 |
| Catastomidae | suckers | 1 | 1 | 0.2 |
| Osteichthyes UID | unidentified bony fishes | 29 | – | 8.9 |
| Total Osteichthyes | total bony fishes | 36 | 4 | 13.0 |
| Vertebrata UID | unidentified vertebrates | n/a | – | 44.3 |
| SAMPLE TOTAL | | 4581 | 36 | 12693.8 |

**Table 5. Faunal Material from Rosario Mission, 41GD2, S4E12, 20-40 cm, S4E13, 20-40, S5E12, 30-40, Zone 2**

| Taxon | Common Name | NISP | MNI | Weight (g) |
|---|---|---|---|---|
| *Odocoileus virginianus* | white-tailed deer | 16 | 2 | 180.7 |
| *Bos/Bison* | cow, bison | 224 | 4 | 6307.9 |
| Caprinae | sheep, goat | 7 | 2 | 28.3 |
| Caprinae/Cervidae | sheep, goat/deer | 8 | – | 1.9 |
| Large Mammal UID | unidentified large mammal | 829 | – | 2879.4 |
| Small mammal UID | unidentified small mammal | 2 | 2 | 2.1 |
| Mammal UID | unidentified mammal | 382 | – | 112.4 |
| Total Mammalia | total mammal | 1476 | 10 | 9512.7 |
| *Anas platyrhynchos* | mallard, domestic duck | 1 | 1 | 1.6 |
| *Chen* sp. | goose | 2 | 1 | 2.4 |
| *Gallus gallus* | chicken | 2 | 2 | 2.3 |
| *Meleagris gallopavo* | turkey | 2 | 1 | 13.5 |
| *Charadridae* cf. *pluvialis* sp. | plover | 1 | 1 | 0.2 |
| Aves UID | unidentified aves | 19 | 1 | 11.0 |
| Total Aves | total birds | 27 | 7 | 31.0 |
| *Alligator mississippiensis* | alligator | 2 | 1 | 8.7 |
| *Chrysemys* sp. | pond slider | 10 | 1 | 24.6 |
| *Apalone ferox* | soft-shelled turtle | 1 | 1 | 1.7 |
| Testudines | turtles | 5 | – | 3.3 |
| Total Reptilia | total reptiles | 18 | 3 | 38.3 |
| *Carcarhinus* sp. | requim shark | 1 | 1 | 0.1 |
| Total Chondrichthyes | total cartilaginous fishes | 1 | 1 | 0.1 |
| *Ictalurus* sp. | catfish | 3 | 3 | 1.4 |
| Osteichthyes UID | unidentified bony fish | 12 | 1 | 2.5 |
| Total Osteichthyes | total bony fishes | 15 | 4 | 3.9 |
| Vertebrata UID | unidentified vertebrates | n/a | – | 37.8 |
| SAMPLE TOTAL | | 1537 | 25 | 9623.8 |

time devoted to farming or other economic enterprises (Ramsdell 1949).

Despite the proliferation of the cattle herds, the ranching economy was relatively short-lived along the coastal plain. Factors that contributed to a decline in the herds were undedicated Native herders, raids by the Lipan Apache and Comanche populations, taxation by Spanish governing bodies, the transport of cattle to other areas (e.g., northern Mexico and Louisiana), and privatization of herd lands (Jordan 1993; Ramsdell 1949). An anonymous account by a Texas missionary in 1793 indicates that uncontrolled slaughter by more recent settlers of many unbranded cattle for

**Table 6. Faunal Material from Rosario Mission, 41GD2, S4E12, 40-50 cm, S4E13, 30-40 cm, S5E12, 35-40+ cm, Zone 3**

| Taxon | Common Name | NISP | MNI | Weight (g) |
|---|---|---|---|---|
| *Odocoileus virginianus* | white-tailed deer | 1 | 1 | 1.6 |
| *Bos/Bison* | cow, bison | 47 | 3 | 1246.5 |
| Caprinae | sheep, goat | 2 | 2 | 17.9 |
| Large Mammal UID | unidentified large mammal | 208 | – | 608.9 |
| Mammal UID | unidentified mammal | 80 | – | 10.7 |
| Total Mammal | total mammal | 338 | 6 | 1885.6 |
| Anatidae | ducks | 1 | 1 | 0.3 |
| *Gallus gallus* | chicken | 1 | 1 | 0.7 |
| *Meleagris gallopavo* | turkey | 11 | 2 | 36.9 |
| *Tympanuchus cupido* | greater prairie chicken | 2 | 1 | 1.1 |
| Aves UID | unidentified aves | 17 | 2 | 4.8 |
| Total Aves | total birds | 32 | 7 | 43.8 |
| Serpentes | snakes | 1 | 1 | 0.5 |
| *Alligator mississippiensis* | alligator | 1 | 1 | 1.2 |
| *Chrysemys* sp. | pond slider | 2 | 2 | 5.6 |
| Total Reptilia | total reptiles | 4 | 4 | 7.3 |
| *Ictalurus* sp. | catfish | 1 | 1 | 0.3 |
| Osteichthyes UID | unidentified bony fish | 1 | 1 | 0.6 |
| Total Osteichthyes | total bony fishes | 2 | 2 | 0.9 |
| SAMPLE TOTAL | | 376 | 19 | 1937.6 |

tallow also contributed to the rapid demise of the herds (Ramsdell 1949:23). By the late 1700s the cattle herds were greatly diminished. At Mission Rosario, abandonment of the mission in 1780 and later reoccupation in 1789 contributed to the further decline in livestock. Fewer than a thousand cattle were controlled by the mission in the early 1800s.

The early cattle ranches served as the foundation for Texas ranching in the 19th century. However, the proliferation of introduced livestock was at the expense of indigenous fauna of the coastal plain. Prior to the introduction of Spanish livestock, viable herds of bison inhabited the coastal plain. Bison hunting was a significant dietary component of the Late Prehistoric and Protohistoric aboriginal populations (Ricklis 1992). The cattle competed for rangeland with native herds of American bison that were once very common on the Texas plains. Anecdotal accounts suggest that the Native American populations residing at the missions preferred the taste of bison meat to cattle; therefore, they would venture from the missions to hunt for bison.

Archeological evidence supporting these claims has yet to be provided. Due to the difficulty in distinguishing bison from cattle using only skeletal elements, archeological research must rely on size characteristics of the bovids and the quantity of non-bovid faunal remains to determine the degree of hunting that took place away from the mission setting. If off-site hunting was a common practice, the faunal samples should indicate some use of domestic introduced animals, particularly domestic barnyard mammals and an abundance of hunted native animals.

The faunal samples from the three sites indicate distinct differences in the use of wild resources (Table 7). The samples from the two Espiritu Santo missions contain primarily large mammal remains of either cattle or bison. Although some deer were hunted, smaller mammals of opossum and rabbit were more common than other large indigenous mammals. At the earlier Espiritu Santo location, 41VT11, fox and black bear also were hunted. While no domestic birds are present at 41VT11, the avian fauna from the Goliad mission location is dominated by chicken and turkey, with a minor use of ducks. The crow, hawk, and turkey vulture present at Goliad do not appear to have been hunted for food. Aquatic turtles were used at both Espiritu Santo locations. Only freshwater catfish are present at 41VT11, while a greater reliance on fishing is indicated at Goliad. At least five species of freshwater fish (including additional species identified in the bulk soil samples) indicate that some use of aquatic resources took place, but that these were not dietary staples. Close proximity to the San Antonio River would have allowed the inhabitants of Espiritu Santo at Goliad access to some aquatic resources without having to venture long distances from the mission compound.

In contrast to the pattern of faunal use at the two Espiritu Santo missions, the inhabitants of Mission Rosario hunted a greater variety of mammals and birds. Although the sample is dominated by large bovids, the remains of mammals, birds, and reptiles all indicate that meat from hunted animals constituted a larger component of the diet at Rosario than at Espiritu Santo (see Table 7). The Zone 3 sample is the least diverse of the three time periods, particularly in terms of mammals. However, the non-domestic birds include ducks and greater prairie chicken. Remains of at least two turkeys are present in the samples that may also represent the use of wild species rather than domesticates. The reptiles include alligator, none of which are present at Espiritu Santo, and pond sliders. A small number of fish remains are present in the initial Rosario occupation.

The mammalian fauna from the Zones 1 and 2 midden deposits indicate that white-tailed deer were relatively common in the samples. While not many individuals are represented, deer are more common than other barnyard domesticates of either caprines (sheep or goats) or pigs. Also present is a single element of a peccary. A greater diversity of birds and reptiles characterize both Zones 1 and 2 than was found at Espiritu Santo. Fishing provided some animal protein, but was again not a significant activity by the mission inhabitants.

During the final occupation of Mission Rosario, both horses and burros were present in the midden faunal sample. Presumably, both animals were used for transportation and as beasts of burden. Since equids were highly valued, their use may have been restricted to the friars. Because only three elements are present in Zone 1, it is not possible to determine if equid use increased through the occupation of the mission or if the recovery of equid remains is exclusively a phenomenon of sampling. One burro is indicated at 41VT11. No equids are represented at Espiritu Santo at Goliad.

The recent Rosario excavations contrast with previous zooarcheological analyses that were conducted by Davidson (1974) and Butler (1974) following the excavations by Gilmore (1974). The identified fauna from both of these earlier field seasons are more diverse than the recent excavations. Mammals previously identified but not present in this analysis include: armadillo, packrat, mink, raccoon, black bear, beaver, jackrabbit, and pronghorn antelope. At least three additional species of birds are present in the two previous studies; however, with the exception of the roadrunner, the birds may not represent food remains. Significantly, the mammals present in the 1974 samples support the evidence that meat obtained through hunting was a significant component of the mission diet.

Although these data indicate that the diet was supplemented with hunted meat, bovids were the most common meat source. If the bovid remains represent bison that were hunted some distance from the mission compound, the representation of skeletal elements should reflect the fact that the preliminary butchering of bison occurred at the kill site. Therefore, if off-site butchering occurred, the samples should contain relatively few non-meaty portions of the skeleton, such as the head and feet. Table 8 presents the element distribution of bovid remains from the three mission sites. The sample from 41VT11 indicates that cranial elements are most common. This high percentage is skewed by the large number of molar fragments. At both Goliad

**Table 7. Species Identified from Excavations at Espiritu Santo de Zuñiga, Mission Valley, 41VT11, Espiritu Santo at Goliad, 41GD1, and Mission Rosario, 41GD2**

| Scientific Name | Common Name | 41VT11 | 41GD1 | 41GD2 |
|---|---|---|---|---|
| *Didelphis virginianas* | opossum | * | * | |
| *Sylvilagus* sp. | rabbit | * | | |
| Leporidae | rabbit | | * | |
| Rodentia | rodent | | | * |
| *Mephitis mephitis* | striped skunk | | | * |
| *Canis familiaris* | dog | | * | |
| Canidae | dog | | * | |
| *Urocyon cinereoargenteus* | gray fox | * | | |
| *Ursus* cf. *americanus* | black bear | * | | |
| *Equus asinus* | burro | * | | * |
| *Equus caballus* | horse | | | * |
| *Sus scrofa* | pig | | | * |
| cf. *Sus scrofa* | pig | * | | |
| *Tayassu tajacu* | collared peccary | | | * |
| *Odocoileus virginianus* | white-tailed deer | * | * | * |
| *Bos/Bison* | cow, bison | * | * | * |
| Caprinae (*Ovis/Capra*) | sheep, goats | * | * | * |
| Caprinae/Cervidae | sheep, goat/deer | | * | * |
| Bovidae/Cervidae | cow, bison/deer | | | * |
| *Anas platyrhynchos* | mallard, domestic duck | | | * |
| Anatidae | ducks | | * | |
| *Anser* sp. | goose | | | * |
| *Chen* sp. | goose | | | * |
| *Cygnus* sp. | swan | | | * |
| *Gallus gallus* | chicken | * | * | |
| *Meleagris gallopavo* | turkey | | * | * |
| *Coragypus atratus* | black vulture | | * | |
| Accipitridae | hawks | | * | |
| *Tympanuchus cupido* | greater prairie chicken | | | * |
| *Charadridae* cf. *Puvialis* sp. | plover | | | * |
| *Corvus* sp. | crow | | * | |
| Serpentes | snakes | | | * |
| *Alligator mississippiensis* | American alligator | | | * |
| Kinosternidae | mud/musk turtles | | * | |
| *Pseudemys* sp. | slider | | | * |
| Emydidae | box and pond turtles | * | | |
| *Gopherus berlandieri* | Texas tortoise | | | * |
| *Apalone ferox* | soft-shelled turtle | * | * | * |
| *Carcarhinus* sp. | requiem shark | | | * |

**Table 7.** *(Continued)*

| Scientific Name | Common Name | 41VT11 | 41GD1 | 41GD2 |
|---|---|---|---|---|
| *Lepisosterus* sp. | gar fish | | * | |
| *Ictalurus* sp. | catfishes | * | * | |
| Ictaluridae | catfishes | * | | |

and Mission Rosario, axial elements (vertebrae and ribs) are the most common. This characteristic is not surprising considering the large number of butchered portions that can be obtained along both the vertebral column and the rib section. With the exception of the Zone 3 midden at Rosario, cranial and feet elements are the 2nd and 3rd most common portions of the skeleton. While both cranial elements, particularly teeth, and feet elements are durable and easy to identify, their high frequency is greater than would be expected if off-site butchering had taken place. Therefore, the element representation is interpreted as indicating that on-site butchering of cattle had taken place rather than off-site butchering and transport of bison.

Bone modifications also support on-site butchering (Table 9). The butchering methods employed at all three missions consisted primarily of hacking larger portions, particularly the axial ribs and vertebrae. Metal cuts are also common. No cuts could be positively identified as stone tool marks. The deposits may have been buried relatively rapidly as there is very little evidence of bone gnawing by either carnivores or rodents.

Another characteristic of the faunal assemblage is the size of the bovid individuals. Dimensional measurements were taken of all complete elements from the three assemblages. The majority of the elements are from mature individuals. In a few instances measurements were taken of complete elements from juveniles individuals. The measurements were compared to a large collection of measurements collected from Spanish colonial sites in Florida, Georgia, and the Caribbean, and from British period and American sites along the Atlantic coast of North America (Reitz and Ruff 1994). Reitz and Ruff (1994) compiled data from a number of time periods ranging from the 16th to the 19th centuries and from sites located along a significant latitudinal gradient. The dimensional measurements indicate that the cattle individuals represented in Spanish colonial sites are generally larger than individuals from either British or American sites. Factors that contribute to this pattern are the origins and post-medieval size of the cattle transported to the colonies, local husbandry strategies, the economic uses of animals, and local environmental conditions (Reitz and Ruff 1994:707).

Although Reitz and Ruff (1994) were unable to discern temporal trends in the size of cattle, some of the largest cattle were from the 16th century site of Puerto Real on Hispaniola. At Puerto Real, cattle were allowed to free-range throughout the island habitat. In the absence of other larger herbivores and the presence of abundant grassland, there were no obstacles to herd growth in the island setting. Consequently, large herds of robust cattle proliferated and served as the foundation of a very profitable economy. In addition to the production of tallow, large numbers of hides were produced for sale, and live animals were exported to other locations throughout the Spanish empire.

In some regards, the 18th century mission setting of South Texas is very similar to that of Puerto Real: cattle were introduced early in the settlement of the area and allowed to free-range. Although there was some initial competition with bison for resources, historical accounts indicate that cattle quickly out-competed the indigenous herbivores. If this comparison is valid, dimensional measurements of bovid remains from the South Texas missions should fall within the larger or largest size range of cattle previously identified from other Spanish colonial sites. If the bovid remains include both bison and cattle, at least some of the measurement should be greater than the previously identified dimensional ranges of the cattle.

Table 10 presents a comparison of dimensional measurements of the most common bone elements from the three South Texas missions, with

**Table 8. Element distribution of *Bos/Bison* from Espiritu Santo de Zuñiga (41VT11) and at Goliad (41GD1) and Mission Rosario (41GD2)**

**Espiritu Santo de Zuñiga, 41VT11**
**Feature 3**

| *Skeletal Portion* | *Number* | *Percent* |
|---|---|---|
| Cranial | 88 | 35.48 |
| Axial | 45 | 18.15 |
| Forelimb | 19 | 7.66 |
| Forefoot | 13 | 5.24 |
| Hindlimb | 32 | 12.90 |
| Hindfoot | 25 | 10.08 |
| Foot | 26 | 10.48 |
| TOTAL | 248 | 100.00 |

**Espiritu Santo de Zuñiga at Goliad, 41GD1**
**Test Unit 6, 0-20 cm**

| *Skeletal Portion* | *Number* | *Percent* |
|---|---|---|
| Cranial | 5 | 8.20 |
| Axial | 16 | 26.23 |
| Forelimb | 10 | 16.39 |
| Forefoot | 4 | 6.56 |
| Hindlimb | 6 | 9.84 |
| Hindfoot | 7 | 11.48 |
| Foot | 13 | 21.31 |
| TOTAL | 61 | 100.00 |

**Excavation Unit, S8E0, 0-120 cm**

| *Skeletal Portion* | *Number* | *Percent* |
|---|---|---|
| Cranial | 38 | 21.59 |
| Axial | 77 | 43.75 |
| Forelimb | 10 | 5.68 |
| Forefoot | 8 | 4.55 |
| Hindlimb | 9 | 5.11 |
| Hindfoot | 6 | 3.41 |
| Foot | 28 | 15.91 |
| TOTAL | 176 | 100.00 |

**Mission Rosario, 41GD2**
**Zone 1 contexts**

| *Skeletal Portion* | *Number* | *Percent* |
|---|---|---|
| Cranial | 21 | 12.21 |
| Axial | 76 | 44.19 |
| Forelimb | 5 | 2.91 |
| Forefoot | 14 | 8.14 |
| Hindlimb | 12 | 6.98 |
| Hindfoot | 12 | 6.98 |
| Foot | 32 | 18.60 |
| TOTAL | 172 | 100.00 |

**Zone 2 contexts**

| *Skeletal Portion* | *Number* | *Percent* |
|---|---|---|
| Cranial | 18 | 8.04 |
| Axial | 137 | 61.16 |
| Forelimb | 10 | 4.46 |
| Forefoot | 5 | 2.23 |
| Hindlimb | 15 | 6.70 |
| Hindfoot | 6 | 2.68 |
| Foot | 33 | 14.73 |
| TOTAL | 224 | 100.00 |

**Zone 3 contexts**

| *Skeletal Portion* | *Number* | *Percent* |
|---|---|---|
| Cranial | 4 | 6.90 |
| Axial | 38 | 65.52 |
| Forelimb | 1 | 1.72 |
| Forefoot | 5 | 8.62 |
| Hindlimb | 3 | 5.17 |
| Hindfoot | 3 | 5.17 |
| Foot | 4 | 6.90 |
| TOTAL | 58 | 100.00 |

**Table 9. Bone Modifications from Espiritu Santo, 41VT11, Espiritu Santo at Goliad, 41GD1 and Mission Rosario, 41GD2**

| Site | Species | Type of modification<br>hack-metal | cut-metal | cut-indet. | polish | gnawed* |
|---|---|---|---|---|---|---|
| 41VT11 | *Bos/Bison* | 58 | 19 | – | – | C-11 |
| | Mammal UID | 31 | 33 | – | – | C-32 |
| 41GD1 | *Bos/Bison* | 78 | 16 | 10 | 1 | C-1 |
| | Large Mammal | 751 | 117 | 42 | -- | R-1; C-1 |
| 41GD2, Zone 1 | *Bos/Bison* | 84 | 17 | 14 | 1 | C-1 |
| | Large Mammal | 278 | 101 | 34 | 2 | C-1 |
| 41GD2, Zone 2 | *Bos/Bison* | 109 | 35 | 9 | 1 | |
| | Large Mammal | 232 | 31 | 1 | – | |
| 41GD2, Zone 3 | *Bos/Bison* | 15 | 5 | 3 | – | R-1 |
| | Large Mammal | 54 | 13 | 5 | – | |

* R = Rodent gnawing; C= Carnivore gnawing

measurements from other Spanish sites and the site of Puerto Real reported by Reitz and Ruff (1994). The most commonly well-preserved elements are distal limb elements, particularly the astragalus and other tarsals and metapodials. Comparisons of Texas mission bovid measurements with those presented by Reitz and Ruff (1994:703-704) indicate that the mission bovid measurements fall within the size range of Spanish cattle from both the Caribbean and Spanish Florida. The elements are smaller than the dimensional measurements of the Puerto Real cattle with the exception of two elements. One is a metacarpus (lower forelimb) from Zone 1 at Mission Rosario. The distal breadth (71.1 mm) of the Rosario element was larger than those reported for either Puerto Real (range 58.0-64.6 mm, n=3) or other Spanish sites (range 57.0-60.6 mm, n=2). The Rosario specimen may represent either a large-sized cattle specimen or possibly a bison individual. Also, one distal metacarpus from 41VT11 exceeds the Puerto Real data (74.4 mm).[1]

These results support the argument that the majority of mission bovids are the remains of cattle rather than bison. Two larger-sized bovids, one present in the terminal occupation of Mission Rosario and one from 41VT11, may be bison. Alternatively, these specimens may represent a different breed of cattle than was present in the Caribbean or at other Spanish sites. The measurements also indicate that individual animals were relatively large; therefore, there were many adults in the assemblage that presumably were healthy. There is a subjective impression among mission researchers who are interested in the faunal remains that the mission refuse often contains the remains of both smaller and larger-sized bovids. Additional dimensional measurements of both cattle and bison elements from other historic and prehistoric sites in Texas would provide further comparative data on this issue. Without more specific information on the origins of the breeds introduced to Texas, however, it is not possible to make more specific generalizations from the morphometric data.

A final issue concerns the probable economic uses of the bovids in the mission setting. The historical accounts indicate that during the height of cattle abundance, many animals were killed for their tallow and that large numbers of cattle were exported to other regions. The relatively short-lived cattle economic boom was followed by a period of

**Table 10. Comparative Dimensional Measurements of *Bos/Bison* Remains**

| Element, dimension[1] | Range (mm) | Mean | N | Archeological Context[2] |
|---|---|---|---|---|
| astragalus, GLl | 68.0-70.5 | 69.3 | 2 | Spanish sites |
| astragalus, GLl | 67.6-89.8 | 74.9 | 26 | Puerto Real |
| astragalus, GLl | 65.0-74.2 | 69.3 | 3 | 41VT11 |
| astragalus, GLl | 61.9-75.3 | 70.5 | 9 | 41GD1 |
| astragalus, GLl | 73.2-75.0 | 74.1 | 4 | 41GD2 |
| astragalus, GLm | 61.0-64.6 | 62.8 | 2 | Spanish sites |
| astragalus, GLm | 65.6-71.5 | 68.6 | 2 | Puerto Real |
| astragalus, GLm | 60.0-68.7 | 65.4 | 6 | 41VT11 |
| astragalus, GLm | 57.0-69.9 | 64.5 | 10 | 41GD1 |
| astragalus, GLm | 67.7-70.0 | 69.1 | 3 | 41GD2 |
| cubonavicular, GB | 62.5 | 62.5 | 1 | Spanish sites |
| cubonavicular, GB | 58.8-67.7 | 63.3 | 2 | Puerto Real |
| cubonavicular, GB | 56.7-65.7 | 61.2 | 2 | 41VT11 |
| cubonavicular, GB | 51.3 | 51.3 | 1 | 41GD1 |
| cubonavicular, GB | 62.4 | 62.4 | 1 | 41GD2 |
| humerus, BT | 75.0 | 75.0 | 1 | Spanish sites |
| humerus, BT | 76.8-87.0 | 81.9 | 2 | Puerto Real |
| humerus, BT | 74.4-78.4 | 76.4 | 2 | 41GD2 |
| metacarpal, Bp | 60.2-65.7 | 63.0 | 2 | Spanish sites |
| metacarpal, Bp | 58.8-71.8 | 66.2 | 3 | Puerto Real |
| metacarpal, Bp | 59.2 | 59.2 | 1 | 41VT11 |
| metacarpal, Bp | 55.3-56.4 | 55.9 | 2 | 41GD1 |
| metacarpal, Bp | 55.0-66.5 | 58.2 | 4 | 41GD2 |
| metacarpal, Bd | 57.0-60.6 | 58.8 | 2 | Spanish sites |
| metacarpal, Bd | 58.0-64.6 | 60.9 | 3 | Puerto Real |
| metacarpal, Bd | 55.2-74.4 | 64.8 | 6 | 41VT11 |
| metacarpal, Bd | 71.1 | 71.1 | 1 | 41GD2 |
| metatarsus, Bp | 47.0-57.3 | 52.2 | 2 | Spanish sites |
| metatarsus, Bp | 52.7-53.6 | 53.2 | 2 | 41VT11 |
| metatarsus, Bp | 42.6-58.2 | 50.4 | 7 | 41GD2 |
| metatarsus, Bd | 52.0-54.9 | 53.5 | 2 | Spanish sites |
| metatarsus, Bd | 47.2-54.6 | 50.9 | 2 | 41GD1 |
| tibia, Bp | 90.3 | 90.3 | 1 | Spanish sites |
| tibia, Bp | 52.2 | 52.2 | 1 | 41VT11 |

**Table 10.** *(Continued)*

| Element, dimension[1] | Range (mm) | Mean | N | Archeological Context[2] |
|---|---|---|---|---|
| tibia, Bd | 65.2 | 65.2 | 1 | Spanish sites |
| tibia, Bd | 66.0-72.6 | 69.7 | 3 | Puerto Real |
| tibia, Bd | 59.0 | 59.0 | 1 | 41VT11 |
| tibia, Bd | 58.7-75.4 | 64.9 | 7 | 41GD1 |

[1]All measurements follow von den Driesch (1976).

[2]Archeological contexts for Spanish sites and Puerto Real are presented by Reitz and Ruff (1994:700); all measurements are presented in Reitz and Ruff (1994:703-704).

cattle scarcity during the late 1780s and 1790s. During the economic boom period many cattle were used for tallow. Tallow production often involves the boiling and splitting of long bones to facilitate the extraction of fat. Long bone splintering can also result from depositional conditions and from excavation technique.

All three assemblages contain large numbers of split shaft fragments. At Mission Rosario, Zone 1 contains a greater percentage of split elements than either Zones 2 or 3. Both locations of Espiritu Santo contained numerous shaft fragments. In addition to animal processing during the mission occupations, soil conditions at each site may have contributed to the high frequency of split long bones. At Mission Rosario, Zone 1 is a highly compact silt and fine-grained sand lens that quickly hardened once exposed. The excavation of this zone with trowels may have contributed to bone breakage. Feature 3 at the Espiritu Santo mission on the Guadalupe River was also a shallow, near surface deposit that hardened very quickly once exposed. At Espiritu Santo at Goliad, the excavations were in heavily wooded areas with a large quantity of roots. The soil throughout the stratigraphic deposit was extremely humid, and some bone breakage may be attributed to these soil conditions. Recent breaks and root etching were not quantified during the analysis, but both were very common. In order to reliably determine if bone breakage resulted from animal processing or if it was a taphonomic phenomenon, a more detailed analysis of the shaft fragments would need to be undertaken. Potential evidence in support of animal processing would include pot polish from boiling and patterned breakage patterns.

## CONCLUSIONS

Excavation of three 18th century missions on the South Texas coastal prairie produced an abundance of faunal remains. These remains are associated with two different Native American populations that were undergoing missionization by Franciscan missionaries. The Aranama and Tamique Indians inhabited the Espiritu Santo de Zuñiga mission along the Guadalupe River and then at its later location in Goliad, Texas, while a population of Karankawa Indians resided at Mission Rosario. One means of control in the mission setting was to alter traditional subsistence activities, particularly hunting practices. This strategy had the two-fold objective of keeping the Indians on the mission compound to increase the chances of religious conversion while at the same time it provided the Franciscan missionaries with a labor pool for the economic activities on the missions.

A zooarcheological analysis of samples from the three missions indicate that large bovids dominate the faunal remains at all three sites and in all time periods. The element representation—including large numbers of cranial and foot parts—strongly suggests that the bovids are cattle rather than bison. Dimensional measurements of bovid remains are almost exclusively within the size range of cattle from Spanish colonial sites in Florida and the Caribbean. Cattle ranching was the economic mainstay of both missions. The quantity of shaft fragments at the sites may indicate carcass processing for tallow; however, additional quantitative data are needed to eliminate the alternative explanation that site taphonomic conditions were responsible for the high frequencies of splintered shaft fragments.

The Indian populations at the missions rapidly adopted the use of metal tools for animal butchering as evidenced by the abundance of both metal hacks and cut marks. Other bone modifications are relatively rare.

One of the strongest differences among the three mission assemblages is the dietary contribution of hunted meat. At Espiritu Santo, hunting was focused on smaller mammals, with some use of white-tailed deer. A small number of birds, reptiles, and fish augmented the diet. In contrast to the pattern indicated at both locations of Espiritu Santo, the Karankawa population residing at Mission Rosario subsisted on a greater quantity and variety of wild animals that were obtained through off-site hunting. Mammals, birds, and reptiles are more diverse and of greater dietary importance at Rosario. This hunting strategy included the capture and transport of some marine coastal resources in addition to freshwater aquatic animals. The greater use of hunted meat by the Karankawa population supports historical accounts that suggest the Karankawa were more resistant to control by the missionaries than the populations residing at Espiritu Santo.

These data and the excavation of other Spanish colonial settlements (e.g., the Refugio mission and additional research at the Guadalupe River location [41VT11, see Walter, this volume]) of Espiritu Santo are expanding our knowledge of the types of culture change the indigenous populations of South Texas underwent as a result of missionization by the Spaniards. The explosion of the cattle ranching economy and subsequent alteration of traditional subsistence practices during the 18th century was one avenue of culture change for the Native populations. This study indicates that comparative, detailed studies of zooarcheological remains from the mission contexts provide empirical data on the process of subsistence and economic change.

## END NOTE

1. The large-sized element from Espiritu Santo (41VT11) was not recovered during controlled excavations. This element was recovered by Texas Archeological Society members who screened backdirt that accumulated after the property owners completed construction of a driveway on the property. The area impacted was the Spanish colonial midden associated with Feature 3, a large bone bed.

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# Early and Protohistoric Agents of Vegetation Change in the Environs of Mission Rosario (41GD2) as Reflected in Palynological Data

*Bruce M. Albert*

## ABSTRACT

An 18th century pollen spectrum was recovered from a cupric oxide-enriched soil from the excavations at Mission Rosario (41GD2), dating to ca. 1760-1780. This pollen sample was compared to a modern pollen analog sample from the site's surface to ascertain the degree of vegetation change experienced in the environs of the mission since the 18th century. Support for a hypothesis of protohistoric fire-setting by indigenous peoples is offered in the interpretation of the pollen spectra.

## SAMPLING ISSUES AND LABORATORY METHODOLOGY

In general, most archeological soils yield only poorly preserved pollen grains unless special conditions for their preservation are effective (cf. Bryant and Holloway 1983; Dimbleby 1985). Factors promoting pollen preservation—such as soil acidity and anaerobicity—are effective in that they reduce the degree of microbial (including fungal) activity that normally acts to consume pollen grains.

The preservative effects of cupric oxides in particular on pollen grains were first suspected by the author during a 1991 examination of Bronze Age (2nd Millennium B.C.) artifacts in the collection of the Archaeological Institute in Plzen, then Czechoslovakia. Bronze swords and axes recovered from burial mounds had preserved such organic materials as wooden scabbards and leather tongs more than 3000 years old. The toxic qualities of the cupric oxide compounds produced in the soil by virtue of contact with bronze artifacts appear to have deterred microbial activity, thus preserving the ancient organic artifacts. Given the degradation-resistant quality of the sporopollenin in pollen grains vis a vis other organic material (cf. Feagri et al. 1989), it was decided to take samples for pollen analysis from further excavations yielding bronze artifacts in the former Czechoslovakia.

Successful attempts to recover prehistoric pollen spectra were then made in 1993 and 1994 from grave contexts at the Early Bronze Age Nitra Culture site of Mytna Nova Ves in West Slovakia, and the Early Iron Age Horákov Culture site of Vojkovice in South Moravia. The spectra produced were inconsistent with their modern vegetation setting, and correlated well with palynological findings from both lacustrine and alluvial pollen sites in the region.

A further opportunity to take pollen samples was realized during excavations of the Rosario Mission (41GD2) by Goliad in South Texas (see Ricklis, this volume), where a large copper kettle fragment (ca. 10 $cm^2$ in size) was found in situ in Zone 2, well-dated deposits (ca. 1760-1780) belonging to the early occupation of the mission. A soil sample of ca. 1 $cm^3$ was recovered from an organic-rich soil underlying the copper kettle fragment. Additional soil was recovered from Zones 1-3, as well as the modern soil surface south of the mission enclosure. It was hoped that the Zone 1-3 soils would provide a comparative basis for the degree of pollen degradation in the soil recovered from the copper artifact.

These soils were reduced by mechanical methods at the Geo-Archaeology Laboratory and then by chemical methods at the Texas Archeological Research Laboratory, both at The University of Texas at Austin. For purposes of mechanical

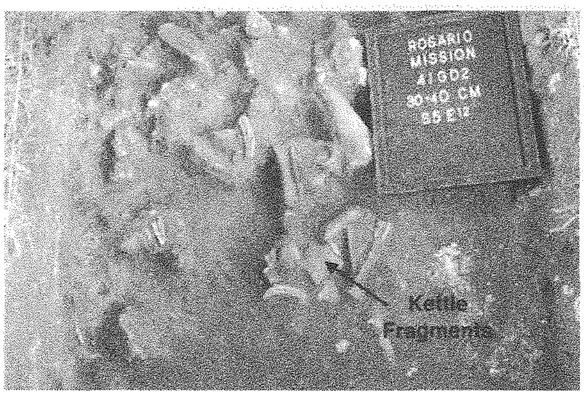


Figure 1. Copper Kettle Fragments in situ prior to pollen sampling, Zone 2, Unit S5E12.

reduction, samples were first defflocated in a 5 percent solution of sodium hexa-metaphosphate in distilled water and filtered through a 177 micron screen (removing particles larger than 177 microns), followed by mechanically-aided filtration through an 8 micron screen (removing particles smaller the 8 microns). Samples thus reduced were then chemically reduced by the application of KOH (to remove gross organics) and then HCL (to remove carbonates). Silicates were further reduced by the application of HF and HCL to remove silico-fluorides. Samples were next subjected to acetolysis (i.e., boiled in a 10 percent solution of sulfuric acid and 90 percent acetic anhydride to remove cellulose), cleaned in distilled water and ethanol, stained in a solution of safranine and tertiary butyl alcohol, and finally mounted in a substrate of 2000 viscosity silicone oil for purposes of light microscopic analyses.

## RESULTS OF THE POLLEN ANALYSES

The general soils from Zones 1-3 contained no recognizable pollen, presumably having been largely degraded by microbial activity. The modern soil contained abundant pollen, producing a spectrum of 15 types. The soil from under the copper kettle fragment also contained abundant pollen, with 14 types (Table 1). Pollen concentrations from the Zone 2 soil at Rosario are also 20 percent greater than that from the modern surface.

Regarding the over-representation of "degradation-resistant" pine and composite pollen, pine is more common in the modern analog sample than in the Zone 2 soil. Conversely, composites of the tubuliflora type appear to be more common in the Zone 2 soil, although unlike pine, these pollen grains are "degradation resistant" because of their thick exines and gross, "spiny" morphology that renders them recognizable, even in a partially degraded state. Twenty to 30 percent of the composite grains are superficially degraded (a "spike" of degraded pollen from soil particles more distal to the copper artifact?). The latter pollen grains should be excluded from what otherwise appears to be an essentially intact pollen spectrum.

## MODERN AFFORESTATION

Given the widespread pollination patterns exhibited by species of oak (*Quercus* sp.) and hackberry (*Celtis* sp.), the order of magnitude increase in pollen types of the tree, shrub, and scrub groups in the modern sample must reflect a regional pattern of afforestation and scrub invasion in the Goliad area in the centuries following the establishment of the presidio and mission system by La Bahía (after 1721). The growth of the modern oak mottes that dot the present-day landscape of the Goliad area might then be a relatively modern phenomenon, as is the "scrub invasion" of leguminous species such as mesquite. Due to the relative dearth of clay soils atop the sand-and-silt-rich Goliad formation, the increase in scrub seems to be primarily hackberry and acacia, as the mesquite tends to thrive better on clays.

This tendency towards the growth of woody vegetation is also expressed across a range of species inhabiting the outer margins of the riparian woodland of the San Antonio River: *Carya* (pecan or hickory, perhaps water hickory), *Juglans* (black walnut), and *Myrica*. Conversely, the inner margins of the riparian woodland as expressed by finds of *Salix* (willow) pollen are no longer found in the modern soil. Presumably, this reflects the exclusion of riverside airborne willow pollen by the leafy canopy space of the now more exuberant riparian woodland elements that have waxed since the colonial era. Finds of *Salix* in early historic times may imply that the outer margins of the riparian zone had been less densely wooded between 1760–1780.

**Table 1. Modern and Early Historic Pollen Spectra from Mission Rosario (41GD2)**

| | Analog soil from modern surface south of mission enclosure Sum = 169/0.5 cm³ | | S5/E12, 30-40 cm bs, (Zone 2) soil under copper kettle fragment Sum = 203/0.5 cm³ | |
|---|---|---|---|---|
| **Trees** | 58 | (34.3%) | 9 | (4.4%) |
| Quercus | 35 | (20.7%) | 5 | (2.5%) |
| Carya | 8 | (4.7%) | 1 | (0.5%) |
| Juglans | 2 | (1.2%) | 0 | (0.0%) |
| Myrica | 1 | (0.6%) | 0 | (0.0%) |
| Pinus | 12 | (7.1%) | 3 | (1.4%) |
| **Inner riparian woodland** | 0 | (0.0%) | 3 | (1.4%) |
| Salix | 0 | (0.0%) | 3 | (1.4%) |
| **Shrubs/scrub** | 38 | (22.5%) | 8 | (3.9%) |
| Celtis | 22 | (13.0%) | 3 | (1.4%) |
| Acacia | 12 | (7.1%) | 2 | (1.0%) |
| Leguminosae | 3 | (1.8%) | 0 | (0.0%) |
| Opuntia | 1 | (0.6%) | 3 | (1.4%) |
| **Herbs** | 73 | (43.2%) | 183 | (90.1%) |
| Zea | 0 | (0.0%) | 1 | (0.5%) |
| Gramineae | 24 | (14.2%) | 61 | (30.0%) |
| Cyperaceae | 9 | (5.3%) | 13 | (6.4%) |
| Compositae tubuliflora | 32 | (18.9%) | 96 | (47.3%) |
| Asteraceae | 3 | (1.8%) | 10 | (4.9%) |
| Compositae liguliflora | 1 | (0.6%) | 1 | (0.5%) |
| Artemisia | 1 | (0.6%) | 1 | (0.5%) |
| Cheno-ams. | 3 | (1.8%) | 0 | (0.0%) |

## PRAIRIE VEGETATION IN EARLY HISTORIC (ZONE 2) AND MODERN TIMES

After the ca. 20-30 percent semi-degraded composite pollen "spike" in the Zone 2 sample is accounted for, the relative composition of the herbal component in the Zone 2 and modern pollen sums is remarkably similar, with the frequency of composite pollen, grasses, and sedges occurring in similar proportions (see Table 1). *Artemisia* and cheno-ams comprise only a very minor part of the open landscape vegetation as reflected in both the early historic Zone 2 and modern pollen sums.

More emphatic in the two pollen sums is the decline in the relative proportion of herbal pollen since ca. 1760-1780. The growth of oak mottes, scrub vegetation (cf. Bogusch 1952), and riparian woodland has certainly led to the contraction of the prairie in modern times as reflected in pollen data.

More enigmatic is the problem of higher pine registration found in modern times (see Table 1). Given the very long distances (up to several hundred km) that the profusely produced pine pollen can travel by means of its buoyant air sacks, it is likely that this modern increase results from events outside the limits of the immediate study region.

## EXTENT OF EARLY HISTORIC PRAIRIES FROM DOCUMENTARY DATA

Later 18th and earlier 19th century records from the Goliad area also attest to the existence of a more-open environment around Rosario and La Bahía prior to the modern period. As Captain Paszina remarked about the landscape around Rosario in 1754: "It has spacious plains, and very fine meadows skirted by the San Antonio River" (Bolton 1906:133). It would appear that the impressionistic statements of the presidio's captain can be taken at face value, not only concerning the generally open character of the landscape, but also in the reduced state of the riparian woodland around the margins of the San Antonio River.

It is important to emphasize that these observations are from the period prior to significant impact by the Spanish on the local environment, dating as they do to the establishment phase of Mission Rosario; later documents also suggest that pressure on the local environment increased with the growth of La Bahía. Population estimates for the colonial La Bahía settlement range as high as 1400 individuals (including mission indians?) by 1806 (O'Conner 1966:95). A ca. 1826 drawing of the La Bahía settlement made by Leno Sanchez y Tapia (Berlandier 1980) is suggestive of a landscape largely denuded of trees, even during this period of population decline in the second and third decades of the 19th century. It is likely that the need for building material as well as the large Spanish mission cattle herds also had some impact on the development of the pre-1830 landscape near Goliad.

## POTENTIAL IMPACTS OF SPANISH COLONIAL AGRICULTURE

Because the dry farming of maize by the inhabitants of La Bahía was always an uncertain enterprise during the 18th century (the San Antonio River cuts too deeply to allow for ready irrigation), its cultivation comprised only a secondary aspect to the ranching economy. However, it is possible that the singular pollen grain of the *Zea* (maize) type recovered from the Zone 2 deposit at Rosario derives from such arable tracts of maize. Otherwise, it may derive from stocks of imported grain obtained from Bexar, a regular supplier of supplementary corn to La Bahía (see de la Teja 1995:90).

Ranching was by far a more important economic activity during the late 18th century, when largely unbranded, free-wandering herds of more than 30,000 head of cattle are periodically recorded as grazing in the Mission Rosario environs (de la Teja 1995:97). Such large herds would surely have had an important impact on the local vegetation, particularly in the evidence for "brush invasion" and denudation of grasslands observed in the modern pollen spectrum. It should also be noted that more open prairie landscapes are also recorded by much later "Anglo-Texan" farmers in parts of South Texas never settled by the Spanish in colonial times. In fact, the recorded large scale "brush invasion" of mesquite and other species (leguminosae, *Acacia*, and *Celtis*) did not begin in earnest until the latter part of the 19th century (Powell 1994:76).

In other respects, expectations of environmental impacts made by cattle herds contradict some of the palynological observations made by the author, notably the modern expansion of the riparian woodland and oak mottes. Experimental data from Southwestern common lands suggest that overgrazing acts to reduce tree cover, even in well-watered riparian areas, through the suppression of sapling growth with excessive soil compaction and exposure (Gillis 1991:668-675). Similarly, factors such as climate change cannot concurrently explain both the "scrub invasion" (a xeric phenomenon) and the "riparian expansion" (a mesic phenomenon; see Holecek [1991:115-120] for a further discussion of this climatic aspect of the problem of "scrub invasion" with respect to Chihuahuan Desert elements). One hypothesis that can account for all observed phenomena (grassland contraction, scrub invasion, and riparian expansion) is fire suppression.

## AGENTS OF FIRE-SETTING ON RANGELAND

Fire serves to recycle nutrients quickly through the topsoil while suppressing brush and favoring grasses and other herbal perennials that are nutritious to cattle and other bovids (including bison). Scrub vegetation is never permanently suppressed; however, such vegetation requires a longer period to recover from fire (see Bock and Bock 1992:49-53). For example, stands of mimosa (a relative of acacia) take two or more years to renew growth as reflected in recent experiments at the Appleton-Whittle Research Ranch. Presumably then, cycles of fire-setting repeated on the same patch of rangeland every three (or more) years will serve to exclude scrub as a significant vegetation element. The exposed margins of the riparian woodland may also be inadvertently affected during such fire setting, performed presumably to improve grazing conditions for bovid herds.

When and by whom would such fire setting, and its subsequent suppression, have taken place? The limited, but corroborative, historical and palynological data suggest that the Spanish entered into what was already an open environment, quite unlike the climax oak mottes and riparian woodland that would develop atop the sandy soils of the Goliad Formation in the absence of human intervention. In temporal terms alone, the agents of the hypothetical range fires must have been the prehistoric and protohistoric Native Americans of the Goliad region. This hypothesis of Native agency may be explained in ecological terms because of the economic character of the Late Prehistoric Toyah phase, an archeological "techno-complex" that seems to be importantly (but not entirely) based upon bison hunting (cf. Ricklis 1994). Those Native groups relying to a greater extent on bison hunting could then have adapted their environment to the benefit of the bison herds by means of cyclical fire-setting of the rangeland. There is corroborative ethnohistoric evidence for such practices by indigenous populations.

## ETHNOHISTORIC EVIDENCE FOR FIRE SETTING BY INDIGENOUS POPULATIONS

As early as the 1520s, Cabeza de Vaca first observed the Natives of an unspecified region of Texas (presumably in the southern or southeastern portion of the state) as "going about in a fire-brand, setting fire to the plains" (Humphrey 1958:235), although de Vaca's account as to why these indigenous inhabitants acted in this way is vague at best. Of greater significance are observations of Minet (1987) in his account of the La Salle expedition in 1687. Entries dated to February 15th and 16th (Minet 1987:104-106) refer to a landward trek of some five leagues into the interior near the north end of Matagorda Island. On the 15th, Minet notes that "we found the country flooded with lakes" (salt marshes?), and after having traveled inland some three leagues, he again records that he "saw smoke from afar" (fire setting?), and "a quantity of killed bison carcasses, killed at least 8-9 months previously" (products of a late spring or early summer bison hunt?). On the second landward day, Minet noted during the two league trek that "fire had burned over all these places." Minet and company then made their way back to the ship, putting an end to further observations, but the potential implications of Minet's final statement are considerable regarding the modification of the coastal plain environment by its indigenous inhabitants. The areal extent of the fires observed by Minet may have been on the order of several $km^2$, as significant patches of the landscape were impacted by "Native fire-branding." Finds of bison carcasses killed in the previous year's hunt reinforces the impression that this measure was made to aid the bison herds on which these peoples' subsistence depended upon to an important degree.

Other reasons for fire setting by the indigenous populations of South Texas include setting fires to help stampede deer in hunting drives (cf. Campbell and Campbell 1981). It is interesting that one of the few Native tribal names that has been reconstructed by Campbell and Campbell (1981) comes from the Great Bend of the Nueces River south of the study area, from the Pastia Indians. It appears that the term "Pastia" derives from Spanish translations of Coahuiltecan terms for "to burn," "scorched," and "seared" (Campbell and Campbell 1981:53). This is a suggestive coincidence in light of ethnohistorical observations of Native fire setting in other regions of Texas.

## CONCLUSIONS AND HYPOTHESES

Limited palynological data, supported by historic and ethnohistoric accounts, suggest that the environment encountered by the Spanish at the establishment of Mission Rosario in the 18th century was one already modified at the hands of the prehistoric and protohistoric indigenous populations of the Goliad area. It is probable that this environment was modified by means of deliberate fire setting. The resurgence of the modern oak and riparian woodlands into modern times has occurred in spite of considerable grazing pressures on the land during the last 250 years. It is likely that these developments occurred more intensively after the widespread replacement of indigenous Native American populations in the 19th century, although the frequency of fire setting may have lessened as early as the mid-18th century as local Native groups were absorbed into the Spanish mission system.

It is fortunate that these speculations derive from observations of sites atop the sandy soils of the Goliad formation, in the environs of the riparian woodland of the San Antonio River that support climax communities of oak and other deciduous hardwoods under natural conditions. This has allowed the historical contraction of the South Texas grassland to be viewed along several lines beyond that of "scrub invasion" alone. The additional recovery of the oak mottes and riparian woodland in the modern period would have been more difficult to detect at sites in the mesquite-infested clay flats lying to the south and east of the Goliad Formation. Furthermore, it is fortunate that Captain Paszina's observations shed light on the very earliest environment encountered by the Spanish, an environment that was already modified from its natural state in 1754. This impression of an open grassland is given quantitative support in 1760-1780 pollen data from Zone 2 at Mission Rosario.

Should these hypotheses be verified by further work on the vegetation history of South Texas, implications for understanding the cultural ecology of the indigenous Native American populations are considerable, particularly the active role such populations took to form their environment to suit their needs. Further insight may be made into possible adaptations of modern range-management and the possible long-term ecological effects of fire setting on rangeland.

## ACKNOWLEDGMENTS

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# Assessing Native American Mobility versus Permanency at Mission San Juan de Capistrano through the Use of Stable Isotope Analysis

*Diane A. Cargill and Robert J. Hard*

## ABSTRACT

Carbon and nitrogen stable isotope analyses were conducted on 19 individuals and six faunal species from Mission San Juan de Capistrano in San Antonio, Texas. The carbon and nitrogen values are most similar to prehistoric Texas coastal hunters and gatherers and least similar to South Texas inland hunters and gatherers. While the observed carbon isotopic values may reflect maize consumption, the nitrogen values are more positive than those typical of maize-dependent populations, and more closely resemble those found in populations consuming freshwater or near-shore marine resources. This suggests that mission residents may have had pre-mission locations near the coast and that their isotopic signatures remained unaffected by a mission diet, indicating that Native residency was intermittent or of short duration.

## INTRODUCTION

Colonial mission research currently includes two main perceptions regarding Native American sedentism at Spanish missions in Texas. The first view is that numerous small hunting and gathering groups settled permanently at the missions because these institutions provided a secure subsistence and a safe haven from enemy raiders (John 1991). Implicit in this perception is the idea that the Native Americans who entered the missions became acculturated and eventually integrated into the larger Spanish community (Habig 1968). This view is currently popularized in the movie "Gente de Razon" or People of Reason, shown daily at the Mission San Jose Visitor's Center. The second perception is that the length of Native residency at Spanish missions was limited due to multiple factors. These include an unwillingness of neophytes to enter and remain at missions (Hinojosa 1991); high infant and maternal mortality and death from European diseases (Schuetz 1980a); and the Native use of missions on an intermittent basis coincident with seasonal food procurement strategies (Ricklis 1996). There is evidence supporting both perceptions in the ethnohistorical literature of the San Antonio missions (Hinojosa 1991; Schuetz 1980a). These two alternatives are not mutually exclusive; however, there were at least a few individuals who were permanent mission residents (Schuetz 1980a). Rather, the question is whether permanent residency was the dominant pattern for the numerous small hunting and gathering groups who entered Spanish missions in South Texas.

We have pursued a preliminary assessment of this issue through stable isotope analysis on 19 human individuals and six faunal species from Mission San Juan de Capistrano, and two prehistoric human individuals from Bexar County, Texas. Stable isotope studies allow for dietary reconstruction. The ethnohistorical and archeological evidence indicates a mission resident diet comprised largely of maize and beef. If the majority of Native people entered and remained at the mission and consumed a diet dominated by maize and beef, their bone collagen would express a particular carbon and nitrogen isotope signal. On the other hand, a non-mission diet may be inferred by alternative isotope values, which would then imply a limited use of the mission by hunting and gathering groups.

## HISTORICAL CONTEXT

The San Antonio missions were established in the early 18th century in present day Bexar County along the San Antonio River (Figure 1). San Antonio de Valero, better known as the Alamo, opened its doors in 1718, and it was soon followed by the founding of Mission San José y San Miguel de Aguayo in 1720. Mission Valero's promoter was Fray Antonio Olivares, who had first seen the San Antonio area in 1709. He felt the area was an ideal location for supplying the material needs of a mission, as well as serving as a half-way station between the Spanish settlements to the west and the presidios and missions in East Texas (Bannon 1979; see Carlson and Corbin, this volume). The settlement of San Antonio was important, therefore, in securing the entire frontier province of Texas. In 1731, 13 years after the establishment of San Antonio de Valero, three missions were moved from East Texas. These were Nuestra Señora de la Purisima Concepción de Acuna, San Juan de Capistrano, and San Francisco de la Espada, creating a chain of five missions on the San Antonio River (Habig 1968).

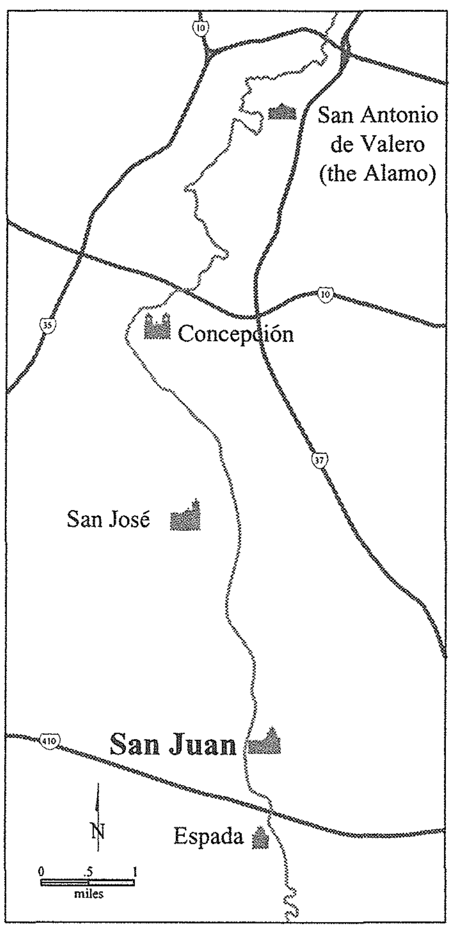


Figure 1. The San Antonio Missions.

Native groups who entered the San Antonio missions came from areas in Texas, Northeastern Mexico, and the Southern High Plains. The latter was home to the Apache, a few of whom entered Mission San Antonio de Valero (Schuetz 1980a). Due to incomplete records, the entirety of groups who entered these missions will probably never be known; however, it appears that indigenous people came from areas south of San Antonio, northeastern Mexico, and along the Rio Grande from its delta as far upstream as Laredo (Campbell and Campbell 1985).

Groups known to have been present at Mission San Juan have been compiled from mission registers and a variety of other sources (Campbell and Campbell 1985; Schuetz 1980a). In 1777, Father Morfi wrote that Mission San Juan de Capistrano was founded for the Orejones, Sayopines, Pamaques, and Piquiques (Schuetz 1968). The early 18th century mission foundation document states, however, that Mission San Juan was founded for the Tilijae (Tiloujaa) and the Venado groups (Campbell and Campbell 1985). Approximate pre-mission locations and mission entrance dates for known Native groups at Mission San Juan (Figure 2) are taken from Campbell and Campbell (1985), Salinas (1990), and Schuetz (1980a).

Prior to missionization, Native Americans in South Texas and northeastern Mexico practiced either an inland hunting and gathering subsistence strategy focused on the prairies and riparian zones, or a coastal adaptation focused primarily on the resources of the bays, estuaries, and barrier islands (Hester 1981). According to historical documents, once these hunters and gatherers became active participants in mission life, their diet was comprised largely of domesticated plants and animals, specifically maize and cattle (Leutenegger 1976; Leutenegger and Habig 1978; Schuetz 1968, 1980a). Maize and beef were significant dietary items in both attracting Native groups to the missions (Hinojosa 1991) and in providing the major components of the mission diet. Analyses of archeological faunal remains from neighboring Mission San José and Mission Valero demonstrate that cattle bone comprised a high percentage of the overall faunal assemblage (Hard et al. 1995; Meissner 1998; Tomka and Fox 1998). Furthermore, numerous references to maize and domesticated animals, as they

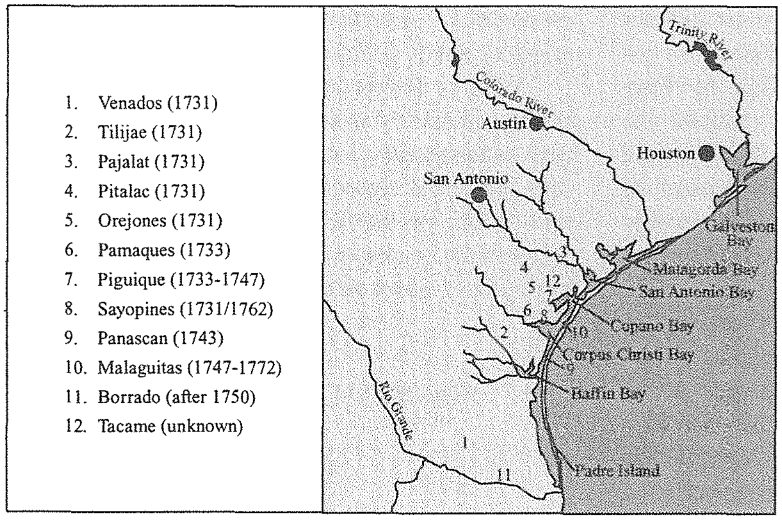


Figure 2. Approximate entrance dates and pre-mission locations for known Native groups at Mission San Juan de Capistrano.

pertain to both consumption and inventories, are found in historical documents of the San Antonio missions. For example, in 1762, Padre Dolores made an inspection of Mission San Juan and reported "...in the granary, that is a spacious room, they store about 1,000 fanegas of maize and beans necessary for the sustenance of the Indians, for which purpose they also keep one thousand head of large cattle, and 3500 small livestock" (Schuetz 1968:46).

## PERMANENT OCCUPATION OF THE MISSIONS

The Spanish Crown and Religious Fathers viewed the mission as an institution for the permanent *reduccion* of Native peoples, and they tried to control the mobility of their residents. Apostates who fled the mission were often returned with the aid of presidial soldiers, thereby insuring that they remained under the supervision of the Padre (Habig 1968; Hinojosa 1991).

Permanent occupation of the missions by some Native groups is inferred from references to the requests and needs of indigenous people, to missionary reports, and to demographic analysis of mission populations. Apparently, some groups were ready to settle and requested missions be established for them. The Fathers found that these individuals were often familiar with many Hispanic skills such as planting and house construction (Hinojosa 1991). It may be that some of these individuals were apostates from missions on the Rio Grande. Others, probably in need of protection from warring groups, were also anxious to enter Spanish missions (Hinojosa 1991). The following passage written by a Texas missionary in 1740 demonstrates the frustration of missionizing Native groups, but alludes to the successful transition to mission life:

> The conversions are not difficult but are burdensome as it is necessary to work with them in the manner of a mother giving birth to an infant. It might take five, six, or seven years to bring them to be rational creatures, and it is a rarity to find one who didn't flee two or three times to the wilderness (Schuetz 1980a:233).

At Mission Valero, where almost complete mission registers exist, it is known that some individuals permanently resided there as they have been traced through birth, baptismal, marriage, and death registers (Schuetz 1980a). Although infant mortality was high at Valero (67 percent of 319 individuals who are recorded in both birth and death registers died before the age of three), there were 14 individuals who attained an age between 20-29 years, and eight who lived to between 30-45 years of age (Schuetz 1980a). This suggests that while life expectancy was low if born at the mission, there were individuals who remained there from birth through adulthood.

## INTERMITTENT, OR SHORT-TERM OCCUPATION OF THE MISSIONS

While it is known that some Native American groups requested the establishment of a mission and appeared to be ready to adopt mission life or simply needed the protection the mission provided, others may have initially "entered" because of the availability of food without understanding in full the obligations inherent in mission life. Hinojosa

(1991) states, however, that most groups did not want to join the missions and many had to be coerced, threatened, or bribed. A passage by Fray Benito Fernandez de Santa Ana aptly explains the process: "There are Indians who are hungry, and they accept the faith through the enticement of food... and there are those who... require the weapons of your Majesty to bring them into civil society" (Hinojosa 1991:67).

Historical documents contain numerous references to Spanish recruiting efforts and Native desertions at Texas missions (Leutenegger 1976; Salinas 1990; Schuetz 1968, 1980a). The continuous recruitment of neophytes by the Spanish Fathers is cited by an anonymous missionary of Concepción in approximately 1760: "From time to time the missionary should journey to the coast and bring back the fugitives, who regularly leave the mission trying at the same time to gain some recruits, if possible, so that more conversions are realized and the mission does not come to an end because of the lack of natives" (Leutenegger 1976:47).

The demographic history of Mission San Juan is characterized by population fluctuations from its founding in 1731 through secularization in 1794 (Schuetz 1968). Declines in resident populations are associated with major desertions and epidemics; population increases resulted from the return of apostates and new recruits (Schuetz 1968, 1980b).

In 1762, the San Antonio missions were working to complete the reduction of Native groups from a broad geographical area ranging from the lower Rio Grande to the west side of present day Galveston Bay (Schuetz 1980a). From ca. 1760-1780, a number of documents referred to recruiting efforts as mission populations declined (Salinas 1990). All five of the San Antonio missions were officially secularized in 1794, and Mission San Juan transferred communal ownership of mission lands to 12 individual Native resident heads of household (Schuetz 1980b).

What is not yet understood is just how successful the missions were in retaining, hispanicizing, and subsequently integrating indigenous peoples into the larger Spanish community. Alternatively, how many of the hunting and gathering groups temporarily or intermittently occupied the missions, or deserted, never to return.

## MATERIALS AND METHODS

### Materials

Stable isotope analysis was conducted on 19 human individuals and six faunal species from Mission San Juan. The individuals were recovered from Mission San Juan's "old church" or Structure 26 (Figure 3). Based on historical records and recovered artifacts, the "old church," which was

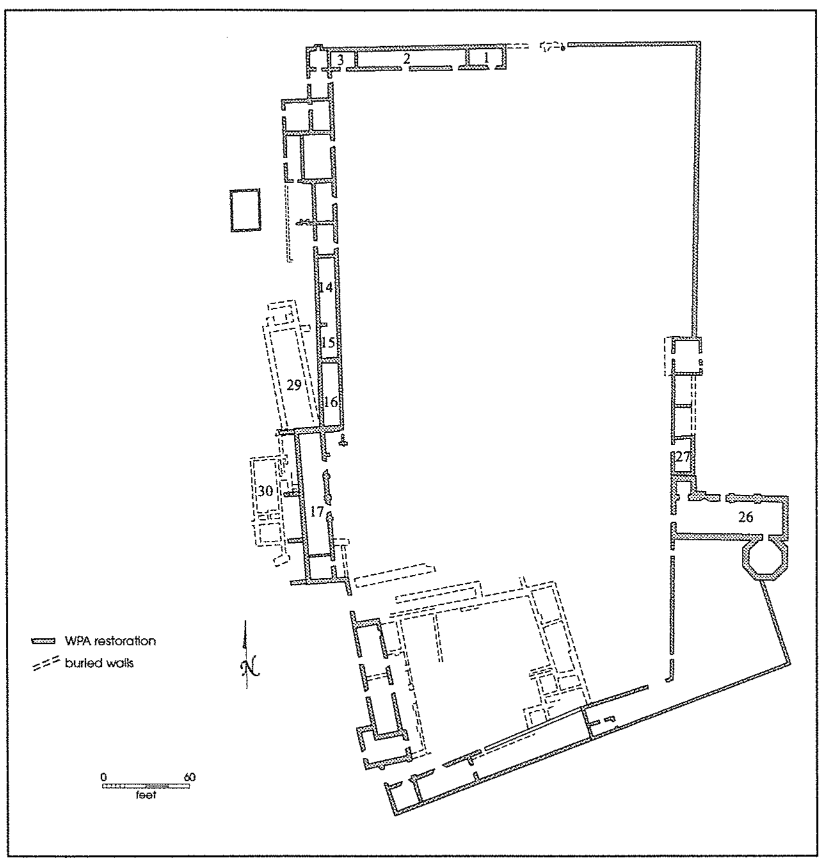


Figure 3. Mission San Juan de Capistrano.

never completed, dates from approximately 1763-1785 (Schuetz 1968). Recent osteological analysis conducted by Doug Owsley (1998 personal communication) from the Smithsonian Institution and a team of physical anthropologists demonstrates that the human skeletal assemblage is largely Native American, with perhaps a small number of individuals of Native American and European admixture. We used two criteria to select the human samples for stable isotope analysis. The first was that the individuals chosen be positively identified as male or female. This was done in order to evaluate potential dietary differences between the sexes. Based on Miller's (1989) analysis, 10 females and 9 males were selected. The second criteria was to include burials that represented only one individual. Comingled burials were not selected in order to avoid the possibility of analyzing multiple elements from the same individual. Human rib bones were chosen for analysis in 15 of the 19 samples; due to the lack of rib bones in four individuals, miscellaneous bone was used. We selected the faunal sample from Mission San Juan rooms containing unmixed colonial deposits. A variety of elements (e.g., turtle carapace and cow femur) were chosen from these collections.

For comparative purposes, we also conducted stable isotope analysis on two individuals from Bexar County. One individual from 41BX952 is dated by the association of an Edwards arrow point. The Edwards point dates from ca. A.D. 900-1040 (Turner and Hester 1993), and while not embedded in the bone, it was in direct association with the vertebrae (Meissner, 1999 personal communication). The other individual from 41BX677 produced an accelerator radiocarbon date of A.D. 1420-1650 (2 sigma, calibrated) from bone collagen (Tennis 1994). We selected miscellaneous bone from these two individuals for analysis. Harold Krueger from Geochron Laboratories (Cambridge, Massachusetts) performed the stable isotope analysis; Krueger and Sullivan (1984) and Cargill (1996) describe the analytical procedures.

## Stable Isotope Analysis

Since their introduction 20 years ago, stable carbon and nitrogen isotope studies have become widely accepted analytical techniques for reconstructing some major dietary components such as the use of maize, aquatic, and terrestrial resources (e.g., Hutchinson et al. 1998; Pate 1994; Schoeninger and Moore 1992; Schwarcz and Schoeninger 1991; Vogel and van der Merwe 1977). Stable $^{13}C$ and $^{15}N$ in human bone collagen are measured with a mass spectrometer. The abundance of a stable isotope in a sample is measured as a ratio of the heavier to the lighter isotope, with reference to the ratio of a standard reference material (Ambrose 1993:65). The reference standards are: $^{13}C/^{12}C$ of Pee Dee Belemnite (PDB) and $^{15}N/^{14}N$ of atmospheric nitrogen known as the Ambient Inhalable Reservoir (AIR). Isotope ratios are expressed with the delta symbol (δ) in parts per thousand (‰ or per mil), using the following formula:

$$\delta(‰) = [(\text{Ratio of sample/Ratio standard})-1] \times 1000$$

Typically the resulting $\delta^{13}C$‰ values are negative and the $\delta^{15}N$‰ values are positive.

As these isotopes are introduced, metabolized, and incorporated into the cells of organisms and passed up through the food chain, the changes that occur in the isotope ratios are known as "fractionation." Because the degree of fractionation is predictable and largely known, an organism's isotopic values can indicate its dietary history. For archeological contexts bone collagen is the most frequently available tissue. When carbon is incorporated into bone collagen, there is a positive fractionation or enrichment of 3-5‰ between diet and collagen, and 5‰ is usually assumed for analytical purposes (Bender et al. 1981; DeNiro and Epstein 1978; Schwarcz and Schoeninger 1991; Vogel 1978). For example, an herbivore with a pure $C_3$ diet (-27.1‰) would have a bone collagen level of around -22.1‰ (Hard et al. 1996:265).

Since omnivores, including humans, consume plants and animals, the carbon chains utilized for collagen synthesis may not be produced in direct proportion to the occurrence of carbon molecules in the bulk diet. Although this has been the standard model (e.g., van der Merwe 1982; Spielmann et al. 1990), it now appears that the carbon molecules are not derived from the bulk diet, but may be derived largely from protein, rather than fats or carbohydrates (Ambrose and Norr 1993; Krueger and Sullivan 1984; Tieszen and Fagre 1993a, 1993b). Glycine is abundant in maize and makes up 33 percent of collagen's amino acids. If it provided the carbon molecules for collagen, it would account for the high carbon isotopic values seen in the human collagen of maize agriculturalists (Tieszen and Fagre 1993b:37). Although this research is in its early stages, it is now clear that collagen isotopic levels cannot be directly translated into the bulk dietary proportions of $C_3$ versus $C_4$ sources, although major dietary trends have been successfully detected. There is some indication that the isotopic values of bone apatite, rather than collagen, more precisely reflect bulk dietary proportions (Ambrose and Norr 1993; Tieszen and Fagre 1993a). While this is a promising alternative, insufficient comparative data are available to consider this approach here, although we also report the bone apatite values from the San Juan Capistrano population. In contrast to carbon, nitrogen is only found in proteins.

Our approach is to use bivariate plots of collagen $\delta^{13}C$ and $\delta^{15}N$ values compared with the collagen isotopic values of other archeological populations whose isotopic signatures and diet are understood. In addition, we consider the known isotopic levels of potential dietary components in order to make inferences regarding the dietary history of the San Juan Capistrano population.

The isotopic collagen signature should reflect the diet over the period of time in which bone collagen is fully replaced. Since the bone collagen turnover rate is 10 to 30 years, the stable isotope values should reflect an average of the dietary intake during this period (Stenhouse and Baxter 1979:339; Bumstead 1985:544; Krueger and Sullivan 1984:210). Thus, the isotopic signature of an individual who spent most of his life in one region, but lived at the mission for only a few years before expiring, will reflect his former rather than his later diet.

## Terrestrial Carbon

Plants incorporate carbon from the atmosphere using one of three photosynthetic pathways, two of which result in distinct carbon stable isotope ratios ($^{13}C/^{12}C$) (Bender et al. 1973; Pate 1994; Smith 1971, 1972). These isotopic signatures are then incorporated into the tissue, including bone collagen, of humans and other animals that eat those plants. Most herbs and shrubs, all trees, and temperate cool-season grasses use the Calvin or $C_3$ pathway, named for a three-carbon molecule formed during $CO_2$ assimilation. These plants discriminate against the heavier $^{13}C$ isotope, producing more negative $\delta^{13}C$ values that range between -20 and -35‰, with a mean of about -27‰ (DeNiro 1987:183; Ehleringer 1989:41; O'Leary 1988:334). Although there is substantial variation in the isotopic signatures of $C_3$ plants, no overlap occurs between them and the other major photosynthetic pathway, the $C_4$ or Hatch/Slack pathway.

Plants such as amaranth, Portulaca, tropical and warm-season grasses, maize, millet, sugarcane, and some shrubs in the Euphorbiaceae and Chenopodiaceae families use the $C_4$ pathway (Pate 1994:172). $C_4$ plants produce a four-carbon molecule during $CO_2$ uptake and they do not discriminate against the $^{13}C$ isotope as much as $C_3$ plants do. Therefore, they have an isotopically heavier $\delta^{13}C$, with a mean of about -13‰ (O'Leary 1988:334; Stothers and Bechtel 1987:138) and a range of -7 to -16‰ (Ehleringer 1989:41; Hard et al. 1996:264: Pate 1994:173). These plants, with their more positive values, are said to be isotopically heavier or enriched in $^{13}C$.

Arid land succulents, such as cacti, agave, and some euphorbs utilize a third photosynthetic pathway, crassulacean acid metabolism (CAM). Such taxa can vary their pathway depending upon if they uptake $CO_2$ diurnally or nocturnally (Ehleringer 1989:41; O'Leary 1981, 1988; Pate 1994:173). The day-growing group has values within the range of $C_3$ taxa and the night group's values are within those of $C_4$ plants.

## Freshwater and Marine Carbon

The $\delta^{13}C$ value of freshwater fish and fauna are affected by the influences of both terrestrial $C_3$ and $C_4$ sources and have been demonstrated to range between -23.7‰ and -12.7‰ (Cargill 1996:103; Katzenberg 1989:323; Schoeninger and DeNiro 1984:629; Tuross et al. 1994:295). The marine $\delta^{13}C$ value of the dissolved inorganic carbon pool, from which oceanic life derives its carbon, is positively enriched about 7.0‰ relative to atmospheric carbon (Fry and Sherr 1984:17). Therefore, most marine plants have $\delta^{13}C$ values more positive than terrestrial $C_3$ plants (DeNiro 1987:187). However, substantial variability exists in the $\delta^{13}C$ values of marine organisms that is related to cold vs. warm water organisms as well as to particular coastal ecosystems such as seagrass meadows, coral reefs, algae blooms, and saltmarshes (Cargill 1996:105; Fry and Sherr 1984:19-20; Little and Schoeninger 1995:358; Schoeninger and DeNiro 1984:628). For example, the large seagrass meadows of *Syringodium filiformis* in the lower Laguna Madre of Texas exhibit a mean $\delta^{13}C$ value of -5.4‰ and *Halodule wrightii*, the dominant seagrass in the upper Laguna Madre, has a mean $\delta^{13}C$ value of -10‰ (Fry and Parker 1979:500-501). In fact, 85 percent of the animals analyzed from seagrass meadows from the Gulf of Mexico had $\delta^{13}C$ values between -8.3 and -14.5‰. In contrast, offshore animals had more negative values (between -15.0‰ and -19.0‰). In addition, there is some evidence that there are slight (<1‰) increases in tissue $\delta^{13}C$ values for each successive trophic level, although this may be related to the role of near shore taxa in the food chain (Fry and Sherr 1984:28, 30).

The $\delta^{13}C$ values of nearshore marine animals can mimic those of terrestrial $C_4$ plants; humans feeding on nearshore taxa may have a similar bone collagen signature as that of a maize-dependent population. Fortunately, stable nitrogen isotope analysis can assist with this discrimination (Hutchinson et al. 1998; Schoeninger and DeNiro 1983:1381; Walker and DeNiro 1986:56).

## Terrestrial Nitrogen

Atmospheric nitrogen is 99.64 percent of the stable isotope $^{14}N$, with the remainder $^{15}N$. Plants uptake soil nitrogen isotopes and animals ingest plant and animal tissue containing nitrogen isotopes. As with carbon, nitrogen isotopes are then incorporated into amino acids in plant and animal tissues. Fractionation occurs at various points in the uptake and metabolic processes, resulting in variability in the $\delta^{15}N$ values that can be compared to known samples. Human bone collagen is typically used for archeological samples. Dietary inferences can be made through comparison with the values of known samples, and by taking into account the fractionation that may have occurred in the nitrogen uptake and tissue formation processes.

Nitrogen, an essential component of all protein, comprises 79 percent of the atmosphere as $N_2$. Paradoxically, $N_2$ cannot be directly used by most organisms, but first must be chemically transformed through bacterial $N_2$ fixation. Fixation occurs with bacteria living symbiotically with legumes and root-noduled, non-leguminous plants, free-living soil bacteria, and blue-green algae in soil (Smith 1990:258). Bacterial action fixes nitrogen in the soil by converting it to ammonia, a form that is plant usable. Fixation occurs in two additional ways: the breakdown of organic matter, and the combination of atmospheric $N_2$ with precipitation, also combined with high energy inputs from lightening to produce usable nitrates (Smith 1990:258). Fractionation can be affected by these fixation processes.

The stable isotope of $^{14}N$, relative to $^{15}N$, is lost more rapidly as soil organic matter decomposes, resulting in $\delta^{15}N$ values of -4.0 to +14. Nitrogen fixing plants have a typical range of -2.0 to +2.0‰ and non-fixing plants have mean values of about +3.0‰, but a range of 0 to +6.0‰ is reported (Pate 1994:180). Variation in plant $\delta^{15}N$ may be related to the degree of nitrogen fixation, climate, and micro-habitat (Ambrose 1993:96). The $^{15}N$ isotope value of the same plant species may vary depending on local ecological conditions.

The relationship between the $\delta^{15}N$ isotope values in animal tissue, such as bone collagen, and diet is dependent upon the degree that $^{14}N$, relative to $^{15}N$, is more rapidly gained during the metabolic and cell formation processes. The $\delta^{15}N$ values increase 3-4‰ from that of the ingested plants, for each successive step up the trophic ladder (Ambrose 1993:97; Pate 1994:180). However, these values are means from global surveys and there is significant variation among different ecological settings. For example, herbivores from hot, dry environments tend to have higher $\delta^{15}N$ values than those from cool, moist environments. This variability is related to variation in fractionation levels and $\delta^{15}N$ dietary plant values (Ambrose 1993:97). Therefore, comparisons should be made within, not across, ecosystems. Ideally, samples from all components of the ecosystem under study should be analyzed in order to reconstruct diet from bone collagen. Fortunately, however, there appears to be no significant difference in $\delta^{15}N$ values among tissues of the same animal (Ambrose 1991:297).

## Freshwater and Marine Nitrogen Isotope Variation

Stable nitrogen isotope values can potentially be used to discriminate between terrestrial and marine diets because marine ecosystems tend to have higher values than most terrestrial systems. Dissolved atmospheric $N_2$ in seawater is +1.0‰. In addition, much more of the usable nitrogen in marine and freshwater systems is produced by bacterial breakdown of organic material into $^{15}N$-enriched nitrates than in terrestrial systems (Schoeninger and Moore 1992:256). As a result, aquatic plants at the base of the trophic scale have $\delta^{15}N$ values of about +7‰, 4‰ higher than most terrestrial plants (Ambrose 1993:94; Schoeninger and Moore 1992:Figure 1). Marine nitrogen-fixing plants, such as blue green algae, seagrasses, and saltmarsh grasses such as those found in reef, mangrove, and saltmarsh ecosystems, may have $\delta^{15}N$ values similar to those of terrestrial ecosystems. Blue green algae and saltmarsh grasses have measured $\delta^{15}N$ values of about +1.0‰ (Little and Schoeninger 1995:358; Minagwa and Wada 1984:1135). Therefore, the distinction between diets derived from marine ecosystems such as those with depleted $\delta^{15}N$ values and terrestrial ones is difficult using stable nitrogen or carbon isotopes (Ambrose 1993:94).

As with terrestrial systems, there is about a 3‰ enrichment of $\delta^{15}N$ values at each successive trophic level. However, because of variation among marine ecosystems, trophic level determinations should only be made within, not between, ecosystems. For example, from the Usujiri tidal zone of Japan, primary producers such as seaweed and phytoplankton have $\delta^{15}N$ value of +6.8‰; primary consumers (mussels, shore crabs, sea anemones, and starfish) are +8.5 to +9.5‰; secondary consumers (including fish and octopuses) are +10.6 to +12.7‰; and tertiary feeders such as seagulls are +15.6 to +16.8‰ (Minagawa and Wada 1984:1137). In contrast, lower $\delta^{15}N$ values are found in nitrogen-fixing seagrass food webs. Juvenile shrimp from seagrass meadows along the South Texas coast have $\delta^{15}N$ values between +6.0 to +8.0‰ (Fry 1983:789), and pinfish from seagrasses in San Antonio Bay have an average $\delta^{15}N$ value of +10.2‰ (Huebner 1994). Offshore non-migratory shrimp are +11.8‰ (Fry 1983:794) and offshore pinfish are 13.6‰ (Huebner 1994). Fish bone collagen from the Mitchell Ridge site (41GV66) in Galveston County had $\delta^{15}N$ values of +9.9‰ for drum and +6.6‰ for gar (Huebner 1994). By examining the stable carbon and nitrogen isotope results from Mission San Juan de Capistrano with the ecological factors affecting isotope values, it is possible to make inferences regarding the dietary history of individuals.

## RESULTS OF THE STABLE ISOTOPE ANALYSES

Delta $^{13}C$ values for bone apatite and collagen, and $\delta^{15}N$ values for bone collagen, for the 19 mission individuals, six faunal species, and two archeological comparative samples are provided in Table 1. The carbon apatite values are discussed in Cargill (1996). Individuals from the San Juan de Capistrano mission exhibit collagen $\delta^{13}C$ values that range between -11.8 and -7.9‰, with a mean of -9.5‰ and a standard deviation of $\pm$ 0.9‰. There is a 3.9‰ difference between the most enriched and the most depleted $\delta^{13}C$ value in the mission sample. Experimental laboratory studies indicate that animals raised on a monotonous diet should yield $\delta^{13}C$ values within 1‰ of one another; this holds true for $\delta^{15}N$ values as well (DeNiro and Schoeninger 1985). The $\delta^{13}C$ values of mission residents, therefore, indicate some variation in food consumption; however, the range of values reflects the consumption of $C_4$ plants and animals reliant upon $C_4$ plants.

The $\delta^{15}N$ values are more tightly clustered and differ by less than 2‰, indicating less variability in the consumption of dietary protein. The values range from +11.0 to +12.8‰ (see Table 1) with a mean of +11.9‰ and a standard deviation of $\pm$ 0.5‰. These values are indicative of a diet that includes freshwater or marine resources. When $\delta^{13}C$ and $\delta^{15}N$ values for females and males are compared, it is apparent that the sexes share similar isotopic signatures.

The faunal samples exhibit a wide range of carbon and nitrogen values. For example, catfish has a $\delta^{13}C$ value of -20.9‰ and a $\delta^{15}N$ value of +10.6‰, while the values for cow are -15.0‰ ($\delta^{13}C$), with a $\delta^{15}N$ value of +5.7‰. Overall, the animals that graze or browse have $\delta^{13}C$ values indicative of a diet based on both $C_3$ and $C_4$ plants. In South Texas, the presence of $C_4$ grasses is often reflected in the $\delta^{13}C$ values of herbivorous animals. The most negative $\delta^{13}C$ values are associated with freshwater catfish and turtle, showing a $C_3$-like source of freshwater carbon. The $\delta^{15}N$ values indicate that catfish has the most positive value (+10.6), while terrestrial herbivores, as expected, exhibit

**Table 1. $\delta^{13}C$ and $\delta^{15}N$ values for Mission San Juan Individuals and Fauna**

| Individual/Sex | $\delta^{13}C$ Apatite | $\delta^{13}C$ Collagen | $\delta^{15}N$ Collagen |
|---|---|---|---|
| 26 B 12B/Female | -5.7 | -9.9 | +11.5 |
| 26 B 13A/Male | -4.9 | -9.6 | +11.6 |
| 26 B 13C/Male | -4.4 | -8.9 | +11.9 |
| 26 B 16B/Male | -4.7 | -8.5 | +12.1 |
| 26 B 16C/Male | -6.3 | -11.8 | +12.3 |
| 26 B 17B/Female | -5.5 | -10.1 | +12.8 |
| 26 B 18A/Male | -5.6 | -9.9 | +11.3 |
| 26 B 18B/Female | -4.6 | -9.4 | +11.9 |
| 26 B 18C/Male | -6.3 | -11.5 | +12.8 |
| 26 B 1/Male | -6.0 | -9.8 | +11.9 |
| 26 B 7D/Male | -4.3 | -9.6 | +12.4 |
| 26 B 8B/Female | -3.8 | -7.9 | +11.5 |
| 26 B 9/Male | -5.0 | -10.2 | +12.2 |
| 26 B 10/Female | -4.7 | -9.7 | +11.8 |
| 26 B 11A/Female | -4.1 | -9.0 | +12.2 |
| 26 B 11C/Female | -5.1 | -9.8 | +12.0 |
| 26 B 11E/Female | -4.5 | -9.0 | +11.3 |
| 26 B 11F/Female | -4.8 | -8.7 | +12.2 |
| 26 B 11G/Female | -5.3 | -9.0 | +11.0 |
| Mean | n/a | -9.5 | +11.9 |
| S.D. | n/a | 0.93 | 0.49 |
| 41BX952 | -11.9 | -17.7 | +7.9 |
| 41BX677 | -5.3 | -10.0 | +10.7 |
| Fauna | $\delta^{13}C$ Apatite | $\delta^{13}C$ Collagen | $\delta^{15}N$ Collagen |
| Cow | -6.1 | -15.0 | +5.7 |
| Javelina | -8.5 | -15.8 | +7.3 |
| Pond Turtle | -6.7 | -19.2 | +5.0 |
| Flathead Catfish | -6.3 | -20.9 | +10.6 |
| Turkey | -9.0 | -16.0 | +6.1 |
| Sheep or Goat | -8.3 | -17.3 | +6.5 |

relatively low $\delta^{15}N$ values of +5.7 and +6.5‰. The two non-mission individuals from Bexar County exhibit isotope values very different from one another. The individual from 41BX952 (associated with an Edwards point) produced a $\delta^{13}C$ value of -17.7‰ and a $\delta^{15}N$ of +7.9‰. The Late Prehistoric/Protohistoric individual from 41BX677 has a $\delta^{13}C$ value of -10.0‰ and a $\delta^{15}N$ of +10.7‰.

## INTERPRETATION AND DISCUSSION

A bivariate plot showing $\delta^{13}C$ values along the X axis and $\delta^{15}N$ values along the Y axis is used to compare the Mission San Juan sample to populations with a diversity of subsistence regimes (Figure 4 and Table 2). When the $\delta^{13}C$ values of Mission San Juan de Capistrano residents are examined, they most closely resemble those $\delta^{13}C$ values observed in maize-dependent groups. Interestingly however, the $\delta^{15}N$ values of San Juan residents do not resemble $\delta^{15}N$ values commonly found in maize agriculturalists, but rather, reflect those $\delta^{15}N$ values associated with populations who exploit freshwater or marine resources.

## $\delta^{13}C$ AND $\delta^{15}N$ VALUES OF MAIZE AGRICULTURALISTS

While maize agriculturalists exhibit mean $\delta^{13}C$ values ranging from -12.4‰ (Spielmann et al. 1990) to -7.2‰ (Hutchinson et al. 1998) that reflect the consumption of a $C_4$ plant, their mean $\delta^{15}N$ values typically fall between +8.0 or +9.0‰ (Schoeninger and DeNiro 1983); this is similar to the mean $\delta^{15}N$ value of +8.0‰ reported for terrestrial carnivores (Schoeninger and DeNiro 1984). A mean $\delta^{15}N$ value of +9.0‰ is reported for both prehistoric maize agriculturalists from the Tehuacan Valley in Mexico (Schoeninger and DeNiro 1983) and Pecos Pueblo (Spielmann et al. 1990). Historic Southwestern Pueblo Hawikuh maize agriculturalists have a mean $\delta^{15}N$ value of +8.0‰ (Schoeninger and DeNiro 1983). Even inland and coastal maize agriculturalists located at Spanish missions in Florida

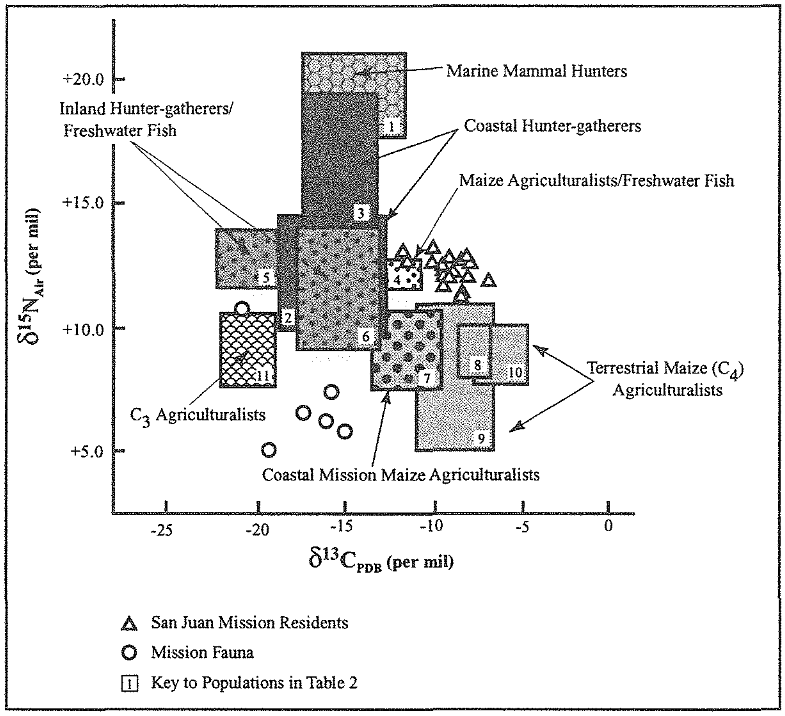


Figure 4. Isotopic signatures from Mission San Juan de Capistrano and historic and prehistoric populations.

and Georgia exhibit mean $\delta^{15}N$ values of +8.6, +9.4, and +10.2‰ (Hutchinson et al. 1998).

The stable isotope data from the Old Socorro Mission in the El Paso, Texas area is anomalous. The mean $\delta^{13}C$ value for the Old Socorro residents (-11.0‰) is similar to populations dependent on maize; however, the mean $\delta^{15}N$ value (+10.8‰) is higher than usual for agriculturists. Consequently, the enriched values at Old Socorro are not well understood as associated fauna have not been isotopically analyzed and substantial temporal variability exists within the sample.

The $\delta^{13}C$ value of maize is well documented (Bender 1968; DeNiro and Hastorf 1985; Schwarcz et al. 1985; Tieszen and Fagre 1993b); however, available $\delta^{15}N$ values for maize are limited. Reported $\delta^{15}N$ values include: +2.2‰ for archeological maize (Schoeninger et al. 1990), +6.4 to +7.8‰ for archeological carbonized maize (DeNiro and Hastorf 1985), and +7.6‰ for modern maize (Spielmann et al. 1990). This wide variation in $\delta^{15}N$ values demonstrates the need for additional stable nitrogen isotope analysis on maize in order to provide a more reliable data set for future dietary reconstruction. Clearly, the Mission San Juan population—with a mean $\delta^{15}N$ value of +11.9‰—has $\delta^{15}N$ values associated with protein sources other than maize and terrestrial herbivores.

Enriched $\delta^{15}N$ values have been documented in plants and animals from arid environments (Ambrose 1991), and in terrestrial plants located near saline or coastal shores (Heaton 1987). In order to assess whether environmental conditions are responsible for the relatively high $\delta^{15}N$ values observed in the mission resident sample, six faunal species from the colonial deposits were analyzed (see Table 1). Although the faunal sample is small, the nitrogen values of the herbivores and omnivores do not suggest either an elevated source of nitrogen at the base of the local food web or that herbivores exhibit high nitrogen values associated with drought-tolerant animals. That the mission residents' isotope signature reflects the consumption of domesticated animals, particularly cattle, is not supported by the $\delta^{15}N$ values of these animals. The fauna have relatively low $\delta^{15}N$ values as expected of herbivores. Applying a +3.0‰ trophic level increase to the $\delta^{15}N$ value of cow and goat/sheep, results in consumer $\delta^{15}N$ values between +8.7 and +9.5‰, respectively, values well below that of mission residents. From the fauna analyzed, catfish has a sufficient $\delta^{15}N$ value (+10.6‰) to account for the elevated $\delta^{15}N$ values observed in mission residents.

## $\delta^{13}C$ AND $\delta^{15}N$ VALUES OF POPULATIONS DEPENDENT ON FRESHWATER FAUNA

It may be the case that the enriched $\delta^{13}C$ values and the elevated $\delta^{15}N$ values observed in the Mission San Juan residents are due to the consumption of maize and freshwater fauna (see Figure 4). Prehistoric maize agriculturalists from Southern Ontario whose diets consisted of approximately 50 percent maize and freshwater fauna from the Great

**Table 2. Key to Populations Shown in Figures 4 and 5**

| Number | Location of Population and Subsistence Strategy | Reference |
|---|---|---|
| 1 | Alaska, Marine Mammal Hunters | Schoeninger and DeNiro 1983 |
| 2 | Georgia, Coastal Hunters-Gatherers | Hutchinson et al. 1998 |
| 3 | California, Coastal Fisher-Gatherers | Schoeninger and DeNiro 1983 |
| 4 | Southern Ontario, Maize Agriculturalists and Freshwater Fauna | Schwarcz et al. 1985 |
| 5 | Southern Ontario, Hunters and Gatherers Freshwater Fauna | Schwarcz et al. 1985 |
| 6 | Florida, Hunters-Gatherers and Freshwater Fauna | Tuross et al. 1994 |
| 7 | Georgia, Coastal Mission, Maize Agriculturalists | Hutchinson et al. 1998 |
| 8 | New Mexico, Pecos Pueblo, Maize Agriculturalists | Spielmann et al. 1990 |
| 9 | New Mexico, Hawikuh, Maize Agriculturalists | Schoeninger and DeNiro 1983 |
| 10 | Mexico, Tehuacan Valley, Maize Agriculturalists | DeNiro and Epstein 1981; Schoeninger and DeNiro 1983 |
| 11 | Europe Agriculturalists | Schoeninger and DeNiro 1983 |
| 12 | Texas, Hunters-Gatherers and Freshwater Fauna, Blue Bayou Site | Huebner and Comuzzie 1992 |
| 13 | Texas, Broad-based Economy, Bison and Maize, Antelope Creek phase | Habicht-Mauche et al. 1994 |
| 14 | Texas, Coastal Hunters-Gatherers, Corpus Christi | Huebner 1994 |
| 15 | Texas, Coastal Hunters-Gatherers, Mitchell Ridge Site | Huebner 1994 |
| 16 | Texas, Maize Agriculturalists, Old Socorro Mission | Evans 1989 |
| 17 | Texas, Inland Hunters-Gatherers, Loeve-Fox Site | Huebner, 1995 personal communication |
| 18 | Texas, Inland Hunters-Gatherers, Olmos | Huebner, 1995 personal communication |
| 19 | Texas, Inland Hunter-Gatherer, 41WY113 | Bousman et al. 1990 |
| 20 | Texas, Inland Hunter-Gatherer, 41BX952 | Cargill 1996 |
| 21 | Texas, Inland Hunter-Gatherer, 41BX677 | Cargill 1996 |
| 22 | Texas, Coastal Hunter-Gatherer, 41WY50 | Bousman et al. 1990 |

Lakes, have a mean $\delta^{13}C$ value of -12.6‰ and a mean $\delta^{15}N$ value of +12.4‰ (Katzenberg 1989). Since $\delta^{15}N$ values observed in freshwater fauna often match or exceed those values found in terrestrial carnivores, a higher $\delta^{15}N$ value exists in freshwater consumers.

Mean $\delta^{15}N$ values similar to Mission San Juan residents are also observed in the Archaic Florida Windover population (+11.8‰), and the Protohistoric Tatham Mound Florida population (+11.5‰). The elevated $\delta^{15}N$ values in the Windover population are attributed to the exploitation of riverine resources (Tuross et al. 1994), and the enriched $\delta^{15}N$ values in the Tatham Mound population are associated with the consumption of riverine and lacustrine fauna (Hutchinson et al. 1998). Similarly, in Texas, Huebner and Commuzie (1992) conclude that the presence of elevated $\delta^{15}N$ values in the Blue Bayou population (mean of +10.5‰) probably resulted from the exploitation of riverine fauna (Figure 5). The $\delta^{13}C$ values of the populations discussed above

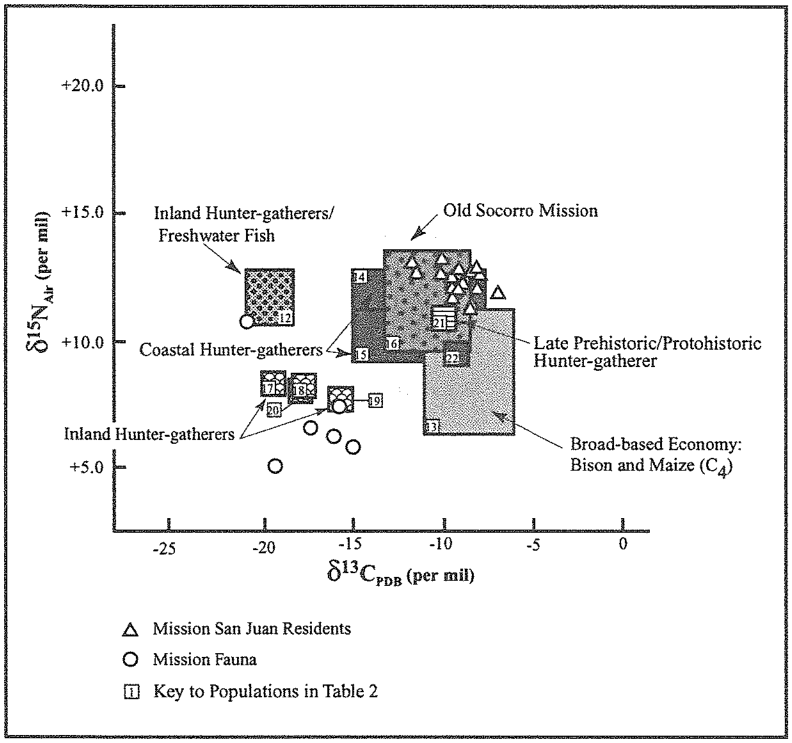


Figure 5. Isotopic signatures from Mission San Juan de Capistrano and historic and prehistoric populations in Texas.

range between -20.3 and -10.0‰, reflecting the availability and exploitation of $C_3$, $C_4$, or a combination of $C_3$ and $C_4$ resources.

## $\delta^{13}C$ AND $\delta^{15}N$ VALUES OF POPULATIONS DEPENDENT ON MARINE RESOURCES

Populations dependent on marine resources exhibit a wide range of $\delta^{15}N$ and $\delta^{13}C$ values (see Figures 4 and 5). The enriched $\delta^{15}N$ values observed in Mission San Juan residents are also observed in coastal populations dependent on nearshore marine resources (see Figures 4 and 5). Delta $^{15}N$ values reported for Georgia coastal hunters and gatherers range between +10.6 and +14.4‰, with a mean $\delta^{15}N$ value of +12.8‰ (Hutchinson et al. 1998). The mean $\delta^{15}N$ value from Georgia, therefore, is only 1‰ more enriched than the mean $\delta^{15}N$ value of the Mission San Juan residents. However, Georgia coastal hunters and gatherers exhibit more depleted $\delta^{13}C$ values (ranging between -18.6 and -13.4‰, with a mean $\delta^{13}C$ of -15.1‰), indicating the consumption of a more $C_3$-like source of terrestrial and/or marine carbon.

In Texas, both the enriched $\delta^{13}C$ and $\delta^{15}N$ values for the Mission San Juan residents occur together in coastal hunters and gatherers (see Figure 5 and Table 2). The enrichment of both carbon and nitrogen stable isotope ratios in coastal populations is probably a result of the exploitation of marine fauna that inhabit the unique ecosystem of extensive seagrass meadows located along the Texas coast. The prehistoric populations of the Mitchell Ridge site, the Corpus Christi area, and 41WY50 (one individual), exhibit values ranging between -14.7 and -7.7‰, with a mean $\delta^{13}C$ value of -11.9‰ reported for Mitchell Ridge and -13.0‰ for the Corpus Christi area (Huebner 1994). The $\delta^{13}C$ value for 41WY50 is -9.7‰ (Bousman et al. 1990). Delta$^{15}N$ values range between +9.2 and +12.8‰, with a mean of +10.4‰ reported for both the Mitchell Ridge site and the Corpus Christi area (Huebner 1994). The $\delta^{15}N$ value reported for 41WY50 is +9.6‰ (Bousman et al. 1990). In comparison, Mission San Juan residents have mean $\delta^{13}C$ and $\delta^{15}N$ values of -9.5 and +11.9‰, respectively, demonstrating that both carbon and nitrogen stable isotope ratios are within the range expected for a Texas coastal diet.

## TEXAS INLAND HUNTERS AND GATHERERS, INCLUDING COMPARATIVE SAMPLES FROM 41BX677 AND 41BX952

Comparative sample 41BX677 is dated to the 15th-17th century A.D. The $\delta^{13}C$ value of -10.0‰ and the $\delta^{15}N$ value of +10.7‰ may reflect an inland hunting and gathering adaptation immediately preceding Spanish contact in the area. While a single sample is certainly not conclusive, and radiocarbon dating of bone is known to be problematic, the $\delta^{13}C$ and $\delta^{15}N$ value of this individual may be explained by the consumption of freshwater fauna, as well as $C_4$ and/or CAM plants and animals dependent upon those plants, including bison. Late Prehistoric bison in Texas have carbon isotopic values ranging from -13.7 to -8.5‰, and nitrogen isotopic values from +3.2 to +7.6‰ (Huebner and Boutton 1996). On the other hand, the isotopic signatures may reflect a marine adaptation, as the $\delta^{13}C$ and $\delta^{15}N$ values of the individual from 41BX677 are similar to those observed in Texas' coastal groups and to predicted values for a subsistence based on nearshore marine resources.

Inland hunters and gatherers dating from the Middle Archaic through the Austin phase of the Late Prehistoric period have $\delta^{13}C$ and $\delta^{15}N$ values quite unlike those observed among the Mission San Juan de Capistrano residents. Both $\delta^{13}C$ and $\delta^{15}N$ values are more depleted, suggesting the exploitation of a very different resource base. The mean $\delta^{13}C$ values associated with the Loeve-Fox and Olmos samples are -19.4 and -17.7‰, respectively (Huebner, 1995 personal communication). The $\delta^{13}C$ values reported for single individuals at 41WY113 and 41BX952 are -15.7 and -17.7‰, respectively. Compared to Mission San Juan residents, the $\delta^{13}C$ values from these samples suggest less $C_4$ influence in the diets of inland hunters and gatherers. The mean $\delta^{15}N$ values reported for both Loeve-Fox and Olmos are +8.0‰. The $\delta^{15}N$ values for the individuals at 41WY113 and 41BX952 are +7.6‰ and +7.9‰, respectively. The $\delta^{13}C$ and $\delta^{15}N$ values indicate that inland hunters and gatherers exploited primarily $C_3$ plants and terrestrial herbivores dependent upon those plants.

## CONCLUSIONS

The $\delta^{13}C$ values of human individuals at Mission San Juan de Capistrano closely resemble those of maize-dependent populations. However, maize-dependent populations do not exhibit the consistently high $\delta^{15}N$ values observed in San Juan residents, unless freshwater fauna contributed significantly to the diet.

That the Mission San Juan residents regularly consumed cattle for the decade or more required for the bone collagen turnover rate, is not supported by the isotope analysis conducted on herbivores from the colonial archeological deposits. The cow and goat/sheep fauna have low $\delta^{15}N$ values, and populations consuming these terrestrial herbivores would exhibit relatively low $\delta^{15}N$ values as well; this contrasts sharply with the elevated $\delta^{15}N$ values (+11.0 to +12.8‰) observed in mission individuals. Therefore, the elevated $\delta^{15}N$ values in Mission San Juan residents are not consistent with the archeological faunal record that indicates that cow was a major resource. Neither are the elevated $\delta^{15}N$ values of Mission San Juan residents consistent with historic mission records indicating that maize was an important dietary component for mission residents (Hard et al. 1995; Leutenegger 1976; Schuetz 1968; Wade 1993).

Enriched $\delta^{13}C$ and elevated $\delta^{15}N$ values similar to those expressed by San Juan residents are observed in Texas hunting and gathering groups who exploited marine resources. In fact, given (a) similar $\delta^{13}C$ and $\delta^{15}N$ values observed in prehistoric humans buried near the coast, (b) the historical literature that discusses the recruitment of neophytes and the recovery of apostates from the coast, and (c) the fact that many of the known groups who entered Mission San Juan had pre-mission locations near the coast (see Figure 2), we believe that the stable isotope values of the Mission San Juan residents represent a coastal hunting and gathering adaptation. Furthermore, we believe that the dominant Native population at Mission San Juan was originally from the coastal area of Texas and lived on a mission diet either intermittently or for a relatively short time.

Based on bone collagen turnover rates, a mission dietary signature should be acquired if an individual remained at the mission for at least 10+ years consuming a diet comprised primarily of maize and beef. Schuetz's (1980a) demographic work at Mission Valero demonstrates that 22 individuals actually occupied the mission from birth through adulthood (20 through 45 years of age). Therefore, if stable isotope analysis was conducted on a complete burial population, at least some individuals should have carbon and nitrogen values reflecting a mission diet. If the human remains analyzed from the "Old Church" at Mission San Juan are representative of the majority of Native Americans who entered the San Antonio missions, the stable isotope values suggest that neophytes did not remain at the mission long enough (10+ years) to have their isotope values affected by a mission diet. In addition, the demographic profile of Native American residents at Mission Valero is characterized by high infant mortality, disease, and desertions. This, combined with mission documents that refer to the continual recruitment of neophytes to replace declining populations, supports the conclusion that the major pattern of mission residency was of short duration. Furthermore, a coastal dietary signature does not run counter to the historical and archeological evidence that indicates that maize and beef were main staples of the mission diet in Texas.

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# The Gristmill at Mission San José y San Miguel de Aguayo: Insights into the Technology and Agricultural Focus of Spanish Colonial Texas

*James A. Neely*

**ABSTRACT**

An historical perspective is provided for the Mission San José and its gristmill, and a detailed description of the mill emphasizes its unusual technological design. I also evaluate the reconstruction of the gristmill under the supervision of Ernst Schuchard, and explore the origins and distribution of the side-shot, horizontal water-wheel technology employed in the San José mill. Lastly, I consider the adaptive qualities of the San José mill relative to technological, ecological, as well as economic and socio-cultural perspectives. In addition to providing insights into the agricultural focus and technology of Spanish Colonial Texas, this study defines the role of this gristmill as a part of the mission complex, and, in the process, contributes views into the religious and social ambience of a rural Spanish Colonial frontier settlement.

## INTRODUCTION

When I first visited the Mission San José and San Miguel de Aguayo, located in San Antonio, Texas, I was astonished to see the strong similarities in the architectural construction and technical operating principals of the San José gristmill in relation to those exhibited by the remains of Sasanian and Early Islamic mills that I found during an archeological study in southwestern Iran some 30 years ago (Neely 1969, 1974, 1998; Neely and Wright 1994).

A few years later, when I was asked to contribute a paper to the Third International Symposium on Cultural Adaptation at the Edge of the Spanish Empire (Institute of Latin American Studies, The University of Texas at Austin, March 1991), I naively thought that a reasonable subject would be an overview of the nature of Spanish Colonial milling on the Texas frontier with a focus on the San José mill. I soon learned that this goal was not attainable within the time frame available. As a result, my goals for this paper have been modified, and are neither as optimistic nor as ambitious as they were when I started.

This paper addresses a number of interrelated themes: (1) a brief historical overview of the mission and its gristmill; (2) the mill and its technology, as well as the origins and distribution of that technology; (3) the technological, ecological, and culturally adaptive qualities of the gristmill as part of the mission complex; and (4) the role of wheat vis-à-vis corn (otherwise known as maize) as a cultigen and agricultural product, as well as a staple of the diet in Colonial Texas and its environs. In the process of considering the role of the gristmill as part of the San José Mission complex, insights are contributed into the religious and social ambience of this rural Spanish Colonial frontier settlement.

## HISTORICAL PERSPECTIVE ON THE MISSION SAN JOSÉ AND ITS GRISTMILL

### The Founding of the Mission San José

In December 1719, Father Antonio Margil de Jesus (Presidente of the Missions of the College of Guadalupe) wrote to the Spanish Governor of Texas, Don Joséph de Azlor Virto de Vera—the Marqués of San Miguel de Aguayo—requesting him to authorize the founding of Mission San José as a mission of the Franciscan College of Zacatecas (Margil 1978). On January 22, 1720, Governor Aguayo (1978) responded with the "Decree of Aguayo," authorizing Lieutenant General Captain Juan Valdéz of the Presidio de San Antonio de Bexar to proceed with the founding of the Mission San José. In March of the same year, Captain Valdéz wrote a detailed account of the February 23, 1720 founding of the Mission San José (Valdéz 1978).

The mission's exact original location is not recorded; but it is known that it was established on the east bank of the San Antonio River, about 3 leagues (about 12-14 km) downstream (south) of the Mission San Antonio de Valero (later known as the Alamo) (Habig 1968a:84; Valdéz 1978:33). The possible first site of Mission San José has been tentatively located by archeological survey (Scurlock et al. 1976:133 and Map 4) about 1.9 km north-northwest of the mission's present location. Sometime prior to 1727 the mission was moved to the west side of the river (Rivera 1978), and in about 1740 (see Habig's comments in Ciprián [1978: 95]) the mission was relocated further away from the river to the place where it stands today (see Scurlock et al. 1976:Map 4).

With its third, and final, relocation, the mission was situated on a high, relatively old terrace of the San Antonio River, approximately 14.0 km south (downstream) of the Mission San Antonio de Valero. The San José Mission was located well away from the river; more than 650 m from the closest section of the old river channel (see Scurlock et al. 1976:Map 1). The Mission was constructed on a low ridge of the terrace, which extends as a large prairie to the north and east into the floodplain of the San Antonio River (Brown 1982:55; Clark 1978:9-10).

## AGRICULTURAL RESOURCE CAPABILITIES OF THE REGION

From the very founding of the San José Mission in 1720, the historical documents frequently make mention of the immediate region's rich soil, abundant land resources, and water resources in the form of springs and rivers (Rivera 1978; Santa Ana 1978; Valdéz 1978). In 1740, Father Benito Fernandez de Santa Ana remarked on the fertility of the land and soils in the region, as well as the capabilities of the San Antonio River. He states, "From its very origin, it is a river whose power can be used to run twelve mills" (Santa Ana 1978: 54). And, in reference to the *acequias* (canals) that provided waters for irrigation and the domestic needs of the five San Antonio missions (see also Cox, this volume), Santa Ana comments: "...this river shows no sign of diminution after accommodating five very abundant withdrawals but seems to be just as replete" (Santa Ana 1978: 55).

The reader may also obtain some idea as to the productivity of the soils and land from statements made by Padre Santa Ana (1978) in 1740 and Padre Ciprián (1978) in 1749 regarding the types and quantities of foodstuffs cultivated and harvested. These data may be further augmented by noting the increasing architectural construction, and subsequent enlargement of processing and storage facilities, as well as the inventories of foodstuffs (including the types and quantities of food) found in the San José granary, as enumerated in the inventories by Padres Marmolejo (1978) and Salas (1978) in 1755 and 1785, respectively.

These early observations, pertaining to the fertility of the soils in the San Antonio region, have been verified by David Brown's study of the region's soils and geomorphology. Brown (1982:60) states, for example, that the Missions Concepción and San José are surrounded by large areas of "Prime #1 farmland," the highest category of farmland rated by the U.S. Soil Conservation Service (Brown 1982:52). John W. Clark, Jr. (1998 personal communication) notes that the *acequia* and farm plots associated with the Mission Espada are still in use by some of the descendants of that mission's original inhabitants.

## PURPOSES AND GOALS OF THE MISSION

If one was to enumerate a list of ideal conditions or expectations that had to be met in order for a Spanish mission to be established and function well, those dealing with reliable and available water sources and arable lands would be preceded only by the need for a group of people that could be proselytized for conversion to the Catholic faith. By 1749, San José mission was widely recognized as not only an aesthetically pleasing architectural complex, but also as a mission that was efficiently achieving the purposes and goals of the Catholic Church and the Spanish Government (Ciprián 1978:97, 100; Vallejo 1978:105).

San José, like all of the Spanish missions of that era, functioned to Christianize the Indians and to provide a Hispanized community to reinforce the Spanish tenure of New Spain at its northern frontier against the threats of French incursion (see Santa Ana 1978:55-56). In order to achieve the latter goals, the Spanish endeavored to inculcate the Indian converts with the social values and customs of Spanish culture as well as to teach them useful trades (e.g., *vaqueros*, smiths, weavers, carpenters, etc.) so that they could become independent members of a Hispanized community. To facilitate this, the Spanish designed their missions to be comprised not only of religiously focused buildings to attend the sacred and spiritual goals, but also to contain a complex of workshops and work areas to fulfill the secular and temporal requirements (see Castañeda 1938:27). The reports and inventories of the 18th century political leaders and missionaries of the San Antonio region attest to the nature and increasing complexity of Mission San José's architectural components. In reading these reports, one also gains an appreciation for the role of the various kinds of architecture as material manifestations of the goals of the missions by noting their size and the permanence of construction, as well as the time and effort expended in their construction and maintenance (the latter is especially true relative to the canal systems).

## ARCHITECTURAL DESCRIPTION OF THE MISSION SAN JOSÉ

With its final relocation in about 1740, the permanent construction of the mission complex began. An adobe church with a flat roof had been built by 1744 (Espinosa 1964:758). By 1749, Father Ignacio Antonio Ciprián noted that there were several structures of stone that had been built at the mission: a convento with an arched formal entryway, a granary, as well as housing for the Indian residents (Habig 1968b:48-49). Father Ildefonso Marmolejo's 1755 inventory and report provides a very complete description of the mission. It is apparent that the church had been enlarged and elaborately decorated, inside and out. Although he does not mention the construction materials employed, it is likely that at least a portion of the church was made of stone. Marmolejo's description of the mission architecture includes the granary and the 84 stone houses of the village area, as well as the 12 stone houses of the hamlet or pueblo, with the latter probably located outside the mission's walls. He also mentions several workshops, many made of stone masonry, including a carpenter's shop, a blacksmith shop, a weaving shop, and a sugar mill (Marmolejo 1978:126).

In his 1768 report concerning the mission, Father Gaspar José de Solís states that the mission was protected by a surrounding compound wall that had four gates and two corner bastions. He also noted that the Indian quarters were built inside the compound, against a part of this wall, as well as the presence of a carpenter shop, a tailor shop, a blacksmith shop, lime and brick kilns, and a well (Solís 1931:19-21, 1978:144-145). Outside the compound were located the tannery, another smithy, a sugar mill, cattle pens, a *matadero*, and other structures. It was evidently at this time that, inside the compound, the original granary had been modified to a vaulted structure made of stone, and had been enlarged to hold more than 5000 bushels of corn and other crops. The interior dimensions of this enlarged granary are about 6.1 m wide, 30.5 m long, and 4.6 m high (Clark 1978:37). Finally, the report of Father José Francisco Lopez (1940) in 1789 notes essentially the same architecture.

Thus, in spite of the relatively well documented rapid growth of the mission and the construction of substantial, permanent architecture, there is no mention of a gristmill having been constructed or in service. In fact, in his 1791 letter to Governor Manuel Muñoz, Commandant General Juan Gutiérrez de la Cueva (1978:272) states that the area lacked "...grinders (i.e., gristmills?) for making pinole..." Furthermore, between 1791 and 1793 there are several references (e.g., Lava 1983a:17, 1983b:56, 1983c:27) to the purchase and shipment of manos and metates to the Mission San José and the other missions in the vicinity, indicating that the gristmill was not in operation. I should also mention that the sugar mill, noted in Padre Marmolejo's Inventory of 1755, was evidently a true sugar mill and, therefore, not to be confused with the gristmill. This is verified in the 1794 inventory of Governor Manuel Muñoz (1983:131), where both, "A water mill for grinding wheat that is operated by a running stream, but no [i.e., lacks a] dam [i.e., sluice gate?]," and "Another one [i.e., water mill] for pressing sugar cane," are listed. Thus, there were two completely different, but, as will be explained shortly, probably interrelated water-driven milling mechanisms and systems at Mission San José.

## HISTORY OF THE SAN JOSÉ MILL

Although a 1779 document (Croix 1779b) mentions that the Padre Presidente of the Missions intended to build a water-driven gristmill (*molino*), the first definite reference to the presence of a gristmill at Mission San José is in 1794. This definite reference appears in an inventory that has been attributed to the Governor of Texas, Don Manuel Muñoz (1983:131), but in fact was most probably authored by the Padre Presidente of the Mission San José, Father José Manuel Pedrajo. The general consensus is that the mill was designed and built by Padre Pedrajo (Guerra 1982:8, 38; Habig 1968a; Rio 1801:78-85); however, one might suspect that the design was by another person trained in such construction and that the mill was built by the mission Indians under that person's direction. As was often the practice of the time, the design and construction of the mill was probably attributed to Pedrajo because he was the Padre in charge of the mission and would have approved the building of the mill. Based largely on the gristmill not being mentioned in the inventory made for the "final secularization" of Mission San José (Díaz de León 1990:149-159; Musquiz et al. 1990:138-148), there has been speculation that the gristmill ceased to be used and fell into disrepair soon after the secularization of the missions in the 1794-1824 period. However, the report of the *alcalde* of Mission San José provides documentation that the mill for grinding wheat was in use in 1809 (Mandujano 1983:259, 264), and there is some evidence that it was maintained and used until about 1859 (Hoermann 1932:95, 110). The latter source, a historical novel written by Father Alto S. Hoermann, the Benedictine priest who was appointed prior of Mission San José and who made a special effort to save the convento, suggests that the mill was largely destroyed (sometime in the period between 1859 and 1864) by the occupants of the mission in an attempt to dislodge Indians attacking the mission who had taken refuge in the milling room and were using it as a defensive position.

Mention of the San José gristmill is not found again until 1933. Works Project Administration (WPA) workers, under the direction of Harvey Smith and Ernst Schuchard for the San Antonio Conservation Society, discovered the mill that year while excavating the *acequia* that passes just north of the mission (Schuchard 1936).

## DESCRIPTION OF THE MILL

As noted above, the present Mission San José was constructed on a ridge. The northern wall of the

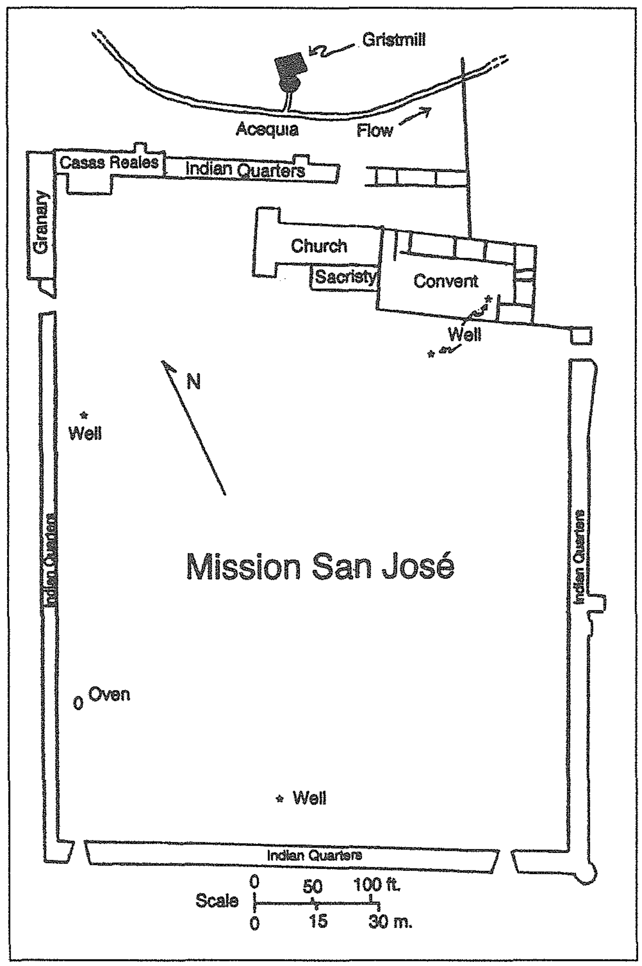


Figure 1. Plan view of the Mission San José y San Miguel de Aguayo, showing the locations of the gristmill and the *acequia* in relation to the Mission compound.

mission compound stands about 25 m south of the edge or scarp of this ridge. The main *acequia* courses generally from west-to-east between the ridge scarp and the northern wall of the mission compound. The gristmill was constructed into the steep face of the ridge, about 7 m north of the main canal (Figure 1; Clark 1978:Figures 1, 3). It was thus placed so that some of the water from the canal could be diverted for power to drive the mill-wheel. Once having driven the mill-wheel, the water flowed through the millrace toward the north, probably to fields and orchards for irrigation. The gristmill at the Mission San José may be best described in relation to its major architectural and technological component parts and how they interrelate.

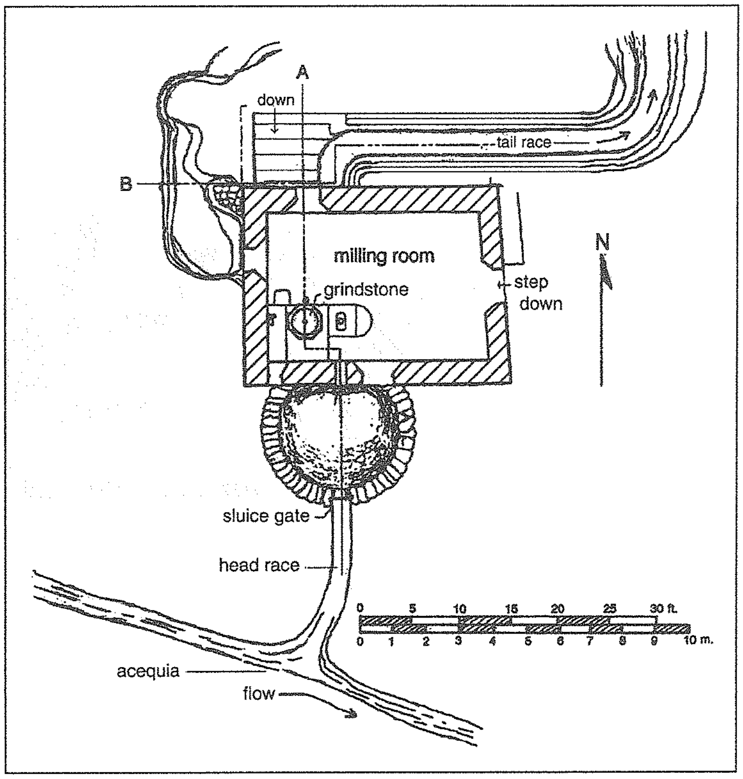


Figure 2. Plan view of the milling room, showing the relative locations of the *acequia*, the holding-tank or penstock, the grinding stone, the stairway down to the wheel room, and the tail race exiting the mill complex (after Minor and Connor 1973).

## THE ACEQUIA SYSTEM

A dam diverted water from the San Antonio River into an *acequia* about 2.3 airline km northwest of the mission (see Scurlock et al. 1976:Map 4). The relatively small, shallow, U-shaped canal had been excavated just upstream from the dam, and coursed from the point of its intake in a general west-to-east direction to pass only about 15 m north of the northern wall of the mission compound (see Figure 1). At a point nearly even with the center of the northern wall of the mission compound, a small, stone-lined, offtake canal branched to the north, forming the "head" of the millrace (Figure 2). The head race conveyed water about 4 m, at which point the water passed through a wooden sluice gate, to flow into a stepped, stone-lined "notch" (Figure 3). This "notch" had been constructed into the northern rim of a holding tank. The water from the head race subsequently flowed through the notch and into this holding tank.

## THE HOLDING TANK

This feature, also known as a "penstock" (Wulff 1966: 280), an "*arubah* penstock" (Avitsur 1960:40-41), and a "forebay" (McEachern and Ralph 1981:10), was located outside the mill house, but abutted against the southern walls of the wheel room and the milling room (see Figures 2 and 3). The holding tank was constructed of stones set into a thick mortar and then surfaced with a lime plaster to form a structure that was circular in plan view, and was an inverted, truncated cone in cross-section. The feature was 3.25 m in depth, its upper edge or rim was 3.5 m in diameter, and its flat floor was about 2 m in diameter. There was a small rectangular opening (about 25 x 30 cm) with a wooden gate (see Figures 2-3) at the bottom of this feature that led into the wheel room. One could reduce or cut-off the flow of water passing from the holding tank through this opening by sliding the small wooden gate downward in the guide slots located to each side. It was apparent that the wooden flume jet inside the wheel room extended from this opening and gate to direct water to the water-wheel. The function of the holding tank or penstock was undoubtedly to provide the pressure of a water column to supply a sufficient jet of water power to

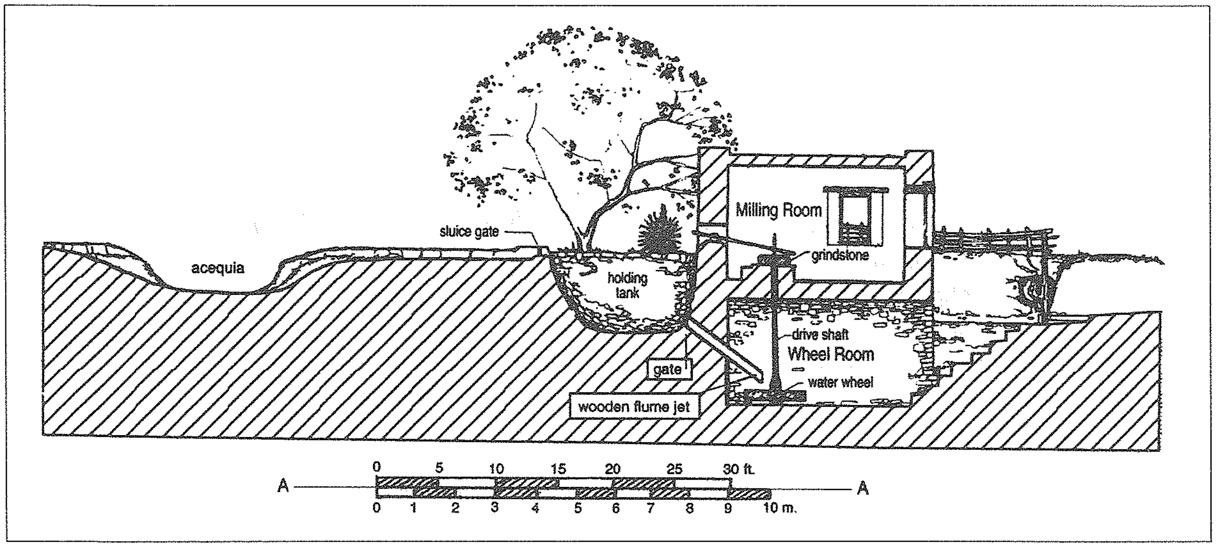


Figure 3. A north-south section (see section line "A" in Figures 2 and 5), looking west, through the gristmill complex, showing the relative vertical positions of the features shown in Figures 2 and 5 (after Minor and Connor 1973).

drive the water-wheel (see the "Adaptive Qualities" section, below, for additional discussion of the function of this feature).

## THE WHEEL ROOM

The wheel room had a vaulted ceiling (Figure 4); was rectangular in plan view (Figure 5); was oriented with its long-axis running north-south; and was constructed by cutting into the steep face of the ridge (see Clark 1978:Figure 11a). The long axis of this room lay under the western portion of the milling room. The dimensions of the wheel room were 2.28 m (E-W) x 4.20 m (N-S), and 2.75 m in maximum height. The water-wheel was located directly below the milling room (see Figure 3), and was attached, by means of a long, thick drive shaft of wood, directly to the uppermost of the two milling grindstones. The drive shaft and the upper grindstone could be raised (to disengage) and lowered (to engage) by means of an ingenious tram-rod framework that traveled in grooves constructed into the masonry side walls of the vaulted wheel room (see Figure 5). The water-wheel was about 1.60 m in diameter, and was situated at the back of the wheel room so that its outer edge rotated only a few centimeters from the wheel room's south wall. The holding tank's wooden flume jet extended through the south wall of the wheel room (see Figures 3 and 5) and was pointed downward at about a 35 to 40 degree angle. It is possible that the diameter of the wooden flume jet was further constricted by means of some sort of insert (see Avitsur 1960:40-41, 45 and Figures 1 and 2), thereby increasing the pressure of the jet of water striking the blades of the water-wheel or turbine. The flume jet was located above and slightly west of the eastern edge of the water-wheel. Water flowing through the penstock's

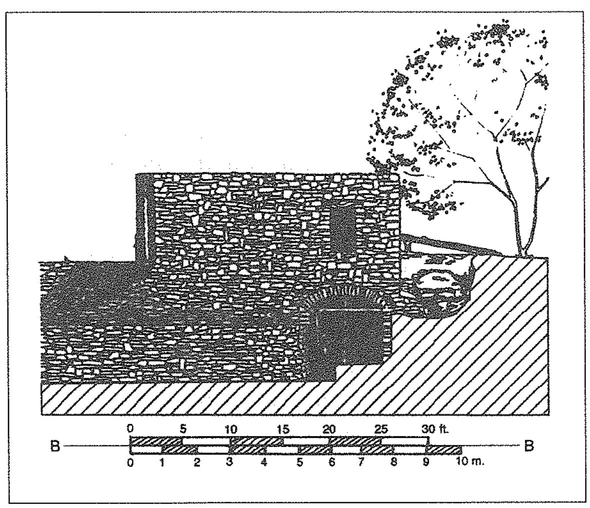


Figure 4. The north elevation, looking south, of the gristmill complex (see elevation line "B" in Figures 2 and 5). The entrance to the vaulted wheel room is in the lower right portion of the structure (after Minor and Connor 1973).

rectangular wooden flume jet would hit the upper and outer edges of the blades or "feathers" and drive the turbine-like wheel in a *counter-clockwise* direction. As will be noted later, this direction of the wheel rotation is extremely significant in determining the possible origins of this technology.

The wheel room was constructed of mortared stone masonry with a floor of large flagstones. Excavation revealed that the flagstone floor of the room extended outward to the north. At the west side of the entrance to the vaulted wheel room, a set of stone stairs led upward to the ground surface (see Figures 3 and 5). To the east of these stairs was found an open area leading from the room at its floor level (see Figure 5). This open area became a type of canal that served as the "tail" of the millrace and led northward for about 3 m, where it abruptly turned eastward to parallel the milling room construction for another 8 m, and then again abruptly turned northward to continue as a traditional canal to supply waters to what very probably were irrigated farmlands (see Figures 2 and 5).

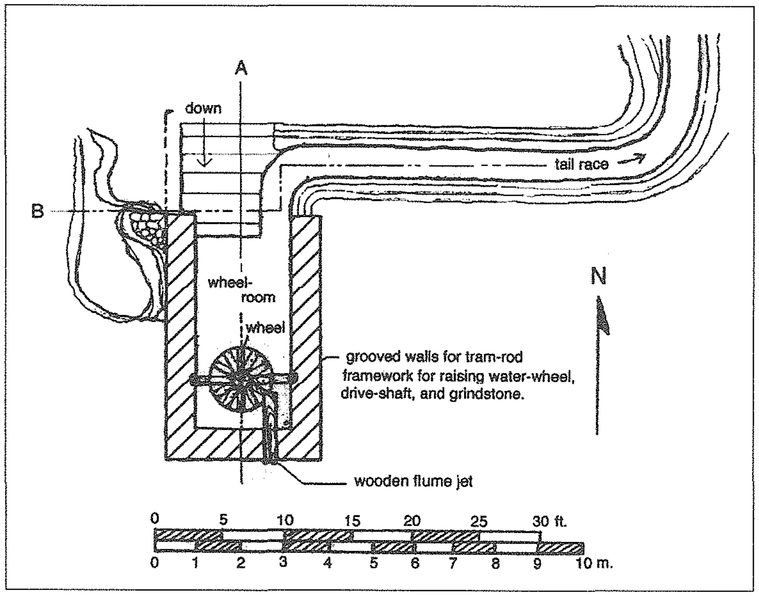


Figure 5. Plan view of the wheel room, showing the relative locations of the penstock flume jet, the water-wheel, the stairway down to the wheel room, and the tail race exiting the mill complex (after Minor and Connor 1973).

## THE MILLING ROOM

The western half of the milling room is situated immediately above the wheel room (see Figures 2-4). The milling room was largely reconstructed by Ernst Schuchard in the 1930s. The interior workings (i.e., the grain milling equipment and machinery) of this structure have been completely reconstructed (see Figure 2). However, the rectangular form of the structure, the average width of the masonry walls (68 cm), and the interior dimensions (4.3 m [N-S] x 6.25 m [E-W]) of the single room are accurate according to the remains found during its excavation.

## THE GRISTMILL RECONSTRUCTION

In 1924, the San Antonio Conservation Society was established to save the river, historical buildings, as well as the missions, and took on the Mission San José as a major project. Harvey P. Smith, Sr., Jack Beretta, and Ernst Schuchard directed the excavations and were in charge of the restoration studies and work at Mission San José. Smith, Sr., who was supervisor of all of the reconstruction activities, was a member of the American Institute of Architects. Schuchard, who was an engineer and Secretary of the Pioneer Flour Mills of San Antonio, was assigned by his employer to assist with the mission reconstruction. Evidently because of his interest in, and knowledge of, milling and milling technology, Ernst Schuchard supervised the reconstruction of the gristmill. The overall reconstruction of Mission San José was done under the auspices of several agencies: funding was provided by the San Antonio Conservation Society and the Catholic Archdiocese of San Antonio, while labor was provided by the WPA and Bexar County, Texas.

Work was begun at the San José Mission in November 1932. In that same year the clearing of the *acequia* was begun, but continued into 1933. The offtake canal to the gristmill was found in 1933, and the excavation of the gristmill took place in 1933 and 1934. The reconstruction of the gristmill was started in 1936 and completed in 1937 (Schuchard 1936, and Schuchard's notes and drawings in the Daughters of the Texas Revolution Library, San Antonio, Texas). Thus, the mill that is seen today is the result of some four years of research and manual labor. The excavation of the mill was sponsored by the San Antonio Conservation Society. The Colonial Dames of Texas furnished the money for the reconstruction of the mill building. The Pioneer Flour Mills built and installed all of the replicas of the old mill machinery.

Apparently the only reports concerning the four years of work on the Mission San José gristmill were two short articles published in equally obscure journals. Both of these articles, one published by Smith, Sr. (1935) and the other by Ernst Schuchard (1939), described the excavation of the gristmill and its subsequent reconstruction. In spite of their brevity, these articles provide excellent information relative to what was found during the excavation of the mill, and on what extant data the gristmill reconstructions were based.

Evidently the holding tank, the wheel room, and the milling room, as they are seen today, are either as they were found, or reconstructed accurately to the form indicated during the last use of the mill. There are three exceptions to this statement: (1) the nature and height of the upper walls, the locations of the windows, and the form and construction of the roof of the milling room (in this regard it appears that Schuchard followed, at least in part, the description presented by Hoermann [1932]); (2) the majority of the internal characteristics of the milling room, including the grain milling equipment and machinery; and (3) the exact nature of the wooden flume jet and the turbine-like water-wheel in the wheel room.

One might wonder about Schuchard's interpretation of the technological and architectural data exposed during the WPA excavations. In my opinion, his interpretation that a horizontal or "side-shot" water-wheel was present is accurate. I also generally agree with his reconstruction of the mill's equipment, mechanics, and architecture based on the tangible evidence found during the excavation of the San José mill (Schuchard 1936), and on comparative information from similar gristmills found elsewhere (see "Origins and Distribution" section below).

It is possible that more precise information, useful in the process of reconstruction, might have been recovered during the excavation of this gristmill. However, this cannot be determined since the excavation was not accomplished by an archeologist using more modern, controlled archeological excavation methods.

## FURTHER OBSERVATIONS RESULTING FROM THE STUDY OF THE SAN JOSÉ MILL

I had several expectations at the start of this study, namely that the San José gristmill was, perhaps, a rather unique phenomenon on the Spanish Colonial frontier; that the mill was built shortly after the founding of the Mission; that the choice of the gristmill technology was largely based on cultural preference; and that there was planting, harvesting, and use of much wheat with the beginning of the Spanish Colonial period. However, as my research on the gristmill progressed, I discovered that these were preconceived assumptions that were not true.

## THE ORIGINS AND DISTRIBUTION OF THE SIDE-SHOT, HORIZONTAL WATER-WHEEL TECHNOLOGY

I was surprised to find that gristmills of the type at the San José Mission have a greater antiquity and a much broader distribution than I had imagined. This type of gristmill, having a horizontal or "side-shot" water-wheel, an early form of turbine, has been variously called the "Norse" mill and the "Greek" mill in the literature (e.g., Forbes 1955, Vol. 2:89; Forbes 1957; Singer 1957, Vol. 2: 593-595; Wulff 1966:280). It is seen to have had a long history of use and a distribution that spans the area from China through the Middle East to western Europe, from Denmark and the British Isles south to Portugal, Spain, Sicily, Italy, Greece, as well as parts of North and South Africa.

While my discovery of this type of gristmill on the Deh Luran Plain of southwestern Iran (Neely 1974) in association with the Early Sasanian period occupation (ca. A.D. 225-425) represents one of the earliest well-dated examples of this mill technology, there are evidently earlier examples from both Greece and what is now Turkey. Such technology can be traced back to at least 85 B.C., when Antipater of Thessalonica makes reference to a similar gristmill (Anderson 1935; Bennett and Elton 1899, Vol. 2:6; Forbes 1955, Vol. 2:89). Strabo states that the Parthian king Mithridates constructed a comparable mill for his palace in Pontus in 65 B.C. (Anderson 1935; Bennett and Elton 1899, Vol. 2:7; Wulff 1966:280).

Perhaps as a statement of, and tribute to, its efficiency in certain environmental situations, it is interesting to note that gristmills with this relatively simple technology have persisted in use into modern times throughout the Old World. Alphabetically by location, such gristmills have been found functioning into the 19th and 20th centuries in: Azerbaijan (Wulff 1966); China (Hsing 1966); Crete and Cyprus (Reynolds 1970); Denmark (Steensberg 1952); England and Wales (Wilson 1960); Faeroe Islands (Williamson 1946); France (Wilson 1960); Germany (Wilson 1960); Greece (Curwen 1945; Hunter 1967); the Hebrides and Orkney Islands (Curwen 1938); Iran (Beazley 1965, 1977; Neely 1969, 1974, 1998; William Sumner, 1977 personal communication; Wulff 1966:280-283), Ireland (Goudie 1886; Lucas 1953); Isle of Man (Wilson 1960); Israel and Palestine (Avitsur 1960); Norway and Sweden (Reynolds 1970); Portugal (author's 1994 personal observations; Oliveira et al. 1983; Wade 1990, 1993); Rumania (Reynolds 1970; Wilson 1960); Shetland Islands (Beasley 1963; Goudie 1886); Sicily (Ayala 1993); South Africa (Reynolds 1970; Wilson 1960); Spain (Hunter 1967; Rosselló i Verger 1989); Switzerland (Reynolds 1970); Turkey (Bryer 1978; Makal 1949; Stirling 1965; Wagstaff 1973); and Yugoslavia (Hunter 1967). I suspect this form of mill was present, and may still be in use today, in other rural areas of the Old World as well.

As yet, the date and place of origin of this technology is not known. However, as noted above, it evidently predates 85 B.C. And, because of two characteristics, it seems more likely that the origin of the Spanish Colonial mills can be traced to somewhere in the Mediterranean area or the Middle East. The two most characteristic attributes that are associated with the Mediterranean and Middle Eastern gristmills are: (1) the use of the water-tower or penstock to build a head of water of sufficient power to efficiently turn the water-wheel; and (2) the *counter-clockwise* direction of rotation of the water-wheels in Mediterranean and Middle Eastern mills, which is regionally quite distinct from the *clockwise* direction of rotation of the water-wheel in the gristmills of northern Europe (Curwen 1944; Storck and Teague 1952:97). The introduction of the side-shot, horizontal water-wheel gristmill to the New World seems most likely to have taken place by means of a Spanish vector; taking the technology first to Mexico and South America, and then northward to the Colonial frontier of what is now Texas, New Mexico, and California.

There is plentiful evidence for the construction of gristmills in Mexico as early as the mid-16th century. Within a few decades they had become quite numerous in the main areas of wheat production. Unfortunately, the documents are remarkably lacking in descriptive details of the mills and their functioning technology. If the precise location of at least one of the 16th century Mexican gristmills can be determined, a detailed archeological excavation of that site would be well warranted.

Zavala (1982) notes that between 1551 and 1552 there was a large number of requests for governmental permission to construct gristmills in the state of Michoacán. In the state of Puebla, Prem (1978:200-201, 299) reports that, in the area of Atlixco and Huetjozingo, permits for at least 23 gristmills were submitted between 1542 and 1640. Between 1557 and 1559, the Franciscans constructed a gristmill in eastern Puebla, in the San Pablo Valley (Licate 1981:109). In the Basin of México, between 41 and 66 licenses to build gristmills had been granted between 1581 and 1607 (Prem 1992:457). Two of these mills were built in the San Juan Teotihuacan Valley, located some 35 km to the northeast of Mexico City. These two mills have also been recorded on maps that show the presence of these structures along canals or streams. One of these maps dates to 1581 (Acuña 1986:214-215; Nuttall 1926:41-84), while the second map dates to 1585 (Archivo General del Nación [México] Tierras, Vol. 1649, exp. 1, f. 12-AGN Catalog No. 1167). Gibson (1964:79) also briefly mentions the presence of gristmills in the area of Tepetlaoztoc, a *cabecera* located in the Acolhua foothills to the northeast of Texcoco, dating to the mid-17th century.

Ernst Schuchard discovered a mill near Mexico City in 1937 that had two adjacent horizontal water-wheels in the same structure. The mill was part of a large hacienda complex known locally as the "Molino de Flores" (Schuchard 1939:9). Recent correspondence with Thomas H. Charlton (1995 personal communication) has revealed that the gristmill Schuchard referred to is most likely part of the Hacienda Molino de Flores that is located just 3 km east of the city of Texcoco on the road to the Baths of Netzahualcoyotl, between Texcoco and San Miguel Tlaixpan. A rapid investigation into the hacienda mentioned by Charlton indicates that the hacienda is now part of the "Parque Nacional Molino de Flores-Netzahualcoyotl" (SEDUE n.d.). A review of the index of *Mercedes* in the Archivo General de la Nación (Colin 1967:343-344) indicates that in 1585 Pedro de Dueñas was granted a *merced* to construct a gristmill at his hacienda in the barrio of Tuzcacuaco. This hacienda subsequently had several owners. After 1667, the hacienda became the property of Don Antonio Flores de Valdez, and was from that time known as the "Molino de los Flores," later becoming "Molino de Flores." Charles Gibson (1964:331) notes that: "A series of remarkable letters written between 1775 and 1765 by the administrator of the Hacienda de Molino de Flores near Texcoco to the hacienda owner in Mexico City describes more fully than any other known documents the daily life and economy of the late Colonial hacienda."

The index of *Mercedes* (Colin 1967:344) also lists two other mills that existed in the vicinity of Texcoco in 1586: one constructed by Don Juan Maldonado de Montejo in the barrio of Cuzquana and the second owned by Francisco García. From the way this *merced* is worded, it appears that the gristmills of Don Juan Maldonado de Montejo, Francisco Garcia, and Pedro de Dueñas were situated, in that respective order from upstream to downstream, along the Rio Coxcacuacos. Although direct evidence is lacking, it is assumed that these two mills employed the same technology as that evinced at the Molino de Flores.

South of Mexico, there is also evidence of gristmills utilizing this technology. There may well be a gristmill of this type in El Salvador that dates to the 16th or 17th century (William R. Fowler, 1995 personal communication). David O. Brown (1995 personal communication) reports two mills in Ecuador that definitely have the horizontal water-wheel technology. One of these, at the Hacienda de Todos Santos near the town of Cuenca, dates to ca. 1547. The second is a system of four water-wheels in a single building at the Molinos de Monserrat, also near Cuenca, evidently constructed by the Spanish Jesuits in 1756.

Returning to the northern Spanish Colonial frontier in Texas, the literature indicates that there were at least three gristmills employing the horizontal water-wheel technology that had been constructed in the San Antonio area in the mid-to late 1700s. The earliest, according to A. T. Jackson (1971:10-12), was a mill named the Molino Blanco. It was constructed on the San Antonio River not far from the Alamo in 1733, and was in operation until about 1830. This mill is reported to have had the same horizontal water-wheel technology as that of the San José mill. I have as yet found no other reference to the technology employed at, or the early date given to, this mill by Jackson.

In about 1780, or a little later, a mill was built for the Mission Nuestra Señora Purisima Concepción de Acuña, located on the east side of the San Antonio River about 900 m north-northwest of the Mission San José (Ivey et al. 1985:193). The mill was probably constructed in response to the 1778 order given by Governor Domingo Cabell for all the missions to begin growing wheat and barley (Morfi 1935:229, 1967:105), and commented on in the letter of Teodoro de Croix (1778). It was evidently situated on the steep bank of the San Antonio River about 270 m north of the mission, where the mission road from the Villa de San Antonio passed close by the river. This location was a good deal further from the mission than was the site of the San José mill. A branch of the Mission Concepción *acequia* supplied water to power the mill. Its design is reported to have been the same as that of the San José gristmill. I have not yet found further data pertaining to this mill.

The San José gristmill, apparently constructed in about 1794, was thus the third mill to be constructed in the San Antonio region. It may also have been constructed in response to the 1778 orders to grow wheat and barley given by Governor Cabell.

After about 1824, however, a number of similar mills were constructed in the San Antonio area and other parts of Central Texas. For example, the Yturri-Edmunds mill was constructed about 1.1 km to the north-northeast of Mission Concepción in about 1824 (Scurlock et al. 1976:107). Also in the San Antonio area, the Ashley mill was driven by a turbine water-wheel (see Scurlock et al. 1976:Figure 48a), and may have had this form of wheel since about 1838 with the construction of its variously named predecessors (Scurlock et al. 1976:235). The Higginbotham-Kerr mill was founded in about 1842 (Scurlock et al. 1976:56). Furthermore, other gristmills in Central Texas with horizontal water-wheels dating to the 1850s (such as the mills at McKinney Falls State Park [McEachern and Ralph 1981] near Austin, Texas, and at the Landmark Inn State Park [Parsons and Burnett 1984] near Castroville, Texas) indicate the technology survived and flourished into the mid-19th century and later.

The technology of operation of the San José mill was evidently not restricted to the Central Texas area, for A.T. Jackson (1971) reports the presence of similar mills during the Colonial Period in two other locations in Texas. A mill, employing a horizontal water-wheel, was built at San Agustine de la Isleta on the Rio Grande in El Paso County, approximately 15 km southeast of the present city of El Paso. It functioned from about 1718 to 1790 (Jackson 1971:5). The second Colonial gristmill mentioned by Jackson was constructed at the Mission Nuestra Señora de los Dolores de los Ais. It is near the modern town of San Augustine and about 50 km east-southeast of the present city of Nacogdoches, Texas. This mill had a horizontal water-wheel, and was in operation from 1721 to about 1773, or perhaps a bit later (Jackson 1971:5). Jackson does not provide sources for his information on these two mills, and I have not as yet found mention of them elsewhere in the literature.

In addition, I have found reference to the use of this same gristmill technology in several locations outside of Texas. New Mexico has many mills that used horizontal water-wheels. A few of these are still in operation or have been reconstructed to working order. They are found in the more isolated Hispanic communities in the northern part of the state. Such mills have been reported for the communities of Manzano (Torrance County); Peña Blanca (Sandoval County); Ojo Caliente (Taos County); Chamita and Chimayo (Rio Arriba County); as well as Santa Cruz, La Cienega, Pojoaque, and Nambe (Santa Fe County). The earliest of the New Mexico gristmills, with horizontal water-wheel technology, was evidently constructed in the city of Santa Fe, and dates to 1756. By 1776, Santa Fe had three such mills in operation. Charles Gritzner (1974), a geographer, has located approximately 50 mills of this type in New Mexico.

Four Spanish Colonial period gristmills of this type have been recorded in California (Ward and Kurutz 1974:142-146). The earliest of these mills was evidently constructed in 1794 in the northern part of the state at the Mission Santa Cruz. Another was constructed at the Mission San Gabriel Archangel, near Pasadena, California, sometime between 1810 and 1823. The third mill was built at the Mission San Antonio de Padua. The fourth California gristmill that could be determined as having this technology has been reported at the Mission San Louis Obispo.

It seems very likely that there were many more gristmills located throughout Mexico, and along the Spanish Colonial frontier in what is now the greater American Southwest. Although gristmills do not seem to have been important enough, or unusual enough, for the chroniclers to focus upon, one can often come across tantalizing passing references to the existence of mills that are usually exasperatingly void of detail. For example, Dunne (1948:217) relates the inventory for the mission pueblo of Satevó, located about 77 km south-southwest of Chihuahua City, for the year 1753. In this inventory there are references to: "...a well-equipped mill..." and "Near the mill was another piece of ground..." (Archivo General de Indias, Audiencia de Guadalajara 67-4-2).

## THE ADAPTIVE QUALITIES OF THE SAN JOSÉ MILL AND ITS TECHNOLOGY

The adaptive qualities of the San José mill water-wheel may be considered in three complimentary, interrelated perspectives: (1) a general, technological perspective; (2) a specific, ecological perspective that is relevant not only to the San José mill but the majority of the mills found to employ the horizontal water-wheel technology; and (3) an economic and socio-cultural perspective.

### The General, Technological Perspective

Relative to the mano and metate, the water-driven mill was undoubtedly a more efficient device. Two questions that arise, however, are just how much more efficient was it and was there a difference in the type of efficiency seen? A recent experiment (Mauldin 1993) measured the amount of time it took a woman experienced in the use of the mano and metate to process one kg of toasted corn to flour. The results of this experiment, seen to vary according to the size of the grinding area of the mano and metate, ranged from about 18 minutes for the smallest mano/metate set used to less than 6 minutes with the largest mano/metate set (Mauldin 1993:319). The rate of flour production of gristmills with horizontal water-wheels is also quite varied, depending on the size of the water-wheel and the grinding stones; the type, condition and weight of the grinding stones; as well as the velocity of the grinding stone rotation. The sparse flour production data I have been able to assemble for relatively small, rural gristmills range from about 3.5 kg per hour for very small mills in Deh Luran, Iran (Abdula Javadi, 1969 personal communication); 10 to 15 kg per hour for small mills of this type in the mountainous northeastern region of Portugal (Wade 1993:39); 27.3 kg per hour for mills in Shetland (British Isles) (Goudie 1886); 50 to 60 kg of meal per hour for medium size mills in Ancora, Portugal (Wade 1993:39); and 68.3 kg to 151.8 kg per hour (depending on the flow of water available) for a mill in Shiraz, Iran (Wulff 1966:280-281). Unfortunately, there is no productivity data for the San José mill, and even an estimate would be difficult because there is no information as to the exact nature and size of the water-wheel and other parts of the grinding machinery. However, even if we assume that small, very crude water-driven gristmills of this type were only as productive as the hand-manipulated mano and metate relative to the volume of grain processed per hour, the water-driven gristmill can still be considered to be more efficient as it could be more easily operated continuously for 24 hours a day.

In relation to water mills of other design, how efficient was the side-shot horizontal water-wheel technology of the San José mill? Dr. Paul L. Czibesz (1953), an engineer affiliated with the Southwest Research Institute in San Antonio, Texas, considered the technological design of the San José mill's water-wheel to be quite efficient. Czibesz stated that, in spite of its rustic and rather primitive construction, using mostly wood rather than metal for its component parts and bearing surfaces, the horizontal "turbine" water-wheel design may be judged to have been approximately twice as efficient as the overshot and the undershot vertical water-wheels. He based his judgment as to this greater efficiency on two factors. First, it is a more efficient use of the pent-up or stored potential power or energy of a stream of water. Second, in spite of the relatively primitive and high friction characteristics of the materials of construction, the direct-drive nature of the San José system, where one rotation of the water-wheel resulted in one rotation of the milling or grinding stone, was more efficient than the geared overshot or undershot water-wheels where the vertical motion of the water wheel had to be converted to the rotation of a horizontal milling or grinding stone. The latter observation may be fundamentally correct, however, Dr. Czibesz does not mention the relative efficiency of the horizontal water-wheel as compared to the overshot or undershot water-wheel when the motion of the vertical wheel is converted, by gearing, to produce several revolutions of the milling/grinding stone for every single rotation of the water-wheel. John W. Clark, Jr. (1998 personal communication) observes that the use of wood for gears, shafts, bearings, etc., in the construction of gristmills and other mechanical contrivances was quite common well into the 19th century in Texas and northern Mexico.

Another aspect of the technology incorporated in this mill, that may have played an integral role in its efficiency, was not considered by Czibesz. The particular design of the side-shot horizontal water-wheel lends itself well to the use of a component feature that is often found in association. The associated holding tank or penstock provides the pressure of a water column to supply a sufficiently powerful jet of water that is great enough to overcome the weight, inertia, and friction of the system in order to start the water-wheel rotating. This jet of water subsequently also imparts a vortex action to the water that has collected on the floor of the wheel room. This vortex action, in turn, serves to speed-up the wheel rotation and thereby achieves greater efficiency in the milling process.

We might consider the efficiency of the horizontal water-wheel at the San José Mission in relation to yet another factor. Clark's (1976) interpretation of a masonry feature, found in his 1974 excavations just north of the San José canal and just east of the gristmill, provides additional information on the gristmill complex. Clark interprets the feature he found as being part of the mission's *Ingenio* (sugar mill) complex. Since Governor Muñoz' (1983:131) inventory states that, by 1794, the sugar mill was water-powered, Clark makes an argument for the sugar mill being attached to, and driven by, the water-wheel of the gristmill. Although Clark (1991 personal communication) now has some doubts that the feature was as he originally interpreted it, I still find his argument viable and intriguing. Since we know that sugar processing required a great deal of water and that the sugar mill was water-powered, there were few, if any, other reasonable places in the San José mission complex where it could have been located to obtain the water required. The point being that the technological efficiency of the San José Mission horizontal water-wheel was increased if, in fact, it powered two mills.

## The Specific, Ecological Perspective

Another consideration of the adaptive efficiency of the San José mill may be seen in its topographic location or situation in relation to the quantity of water available at a high enough velocity to drive the water-wheel. A review of the literature that describes the topography and water supply of the immediate environs of the gristmills that employed this form of horizontal water-wheel indicates that they were located in or on hilly or steep terrain and that the quantity of water available was relatively small and/or that the velocity of the water flow was relatively slow. In other words, the horizontal water-wheel and its associated holding tank or penstock technology permitted the use of a gristmill where the extant topography of the land would not have readily permitted the construction of a vertical-wheeled mill and where a relatively small and/or slow flow of water would not have been sufficient to efficiently run a mill of the vertical-wheeled design.

## The Economic and Socio-Cultural Perspective

Having established the technological and ecological efficiency of this milling machinery, one may see certain distinct advantages to the changes that took place in the processing of grains at Mission San José. However, "efficiency" and "advantages" are seldom the sole motivation for changing long-lived traditions. What were the factors that influenced the change from the old technology (i.e., mano and metate) to the new gristmill and from the old staple crop of corn to the introduction of wheat? This section discusses some possible economic and socio-cultural motivating factors that led to these changes.

Let me first deal with the gristmill. As has been amply illustrated, my assumption that the gristmill was built shortly after Mission San José had been moved to its third, and present, location was evidently not correct. A search of the archival documentation and archeological literature indicates that the task of grain processing at the San José Mission was accomplished by hand, using the simple technology of the mano/metate and mortar/pestle, prior to the construction of the gristmill.

The presence and use of the mano/metate and/or mortar/pestle in most, if not all, of the Indian houses at the San José mission, as well as in the mission's kitchen, is indicated in three very complete inventories of the mission by Padre Marmolejo (1978:115) in 1755, Governor Barrios y Jauregui (1978:131-132) in 1758, and Padre Salas (1978) in 1785. There are also accountings for the years 1792 and 1793, by the Father General Ygnacio Maria Lava (1983a:17, 1983c:27), that list metates as one of the items in the supplies being sent to the San José mission from Zacatecas, México. The origins and history of the mano/metate and mortar/pestle in the San Antonio area has not yet been thoroughly researched. However, it is known that there was a long history of Indian manufacture and use of these tools in the processing of wild foodstuffs (Fox 1989:32). My preliminary research indicates that the first manos and metates used at the San José mission were probably very similar to the traditional one-handed, modified-cobble manos and the only slightly modified slab or boulder metate types found in the prehistoric sites of the region (e.g., Hall et al. 1982:372-385; Hall et al. 1986:320-331; Jelks 1962:54-55). Later, however, the more stylized and formalized footed-metates from Mexico became more prevalent.

But why was the gristmill not constructed earlier in the history of the San José mission, and why was it finally built in 1794? The answers to these questions are not readily evident from the documents of the time, and it seems likely that there may well have been several interrelated answers to each of these questions, rather than just one. As will be expanded upon below, however, it is evident that corn, and not wheat, was perhaps the only grain cultivated in the San Antonio region until about 1779. This may have been at least part of the reason why the gristmill was not introduced until wheat was included as part of the grain crop: because the gristmill was able to grind wheat more efficiently (i.e., produce a finer flour) than the mano and metate. The tradition of mano and metate use, and more specifically the grinding of corn with the mano and metate, had by the 1700s been firmly imbedded in the Indian cultures of what is now Northern Mexico and Texas. However, in addition to this imbeddedness of tradition, discussed more fully below, there may well have been two other explanations for the questions posed above.

First, as has been pointed out by Wade (1993:97-103), one possible reason why the gristmill was not constructed at Mission San José may well have been due to the complex interrelationship of the general goals of the mission: to attend to the Indian's sacred and spiritual needs as well as to fulfill their secular and temporal requirements. In Spain's religiously-oriented value system and moral discourse, dedicated secular work, that fulfilled the temporal requirements of life, also served to fulfill the sacred goal of spiritual salvation of the sinners (i.e., the Indians). In his poem "Carmen for King Robert," Adalbero, Bishop of Laon wrote: "...some were to order, some to obey and those that obeyed, as punishment worked" (Duby 1980:50-55, 165-166). Thus, the labor-saving gristmill may purposefully not have been introduced by the friars so that the Indians had plenty of work to do throughout the year.

Second, the timing of the introduction of the gristmill at Mission San José may have been the result of at least four factors. The first of these may have been the demand in the late 1700s for such technology by the general non-Indian populace of the San Antonio area. This demand came from the desire to produce a product (i.e., flour) that would not only be locally consummed, but would also be tradeable or saleable outside of the region (see Croix 1779b). The second factor may have been the 1778 orders and urgings by the political and religious leaders from Mexico for the Texas missions to start growing wheat. This encouragement was probably based on their desire to make the Texas missions more self-reliant in the food they produced so that staples did not have to be imported from Mexico. In addition, since the wheat crops had failed in Iberia over the previous few years, they may have looked upon Texas as a possible source for wheat to be exported to Spain. Third, with the onset of the secularization of the missions, the missions were slowly losing their labor force as the Indians left. A gristmill would have allowed the time and energy of a reduced work force to be reallocated from grain processing to other necessary tasks. Fourth, and finally, as will be discussed below, it appears that Mission San José was given the responsibility of supplying foodstuffs and other materials to the other San Antonio missions, as well as to several presidios. Thus, it may have been due to several of the preceding factors, and very probably some that have yet to be defined, that the gristmill was constructed at Mission San José.

There are several bits of information that would suggest that at least some of the tentative explanations presented above are correct. Jackson's (1971:10-12) reference to the *Molino Blanco* and Croix' (1779b) notation concerning the cattle-driven mill (*taona*), both situated in San Antonio, certainly indicate that the secular farmers were grinding flour, and thereby would have presented an economic competition and threat to the missions. Also, while Mandujano's (1983:264) 1809 census of Mission San José specifically mentions that San José, "....maintains a mill that still grinds wheat," Salcedo's (1983) general census of 1809 does not mention the presence of a gristmill at the other three missions in the San Antonio area. The information supplied by these two documents implies that San José may have been grinding flour for all of the missions. The extremely large granary at Mission San José, mentioned above, would perhaps also suggest that it may have been the repository of foodstuffs from and for the other missions in the area. In addition to the competition with the secular populace of the area and supplying the three other major missions in the area, San José had yet a further economic burden: to furnish supplies to the presidios of San Antonio, La Bahía del Espíritu Santo, San Saba, El Orcoquisac, and Los Adaes. This is indicated in the 1767-1768 report on Mission San José written by Solís (1978:145, 157).

Quite admittedly, the case I have built above is based on circumstantial evidence. In addition, there are some inexplicable factors that throw some doubt on my reconstruction. For example, the alleged presence of a gristmill built for Mission Nuestra Señora Purisima Concepción de Acuña in about 1780, or a little later (Ivey et al. 1985:193), certainly presents problems relative to the explanation presented above. The problem in evaluating this inconsistency is the fact that I have not been able to find any other reference to, or information about, the alleged mill at Mission Concepción. On the other hand, even if further evidence for the existence of the Mission Concepción mill does come to light, it is possible that the Mission Concepción mill was no longer functioning or was shut down when this mission was partially secularized and put under the authority and control of Mission San José in 1794 (Cárdenas 1983:156; Guerra 1982:38). In spite of these considerations, I feel that it has been worth the effort to present tentative explanations for the questions posed.

Now let me turn to the subject of wheat. My search of the literature led me to question my original assumption that wheat was the primary grain being planted, harvested, and consumed by the occupants of the San José Mission from its founding throughout its occupation. Although early 18th century descriptions of the San Antonio region laud its rich soils and irrigation potentials in relation to the cultivation of wheat (Rivera 1978; Santa Ana 1978; Valdéz 1978), it is evidently not until much later that wheat was actually cultivated in the San Antonio region. The earliest definite mention of the cultivation of wheat and barley in the San Antonio region occurs in four documents dating from 1779. Two of these documents relate disastrous events: (1) the loss of a large wheat and barley crop in the San Antonio region due to a bad storm, and (2) the Apache Indian destruction of wagons, traveling from Mexico to the San Antonio area, that contained seeds to be used for planting wheat and barley crops (see Gunn [1982:249] as it relates to Watkins and Gunn [1982:195]). The first of the other two documents comments on the sowing and harvesting of wheat, corn, beans, and barley (Croix 1779a), while the second notes that the local farmers have no incentive to grow corn or wheat in greater quantities than they can consume themselves because they cannot sell the surplus (Croix 1779b). The earliest definite mention of wheat that I have found specifically for Mission San José is in the inventory of Governor Muñoz (1983) in 1794 (this is the same document where the gristmill is first mentioned). As noted previously, the trend toward the cultivation of wheat may well have been a direct result of the order presented in 1778 by Governor Domingo Cabell (Morfi 1935:229, 1967:105) and the letter of Teodoro de Croix (1778).

Prior to 1779, the only grain mentioned, and it is mentioned quite frequently, is corn or maize. It is mentioned relative to its cultivation and harvesting, relative to the productivity of the lands or fields, and relative to the amounts of grain stored in the mission's *bodegas* or granaries. After the 1779 reports, wheat is mentioned, albeit infrequently, in all of the above-mentioned relationships.

Two questions immediately arise from the above observations: (1) when was corn introduced to the San Antonio region, and where did it come from?; and (2) why was wheat not mentioned, and evidently not grown and harvested, until so late in the history of the San Antonio region? The answers to these questions are not readily available and appear to be quite complex. Again, it is likely that there may well be several interrelated answers to each question, rather than just one.

At the onset, there seems to be some question as to whether corn was a mainstay of the subsistence pattern in Central Texas during Prehispanic times. A brief mention of the presence of Prehispanic water management technology (i.e., irrigation ditches, with taps or sluices, as well as terraced fields) appears in the 1709 diary of Fray Isidoro de Espinosa (Foster 1995:99; Tous 1930:5). Following the route of travel indicated by the diary, as well as noting the stated association of the irrigation technology with the San Pedro Springs and its drainage, San Pedro Creek, which still flows through the city of San Antonio and joins the San Antonio River about 575 m southwest of Mission Concepción, strongly suggests that the irrigated fields were within what are now the San Antonio city limits.

A second mention of the presence of Prehispanic irrigation in Central Texas is found in the Fray Pedro de Mezquía diary of 1718 that documents a portion of the Martín de Alarcon expedition into Texas. This diary notes the area of irrigation as being near the banks of the San Marcos River (Hoffmann 1938:319-320), perhaps in the vicinity of the present Palmetto State Park (Foster 1995:133), somewhat more than 70 km to the east-northeast of the present San Antonio city limits.

Unfortunately, further details as to the nature of the water management technology, or the crops being cultivated and irrigated, were not given by these two chroniclers. In spite of these failings, it seems probable, if irrigation agriculture was being practiced by the Prehispanic occupants of Central Texas, that corn was one of the crops being grown. However, withstanding the two recorded sightings of indigenous irrigated agriculture mentioned above, archeological and other archival sources do not provide support that corn was cultivated in the San Antonio region prior to the arrival of the Spanish (Fox 1989:29; Fox 1983:21-23; Garant 1989:20; Garza 1989:24-25, 27; Hester 1989:4; Watkins and Gunn 1982:193-196). It is John W. Clark's opinion (1998 personal communication) that while these evidences of irrigated agriculture may possibly be the remains of Jumano subsistence activities, they more likely represent the works of temporary or clandestine Spanish or *mestizo* settlers following herds of cattle or buffalo into the area as early as 1697 or 1700.

Even if indigenous irrigated agriculture was not practiced in Central Texas prior to the arrival of the Spanish, it seems quite likely that the aboriginal inhabitants knew of corn from their neighbors: the Pueblo Indians to the west, the Caddo to the north and east (Fox 1983:24-28), and the Indians of Mexico to the south. Occasional evidence of this is suggested by the archeological discovery of a few cobs of corn found in dry Central Texas rockshelters and caves (e.g., Timmeron Rockshelter [Harris 1985] and the Kyle site [Jelks 1962]). In relation to the corn grown at the missions, however, it seems quite possible, but as yet unproved, that it was brought to Texas from northern Mexico by the Spanish and the Mexican Indians that accompanied them.

One additional observation must be made here: there evidently were few Spanish females that came to the New World with the Conquistadores, therefore, a good deal of intermarriage took place between the Spanish males and Indian females. The Mexican Indian females most likely emphasized Indian cuisine, with its focus on corn. This is reflected in one of the few detailed accounts of Indian foods that Fox (1989) found with the aid of Father Marion Habig's search of the mission documents. Habig and Fox found that both *atole* and *pozole* formed mainstays in the mission Indian's diet. In addition, Gutiérrez de la Cueva (1978:272) comments on the use of *pinole* in the San Antonio area in 1791. Although apparently not mentioned, I would think *tortillas*, *tamales*, *esquiate*, and *yoriki* also may well have been part of the diet (see Pennington [1963: 75-81, 1969: 99-103] for a discussion of all of the above-mentioned foods and their mode(s) of preparation in northern Mexico). The main component of all of these foods is corn.

Traditionally, and perhaps functionally as well, the grinding of the corn to the proper consistency for these foods requires the use of the mano and metate. Thus, the only proper way to prepare corn for these foods, in the opinion of the Indians, was to use the mano and metate. This most likely would have strongly reinforced the daily use of these tools in the missions by the Indian converts living there as well as those working in the mission's kitchens. There are several references (e.g., Lava 1983a:17, 1983b:56, 1983c:27), between 1791 and 1793, to the purchase and shipment of manos and metates to Mission San José and the other missions in the vicinity that indicates the continuing focus on the use of corn. Furthermore, between 1794 and 1804 the San José documents provide very specific references to the growing and harvesting of corn (Muñoz 1983:124, 127; Nava 1983:98, 101; Vallejo 1983:235) interspersed with the mention of wheat (*trigo*) (e.g., Muñoz 1983:128-129, 131; Anonymous 1983:162), implying the continued importance of corn (as well as manos and metates) even after wheat became more popular in the area and the gristmill had been constructed.

The potential answers to the second question posed above are quite interesting, but as yet somewhat speculative. The reasons why wheat was not brought from northern Mexico, along with corn, early in the history of the missions may have been fourfold:

(1) Wheat in northern Mexico, contrary to my perception prior to this study, evidently was not as prevalent as corn in agricultural production and the diet. Coming from a completely different direction in his research, Doolittle (1991, 1998) has come to the same conclusion.

(2) As noted above, corn was a grain known, albeit perhaps not cultivated, by the Indians of the San Antonio region, and evidently a very popular crop and foodstuff in northern Mexico. The acceptance of corn, as opposed to wheat, as a staple in the Colonial diet in the San Antonio region is verified by the statement of the Franciscan Missionary President, Father Lopez, in his 1789 report of his visit to Texas. At Mission San José he observed that: "Wheat is not sown, although it does well, because the

Indians hold it in very low regard in comparison with corn, which is the daily bread of this land, and also because its cultivation would interfere with that of the latter, which is here considered absolutely necessary for life" (Lopez 1940:55-56). Note that Father Lopez' observation is not entirely correct, for, as noted above, there are at least four documents dating to 1779 that indicate that wheat was grown in the area.

(3) The cultivation and consumption emphasis on corn by the Spanish may well have been to please the Indians in order to get them to stay at the missions and thereby facilitate their conversion. Conversely, when the missions became secularized (after 1793), the emphasis on corn became less and wheat became a greater part of the diet.

(4) There is a likelihood that wheat was not only a culturally preferred food for the Spanish, but a status indicator linked to the diet. That is, persons of higher socio-economic status ate (or could economically afford to eat) wheat. Therefore, because there were so few individuals of higher socio-economic status in the San Antonio area prior to the 1790s, the focus was on corn rather than wheat. As it was not economically worthwhile to cultivate this relatively fragile grain locally, most of the small amounts of wheat that were consumed were supplied by importation from Mexico. The small number of *peninsulares*, or even *criollos*, in Bejar during the early 18th century has been verified by John W. Clark, jr. (1998 personal communication), lending support to the dominance of the *mestizo*, *ladino*, and Indian foodways in this area at that time. When more individuals of higher status moved into the San Antonio area from Mexico, the increased demand for wheat was such that it was cultivated and milled in the San Antonio area. The improvement of trade, due to better roads, modes of transportation, etc., must also be considered. Such improvements may have affected the growth in the demand for wheat, not only to meet the demands of the local inhabitants but, as noted above, as a potential export to Spain. Although an interesting possibility, there is yet little data to verify this hypothesis; it is an idea that must be investigated in greater detail.

Evidently, wheat never really became a popular grain in Central Texas. In the Province of Texas, the City of (San Antonio de) Béjar was statistically censused in 1819 by the Intendancy of San Louis Potosi. The following is quoted from that document: "...The citizenry don't [sic] have other occupations except agriculture and those who can't do that, hunt bear and deer. The crops they cultivate consist only of maize, beans, and some sugar cane, which this present year have been augmented by wheat" (Monroy de Martí 1991:8). As late as the 1850s, Olmsted (1857:133-195) observed the predominance of corn and the sparse cultivation of wheat in Central Texas. However, he also noted that in the area of New Braunfels, Texas, the farmers of German heritage preferred wheat, and were cultivating it in "considerable" amounts with "satisfactory success" (Olmsted 1857:170). For the most part, the tradition and focus of corn cultivation and consumption, relative to wheat, predominates to the present day not only in Central Texas but in northern Mexico as well (Doolittle 1991:3, 1998).

## FINAL OBSERVATIONS

Whatever the immediate and local reasons may have been, the construction of the gristmill ultimately resulted from a change in grain processing from a focus on individual or small group consumption and barter to an emphasis on the processing of grain for larger communities and as a commodity for a market economy. The construction of the gristmill constituted the means to produce wealth and attain power.

My research indicates that there are many aspects of agricultural production that are not well studied and are as yet poorly understood for the Colonial Period of northern Mexico and the northern frontier of the Spanish Empire. Included in these failings are details concerning the dietary preferences and medicinal consumption of cultivated plants as well as the technology involved in the processing and preparation of these foodstuffs. One of the prime reasons for this problem is that it has been only recently that historical archeology has dealt with the missions, and Colonial sites in general, in any other way than as "salvage archeology." And, of the more recent work, very few projects have been well-funded, problem-oriented studies that have combined the mutually beneficial research of both archeology and archival studies. Quite obviously these deficiencies need to be addressed as future research is planned and implemented.

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# Historic Period Lithic Technology at Mission San José y San Miguel De Aguayo

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## ABSTRACT

Numerous small–scale archeological excavations have been carried out at Mission San José y San Miguel de Aguayo since its acquisition by the National Park Service. Often, these investigations yielded Native American artifact collections that were too small for meaningful analysis. This article reports the results of reanalysis of the available chipped lithic artifacts recovered from Mission San José and housed at the Center for Archaeological Research at the University of Texas at San Antonio. Using these results as a starting point, I present an alternative explanation of the shift from formal bifacial reduction strategies to flake core reduction and expedient technologies put forth by Parry and Kelly (1987).

## INTRODUCTION

The earliest excavations at Mission San José were conducted by Schuetz (1970). Since that time numerous archeological investigations have been carried out at the mission, with each effort contributing new and important but small quantities of materials to the overall collection. By themselves each of these samples were hardly large enough to provide a solid basis to characterize the lithic technology of the Indians that occupied the mission. In addition, because these excavations occurred some years apart, often different individuals were involved in the analyses and the writing of reports. Finally, due to the rigors of cultural resource management archaeological schedules, the opportunity did not seem to exist to combine these small and disparate samples into a larger whole. This article has two goals: (1) bring together and analyze all of the lithic artifacts hitherto excavated from Mission San José, and (2) place the results of the analyses into the framework of current discussion related to diachronic changes in lithic technology.

## MISSION SAN JOSÉ Y SAN MIGUEL DE AGUAYO AND ITS HISTORY

Mission San José y San Miguel de Aguayo was founded in February 1720 on the east bank of the San Antonio River "a little more than 3 leagues" (about 7 miles) south of Mission San Antonio de Valero (Habig 1978:33; Figure 1). It was to be used by members of the Pampopa, Pastia, and Suliajame bands who were apparently at odds with the groups settled at Valero (Habig 1978:24).

In his 1768 report on the mission, Fray Solís lists the following tribes at San José: Pampoas, Mesquites, Pastias, Canamas, Tacames, Canas, Aguasallas, and Xaunaes (Habig 1978:159). In 1789, Fray López reports that a group of 31 Barrados, from the coast, had also joined the others living at the mission (Habig 1978:250). The mission was still at its founding site in the spring of 1721, when Marques de Aguayo visited on his way to East Texas (Habig 1968a:28–29). However, by the spring of 1727, when Brigadier General Pedro de Rivera visited the area, San José had been moved onto a low terrace on the west bank of the river a little downstream from its first location (Habig 1968a:29, 32–33). This second site was apparently relatively close to the river bank and subject to overbank flooding. Due in part to a disastrous smallpox epidemic in 1739, sometime in 1740 the mission was moved yet again, this time to its present location onto a higher terrace of the river. Habig (1968a:45) states that this site was about 25 feet higher and about a half–mile from the second site.

In 1749, when Fray Ignacio Antonio Ciprián visited the mission, there were 200 resident Indians

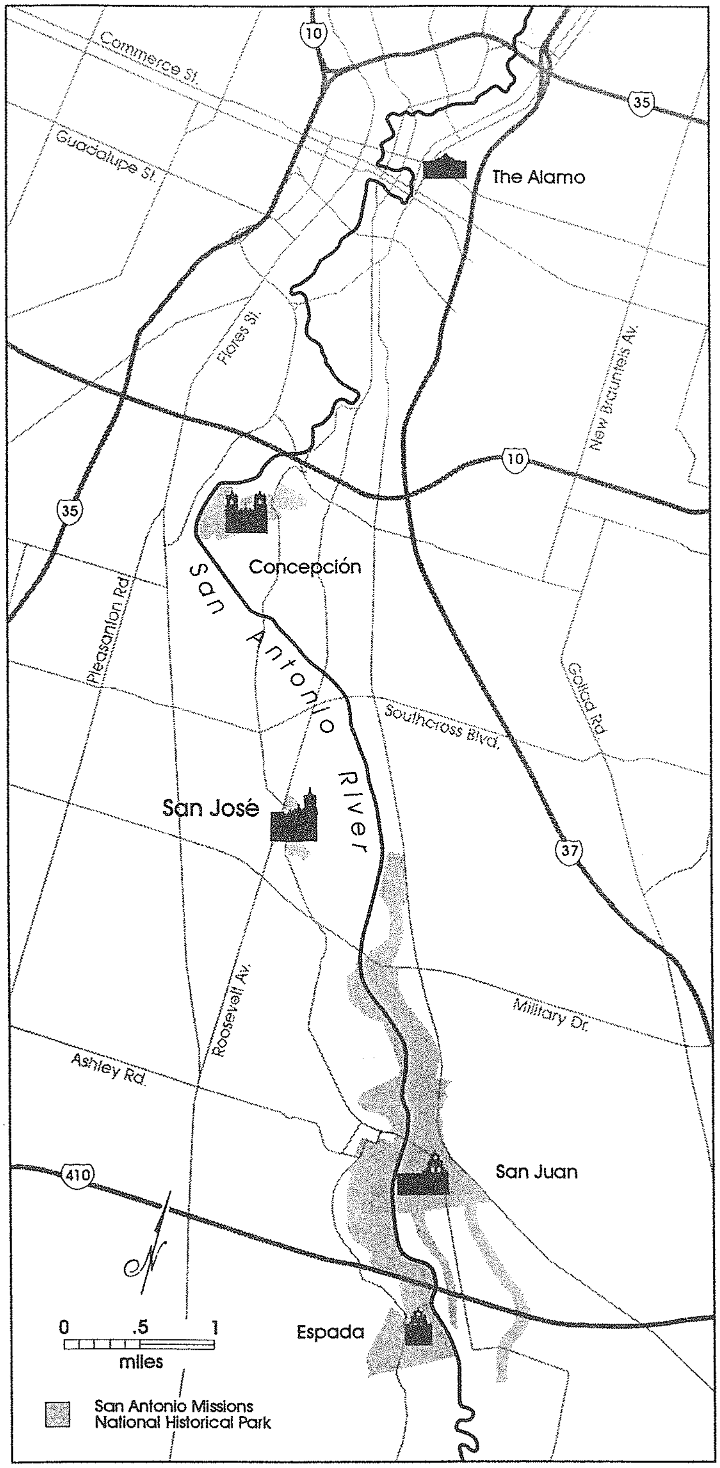


Figure 1. Location of Mission San José y San Miguel de Aguayo.

living there. The stock of the mission included 2,000 head of cattle and 1,000 sheep (Habig 1968a:48–49). By 1758 the Indian population of the mission was 281, of whom 113 were men (Habig 1968a:51). The mission ranch (Rancho Atascoso), which was apparently located 25–30 miles south of the mission, had 1,500 head of cattle, 3,376 sheep, 103 horses, 80 mares, and 30 yoke of oxen (Habig 1968a:52, 56). Since 1749, the ranch had lost 2,000 head of cattle to hostile Apaches (Habig 1968a:52) In 1768, Fray Solís visited the mission for 16 days in August and mentioned 350 Indians living in the mission. Of the 110 warriors, he described 45 as being armed with guns, and the remaining 65 as having bows and arrows, spears, and other weapons (Habig 1968a:55–56). Fray Solís remarked that while the able-bodied men attended to manual labor the old men made arrows for the warriors (Habig 1968a:57).

By Solís' visit the mission compound consisted of a large square 611 feet on each side. Gates were present at each corner, and "on diagonal corners," or perhaps the wall opposite the church, there were two towers or bastions. The Indian quarters were of stone and were part of the outside walls of the mission. Other structures in the compound included a stone granary, a carpenter's shop, other workshops, a sugar mill, and a cemetery (Habig 1968a:52, 55).

The Indian population began to decline in the last quarter of the 18th century and, by 1791, only 106 Indians remained in residence (Habig 1968a: 85). Contributing to the decline were a number of factors including the 1778 decree of De Croix regarding the disposition of unbranded cattle; Apache raids; the depredations of the soldiers; the hunting trips of the settlers; the recurring epidemics; the unrestrained flight of the Indians from the mission; and the inability of the missionaries to gather new Indians (Habig 1968a:90). For instance, when Fray López visited the mission in 1789, he cited the "lack of cattle" as one of the main obstacles in the way of increasing the number of Indian converts in the mission (Habig 1968a:91). Secularization of the mission began in 1794 when the property was divided among the 93 remaining

Indians. During the 19th century, the population consisted of local families who had taken up residence in and around the mission. A gradual decline in use and a lack of interest on the part of San Antonians allowed deterioration of the mission buildings.

After Bexar County obtained title to the various plots of land in the vicinity to create a park, in 1933 the Civil Works Administration (CWA) began the reconstruction of the original south, west, and east walls of the mission, which had been the Indian Quarters. On May 8th, 1941, the entire site had been acquired by the State of Texas, and San José was designated a National Historic Site during a formal dedication (Habig 1968b:185–186).

No documentary descriptions have so far been found that indicate the method of construction or the exact location of the Indian Quarters during the first years of San José's existence on its present site. However, it was customary for the first, temporary buildings on a Spanish colonial site to be of *jacal* construction, a method that involved setting upright logs into trenches to form walls, over which a thatched roof was constructed.

By 1749, Fray Ciprián reported that at least some of the Indian houses were made of stone (Habig 1968a:49). Of 84 Indian apartments in 1755, 12 were of stone and consisted of two rooms each. They were arranged in "streetlike form" (Habig 1978:115). This layout resembles those described for the earliest years at missions San Juan Capistrano (Schuetz 1968:33) and San Antonio de Valero (Fox et al. 1976:3). Governor Barrios in 1758 described the Indian Quarters as consisting of eight units or squares of stone with flat roofs and parapets arranged within a larger square (Habig 1968a:50–51). By the time of the visit of Fray Gaspar de Solís in 1768, the Indian apartments were stone structures formed as a part of the perimeter walls (Habig 1968a:55). This description was confirmed by Fray Juan Agustín Morfi in 1777 (Habig 1968a:68).

After the secularization of the mission in 1794 and the division of the property, the houses of the Indian Quarters that were unoccupied began to deteriorate into ruins. Some were replaced by frame houses as the mid–19th century approached. By the early 20th century, the mission was the center of a small settlement composed primarily of the descendants of the first landowners (Hard et al. 1995:3–8). A 1905 USGS map and an aerial photograph taken 15 years later indicate small structures stood along the south, west, and east sides of the compound at that time, most of them of frame construction. A few traces of the original walls still existed as ruins.

By the time of the CWA reconstruction of the mission walls in 1933, the only above ground trace of the original Indian Quarters visible was a small section of one apartment at the southwest corner, visible on aerial photographs but probably hardly noticeable from ground level (Hard et al. 1995:Figure 5). The foundations of the original walls were relocated by the CWA workers under the instructions of architect Harvey Smith, and the new walls were then built upon these foundations. This has since been confirmed by various archeological excavations and by Anne A. Fox's observations of small construction projects on the site since 1971.

## SUMMARY OF PREVIOUS INVESTIGATIONS AT THE MISSION

At least nine archeological investigations have been carried out at Mission San José during the past 30 years. These excavations have sampled many parts of the mission grounds, including the central courtyard, areas adjacent to but outside of the west, east, and south walls, and the *acequia* along the north wall of the mission. Unfortunately, only one of the investigations actually involved excavations within the Indian Quarters, so that a smaller proportion of the artifacts discussed here derive from within the rooms of the Indian Quarters themselves.

The first systematic investigations of the mission were carried out in 1968 by Mardith Schuetz (1970) of the Witte Museum. This work involved the monitoring and recovery of artifacts from a series of sprinkler system trenches within the mission compound and outside and parallel to the south, west, and north walls. The trenches averaged 30 cm in depth. Few field notes were taken, and the report consists mostly of lists of artifacts recovered from each trench and a few brief descriptions of features encountered.

In 1970, D. Fox (1970) reported several monitoring operations previously carried out as well as testing he conducted in the vicinity of the north wall of the mission. Included in this report are descriptions of monitoring of a large sewer line trench dug in December 1969 parallel to and north of the north wall of the mission, and an electrical line trench dug just north of the church in April 1970. The third section of the report deals with the excavation in August 1970 of a 2.5 x 3 m unit north of the church where a persimmon tree was to be planted. Also mentioned is a drainage trench 30 cm wide and 40 cm deep dug by workmen for a pipe to carry water from the church entrance patio to a drain east of the north wall rooms.

In 1974, Clark (1978) conducted test excavations in a number of locations around the mission buildings to study the effects of climatic conditions on the major structures. This involved the excavation of eight test units, generally 1 x 2 m, in 20 cm levels. Clark also summarized the history and construction of the various buildings at the mission and provided a detailed plan showing all disturbances that had occurred and archeological units that had been excavated at the mission up to that time.

In 1974, and again in 1976, Texas Parks and Wildlife Department archeologists conducted excavations in the vicinity of the southwest corner of the mission, including test trenches inside three rooms of the Indian Quarters (Roberson and Medlin 1976). These excavations were significant in that they identified the wall trenches of the earliest *jacal* buildings ever constructed at the mission.

In 1979, Clark and Prewitt conducted a testing operation to the west of the granary in preparation for the proposed installation of a French drain that was "intended to relieve moisture–related structural problems along the west wall of the granary" (Clark and Prewitt 1979:iii). Six 0.5 x 1 m test pits were excavated in the affected area. These revealed a remnant of a flagstone surface and a number of pits and other disturbances, along with artifactual evidence of Spanish colonial and later uses of the area.

When improvements were planned to Napier Avenue in 1984, the Texas State Department of Highways and Public Transportation conducted investigations in the roadbed, locating a number of features (Henderson and Clark 1984). Among these were a section of an *acequia* lateral southeast of the mission compound, a 19th century burial dug into the west bank of that feature, and what appeared to be a Colonial foundation trench ca. 30 m outside the south wall of the mission. The latter contained a number of post holes, suggesting that it represented a corral structure. Colonial and later period artifacts were recovered in the investigations.

In 1991, the Center for Archaeological Research at The University of Texas at San Antonio (CAR) conducted archival research and backhoe testing to locate and map the *acequia* outside the east wall of the mission in preparation for the construction of a parking area for a new visitor's center (Fox and Cox 1991). The exact location of the *acequia madre* or main ditch was determined by excavating two backhoe trenches perpendicular to the suspected path of the *acequia* and following out the line of the feature based on early maps of the area. The ditch was found to contain late 19th century and early 20th century fill. An *acequia* lateral first located by Henderson and Clark (1984) was relocated and mapped by crossing it periodically with backhoe cuts (Fox and Cox 1991:Figure 3).

CAR conducted test excavations at the southeast gateway and throughout the interior compound of the mission in 1993 (Hard et al. 1995), and additional excavations at the gateway in 1996 (Tennis 1997). These investigations revealed the construction of the 19th century road that ran through the area and the original location of the mission walls. The testing within the compound yielded information on the nature and depth of mission period and later deposits.

The previous excavations that have been most pertinent to this article were conducted from the summer of 1997 through the summer of 1998 by CAR archeologists in the vicinity of the southeast gate of the mission (Tomka and Fox 1998, 1999). Part of the work included excavation of three 3 x 3 foot units along the outside of the east, west, and south walls of the mission, and excavations along the southwest corner of the Southeast gate, along both the inside and outside of the corner. Also included was the excavation of 39 shovel tests along the outside of the east, west, and south walls of the mission. These excavations established the stratigraphy of the deposits both inside and outside the Indian Quarters and mission compound, and identified mission-era cultural materials as much as 15 m outside the south wall of the mission.

The various excavations by CAR have indicated that in general, deposits between 0–12 inches deep contain a mix of Colonial and post-Colonial cultural materials. Deposits from 1.0-1.5 feet appear to be a transition zone characterized by a decreased proportion of post-Colonial materials and an increasing percentage of Colonial materials. Deeper deposits (1.5-2.5 feet) contain predominantly Colonial materials consisting of large quantities of animal bone, unglazed ceramics (primarily Goliad wares), and chipped lithic artifacts (Tomka and Fox 1998, 1999).

## LITHIC TECHNOLOGY AT SAN JOSÉ

### The Artifact Samples

The lithic sample utilized for this article consists of all the chipped lithic artifacts from Mission San José presently curated at CAR. The materials include all the specimens from previous CAR projects, and well as specimens from the above-mentioned work conducted by Schuetz, Fox, Clark, and Clark and Prewitt. Many of them from early excavations are poorly provenienced. In addition, even some of the samples from well-documented contexts are from mixed deposits (e.g., 0-1.5 feet bs). Nonetheless, two characteristics of the collection are notable: (1) the almost total absence of chipped lithic artifacts from pre-Colonial time periods; and (2) the spatial distribution of the samples.

Of the 159 non-debitage chipped lithic artifacts, only three (2 percent) are specimens that are diagnostic of pre-colonial periods. They include a Guadalupe adze and two medial dart point fragments. The two dart point fragments were recycled as gunflints. The Guadalupe adze, which is assumed to be an Early Archaic tool form (Black and McGraw 1985), does not exhibit obvious signs of reworking (e.g., differential patina) but it may nonetheless represent a recycled item. Since it does not appear that Mission San José, at its present location, was built on a prehistoric site, and given the scarcity of pre-colonial diagnostics in the collection, I assume that the bulk of the chipped lithic collection—including debitage—derives from the Colonial occupation of the mission. Given this, and regardless of the disturbed and poor provenience of some of the collection, all of the mission specimens are included in the present analysis.

It is often likely that small samples do not constitute a representative sample of artifacts from a site. However, the 760 artifacts reanalyzed for this study come from a variety of contexts, including outside the east, west, and south walls of the mission; within the central compound; from a possible midden deposits adjacent to the southeast gate; and within structures from Indian Quarter Rooms 21, 54, and 74. Although it would be desirable to have a larger sample (n=26) of lithics from within room contexts, it is possible that the small sample actually reflects room maintenance and/or the performance of the majority of the lithic manufacture and/or maintenance activities outside. The use of 1/4-inch mesh screening may have reduced the sample of artifacts recovered from these contexts, but 50 percent of the matrix from within two of the four rooms investigated was screened using 1/8-inch mesh. This procedure did not yield greater numbers of debitage, but nonetheless, given the variety of recovery contexts represented, it is likely that the small collection is representative of the lithics manufactured and used at the mission during its occupation by Indian groups.

### Results of Analysis

A total of 760 chipped lithic artifacts were recovered during the various investigations at San José (Table 1). They are categorized into the following functional groups: 35 arrow points and arrow point blanks; 18 gunflints; 2 strike–a–lites; 25 scrapers; 1 graver; 9 knives; and 1 Guadalupe adze. In addition, 42 unifacially flaked artifacts and 11 bifacially flaked item could not be grouped into functional categories. They are classified as indeterminate unifaces and bifaces, respectively. The presence/absence of use wear on artifacts was determined using low–powered (80X) micro–wear analysis. Fifteen flake/blade cores also were recovered, in addition to 601 pieces of unmodified lithic debitage. Nearly all of artifacts are of fine–grained chert, most likely obtained from the nearby San Antonio River.

#### *Arrow Points*

A total of 35 arrow points and fragments were identified in the collection. Of these, 18 are manufacture-broken or rejected blanks (Figure 2a-c), one is a Guerrero preform, and 16 are finished specimens of the Guerrero type (Figure 2d-e). Guerrero points are commonly associated with mission occupations (Turner and Hester 1993).

**Table 1. Artifacts from Mission San José y San Miguel de Aguayo**

| Tool Type/Completeness | Max. Length (mm) | Max. Width (mm) | Max. Thickness (mm) | BlankType |
|---|---|---|---|---|
| **Arrow Points** | | | | |
| Arrow Point Blank; Proximal Fragment | | 14 | 3 | Flake blank |
| Arrow Point Blank; Complete | 27 | 15 | 4 | Flake blank |
| Arrow Point Blank; Medial Fragment | | | 3 | Flake blank |
| Arrow Point Blank; Proximal Fragment | | 19 | 5 | Flake blank |
| Arrow Point Blank; Distal Fragment | | | 4 | Flake blank |
| Arrow Point Blank; Complete | 27 | 18 | 4 | Flake blank |
| Arrow Point Blank; Proximal Fragment | | 17 | 4 | Indeterminate |
| Arrow Point Blank; Longitudinal Fragment | | | 10 | Flake blank |
| Arrow Point Blank; Complete | 39 | 24 | 4 | Tertiary flake blank |
| Arrow Point Blank; Complete | 38 | 25 | 6 | Tertiary flake blank |
| Arrow Point Blank; Complete | 40 | 15 | 6 | Secondary flake blank |
| Arrow Point Blank Disal Fragment | | 16 | 4 | Tertiary flake blank |
| Arrow Point Blank; Complete | 42 | 17 | 5 | Secondary bladelet |
| Arrow Point Blank; Proximal Fragment | | 13 | 3 | Tertiary flake blank |
| Arrow Point Blank Proximal Fragment | | 18 | 5 | Tertiary indeterminate |
| Arrow Point Blank; Distal Fragment | | | 4 | Indeterminate |
| Arrow Point Blank; Proximal Fragment | | 14 | 3 | Tertiary flake blank |
| Arrow Point Blank; Distal Fragment | | | 3 | Indeterminate |
| Guerrero Arrow Point Preform; Complete | 31 | 10 | 4 | Tertiary bladelet |
| Guerrero Arrow Point; Complete | 24 | 12 | 2 | Indeterminate |
| Guerrero Arrow Point; Complete | 18 | 13 | 3 | Indeterminate |
| Guerrero Arrow Point; Proximal Fragment | | 13 | 3 | Flake blank |
| Guerrero Arrow Point; Medial Fragment | | | 3 | Flake blank |
| Guerrero Arrow Point; Distal Fragment | | | 2 | Indeterminate |
| Guerrero Arrow Point; Distal Fragment | | | 4 | Indeterminate |
| Guerrero Arrow Point; Complete | 22 | 11 | 4 | Flake blank |
| Guerrero Arrow Point; Complete | 27 | 16 | 4 | Flake blank |
| Guerrero Arrow Point; Proximal Fragment | | 10 | 2 | Flake blank |
| Guerrero Arrow Point; Proximal Fragment | | 14 | 4 | Indeterminate |
| Guerrero Arrow Point; Complete | 36 | 14 | 4 | Indeterminate |
| Guerrero Arrow Point; Complete | 22 | 10 | 3 | Indeterminate |
| Guerrero Arrow Point; Distal Fragment | | 10 | 3 | Tertiary flake blank |
| Guerrero Arrow Point; Medial Fragment | | | 4 | Tertiary indeterminate |
| Guerrero Arrow Point; Proximal Fragment | | 13 | 3 | Tertiary Indeterminate |
| Guerrero Arrow Point; Complete | 24 | 12 | 4 | Tertiary bladelet |
| **Gunflints and Strike–a–Lites** | | | | |
| Gunflint | 26 | 20 | 4 | Tertiary flake |
| Gunflint | 35 | 34 | 10 | Tertiary flake |
| Gunflint; Reworked Uniface | 25 | 23 | 8 | Tertiary flake |
| Gunflint; Reworked Uniface | 22 | 21 | 9 | Tertiary flake |

**Table 1.** *(Continued)*

| Tool Type/Completeness | Max. Length (mm) | Max. Width (mm) | Max. Thickness (mm) | BlankType |
|---|---|---|---|---|
| **Gunflints and Strike–a–Lite** *(Continued)* | | | | |
| Gunflint | 24 | 24 | 5 | Tertiary flake |
| Gunflint | 32 | 28 | 12 | Tertiary blade fragment |
| Gunflint | 34 | 26 | 6 | Tertiary flake |
| Gunflint | 30 | 24 | 8 | Tertiary recycled blade |
| Gunflint | 25 | 23 | 7 | Tertiary specimen indeterminate |
| Gunflint | 29 | 20 | 7 | Rectangular, narrow, indeterminate |
| Gunflint | | 27 | 22 | 7 Rectangular, unfinished, flake |
| Gunflint | 25 | 17 | 6 | Rectangular, narrow, flake |
| Gunflint | 25 | 20 | 7 | Tertiary indeterminate |
| Gunflint | 27 | 16 | 5 | Tertiary indeterminate |
| Gunflint; Recycled Dart Point Medial Fragment | | 31 | 9 | Medial fragment |
| Gunflint; Recycled Dart Point Medial Fragment | | 26 | 8 | Medial fragment |
| Gunflint | 29 | 26 | 6 | Tertiary indeterminate |
| Gunflint | 29 | 20 | 6 | Tertiary indeterminate |
| Strike–a–Lite | 49 | 26 | 8 | Tertiary blade |
| Strike–a–Lite | 42 | 33 | 14 | Secondary flake |
| **Scrapers** | | | | |
| Formal Side Scraper Fragment | | | 9 | Secondary blade |
| Formal End/Side Scraper | 31 | 42 | 15 | Secondary flake |
| Formal End/Minimally Retouched Side Scraper | 32 | 25 | 6 | Secondary blade |
| Minimally Retouched End Scraper | 62 | 55 | 22 | Secondary flake |
| Minimally Retouched End Scraper | 65 | 35 | 13 | Secondary flake |
| Minimally Retouched End Scraper | 36 | 33 | 14 | Secondary flake |
| Minimally Retouched Side Scraper | 39 | 33 | 9 | Tertiary blade |
| Minimally Retouched Side Scraper | 58 | 34 | 10 | Secondary flake |
| Minimally Retouched End-Side Scraper | | 25 | 6 | Tertiary blade |
| Minimally Retouched End-Side Scraper | | 29 | 7 | Tertiary flake |
| Minimally Retouched End-Side Scraper | 31 | 22 | 5 | Tertiary flake |
| Minimally Retouched/Expedient End-Side Scr. | 60 | 43 | 10 | Tertiary blade |
| Minimally Retouched/Expedient End-Side Scr. | 34 | 21 | 8 | Tertiary blade |
| Expedient End Scraper | 42 | 68 | 14 | Tertiary flake |
| Expedient End Scraper | 25 | 25 | 7 | Tertiary flake |
| Expedient Side Scraper | 42 | 31 | 7 | Tertiary blade |
| Expedient Side Scraper | 35 | 25 | 6 | Tertiary flake |
| Expedient Side Scraper | 32 | 29 | 3 | Tertiary blade |
| Expedient Side Scraper | 61 | 36 | 12 | Secondary blade |

**Table 1.** *(Continued)*

| **Tool Type/Completeness** | **Max. Length (mm)** | **Max. Width (mm)** | **Max. Thickness (mm)** | **BlankType** |
|---|---|---|---|---|
| **Scrapers** *(Continued)* | | | | |
| Expedient Side Scraper | 46 | 33 | 8 | Tertiary flake |
| Expedient Side Scraper | 39 | 37 | 9 | Tertiary flake |
| Expedient Side Scraper | 48 | 33 | 12 | Secondary flake |
| Expedient Side Scraper Distal Fragment | | 34 | 8 | Secondary blade |
| Expedient Side Scraper/Spoke Shave | 51 | 44 | 13 | Secondary flake |
| **Graver** | | | | |
| Minimally Retouched Graver | 36 | 29 | 6 | Tertiary flake |
| **Knives** | | | | |
| Expedient Knife; Distal Fragment | | 26 | 11 | Tertiary blade |
| Expedient Knife; Distal Fragment | | 44 | 11 | Secondary blade |
| Expedient Knife; Complete | 53 | 39 | 9 | Tertiary flake |
| Expedient Knife; Complete | 32 | 15 | 6 | Tertiary blade |
| Expedient Knife (denticulate); Distal Fragment | | 38 | 7 | Secondary flake |
| Expedient Knife; Complete | 52 | 28 | 12 | Tertiary blade |
| Expedient Knife; Complete | 39 | 25 | 6 | Secondary blade |
| Expedient Knife; Medial Fragment | | 27 | 6 | Tertiary blade |
| Expedient Knife; Complete | 54 | 54 | 13 | Secondary flake |
| **Indeterminate Unifaces** | | | | |
| Indeterminate Uniface; Complete | 53 | 43 | 22 | Small pebble |
| Indeterminate Uniface; Medial Fragment | | | 6 | Tertiary blade fragment |
| Indeterminate Uniface; Medial Fragment | | | 7 | Secondary blade fragment |
| Indeterminate Uniface; Medial Fragment | | | 10 | Tertiary blade fragment |
| Indeterminate Uniface; Proximal Fragment | | | 5 | Secondary blade fragment |
| Indeterminate Uniface; Edge Fragment | | | 4 | Secondary blade |
| Indeterminate Uniface; Edge Fragment | | | | Indeterminate |
| Indeterminate Uniface; Edge Fragment | | | | Indeterminate |
| Indeterminate Uniface; Edge Fragment | | | | Secondary flake |
| Indeterminate Uniface; Edge Fragment | | | | Indeterminate blade |
| Indeterminate Uniface; Edge Fragment | | | | Indeterminate |
| Indeterminate Uniface; Complete | 49 | 20 | 15 | Secondary flake |
| Indeterminate Uniface; Medial Fragment | | | | Tertiary blade |
| Indeterminate Uniface; Proximal Fragment | | | 13 | Secondary blade |
| Indeterminate Uniface; Edge Fragment | | | | Indeterminate |
| Indeterminate Uniface; Edge Fragment | | | | Indeterminate |
| Indeterminate Uniface; Edge Fragment | | | | Indeterminate |
| Indeterminate Uniface; Edge Fragment | | | 8 | Tertiary indeterminate |

**Table 1.** *(Continued)*

| Tool Type/Completeness | Max. Length (mm) | Max. Width (mm) | Max. Thickness (mm) | BlankType |
|---|---|---|---|---|
| **Indeterminate Unifaces** *(Continued)* | | | | |
| Indeterminate Uniface; Edge Fragment | | | 7 | Secondary blade |
| Indeterminate Uniface; Edge Fragment | | | 6 | Tertiary indeterminate |
| Indeterminate Uniface; Edge Fragment | | | 12 | Tertiary blade |
| Indeterminate Uniface; Edge Fragment | | | 6 | Secondary flake |
| Indeterminate Uniface; Edge Fragment | | | 5 | Tertiary blade |
| Indeterminate Uniface; Edge Fragment | | | 7 | Tertiary indeterminate |
| Indeterminate Uniface; Edge Fragment | | | 8 | Secondary indeterminate |
| Indeterminate Uniface; Edge Fragment | | | 7 | Tertiary blade |
| Indeterminate Uniface; Edge Fragment | | | 10 | Tertiary indeterminate |
| Indeterminate Uniface; Edge Fragment | 36 | 19 | 6 | Secondary flake |
| Indeterminate Uniface; Edge Fragment | 29 | 22 | 10 | Tertiary flake |
| Indeterminate Uniface; Edge Fragment | | 23 | 5 | Tertiary blade |
| Indeterminate Uniface; Complete | 29 | 29 | 8 | Tertiary indeterminate |
| Indeterminate Uniface Fragment | | 33 | 9 | Secondary proximal blade |
| Indeterminate Uniface Fragment | | 40 | 6 | Tertiary blade |
| Indeterminate Uniface; Complete | 23 | 20 | 9 | Tertiary indeterminate |
| Indeterminate Uniface; Edge Fragment | | | 2 | Tertiary indeterminate |
| Indeterminate Uniface; Edge Fragment | | | 8 | Secondary blade |
| Indeterminate Uniface; Edge Fragment | | 42 | 10 | Secondary blade |
| Indeterminate Uniface; Edge Fragment | | | 3 | Tertiary indeterminate |
| **Indeterminate Bifaces** | | | | |
| Indeterminate Biface; Edge Fragment | | | 5 | Tertiary flake |
| Cortex-backed Biface; Complete | 32 | 48 | 12 | Small pebble |
| Indeterminate Biface; Edge Fragment | | | 10 | Indeterminate |
| Early Reduction Stage Biface; Complete | 52 | 37 | 10 | Secondary flake |
| Late Reduction Stage Biface; Distal Fragment | | | 6 | Indeterminate |
| Indeterminate Biface; Proximal Fragment | | 27 | 6 | Tertiary blade |
| Indeterminate Biface; Proximal Fragment | | | 7 | Heavily burned |
| Early Reduction Stage Biface; Proximal Fragment | | 38 | 10 | Indeterminate |
| Early Reduction Stage Biface; Medial Fragment | | 39 | 13 | Indeterminate |
| Early Reduction Stage Biface; Proximal Fragment | | 51 | 29 | Corticate cobble |
| Late Reduction Stage Biface; Proximal Fragment | | 12 | 4 | Tertiary indeterminate |
| **Cores** | | | | |
| Flake Core | 63 | 56 | 19 | Secondary flake |
| Flake Core | 75 | 52 | 33 | Primary flake |
| Pebble Core | 68 | 49 | 28 | Chert pebble |
| Split Pebble Core | 47 | 42 | 25 | Chert pebble |

**Table 1.** *(Continued)*

| Tool Type/Completeness | Max. Length (mm) | Max. Width (mm) | Max. Thickness (mm) | BlankType |
|---|---|---|---|---|
| **Cores** *(Continued)* | | | | |
| Pebble Core | 45 | 38 | 21 | Chert pebble |
| Flake Core | | 50 | 12 | Secondary flake |
| Split Pebble Core Fragment | 43 | 31 | 20 | Chert pebble |
| Flake Core | 51 | 44 | 21 | Primary flake |
| Large flake or split pebble | 34 | 25 | 17 | No cortex |
| Flake Core | 57 | 43 | 19 | Secondary flake |
| Bi-directional Cobble Core | 84 | 55 | 55 | Corticate cobble |
| Unidirectional Flake Core | 55 | 40 | 20 | Tertiary blade |
| Flake Core | 33 | 27 | 11 | Secondary flake |
| Multi-directional Core | 35 | 25 | 25 | Angular nodule |
| Unidirectional Flake Core | 42 | 33 | 41 | Split pebble |
| **Adze** | | | | |
| Guadalupe Adze | 69 | 32 | 23 | Nodule |

The specimens are characterized by triangular to lanceolate outlines and slightly to moderately concave bases. It is probable that these points were manufactured from flake and/or blade blanks rather than small nodular cores. Ten of the 35 specimens have been fully bifacially flaked. Of the remaining 25 specimens, 22 are made on flake blanks and three are made on small blades or bladelets. Of the 16 finished complete or use-broken points, only seven (44 percent) are fully bifacially flaked, while the remaining nine retain portions of the flake/blade blank's ventral surface. This manufacture strategy is reminiscent of the manufacture of some Perdiz points.

In general, the seven complete finished specimens are shorter, narrower, and thinner (length= 24.7 ± 5.7 mm; width=12.6 ± 2.0 mm; thickness= 3.4 ± 0.81 mm) than the seven complete arrow point blanks (length=34.9 ± 6.4 mm; width=17.7 ± 5.3 mm; thickness=4.7 ± 1.0 mm). These differences in size attest to the unfinished nature of the blanks and the smaller size of the functional specimens due to reworking.

### *Gunflints and Strike–a–Lites*

Eighteen gunflints (Figure 2f-g) and two strike–a–lites (Figure 2h-i) made of local fine–grained chert and chalcedony were recovered from Mission San José. Of the 18 gunflints, two are made on recycled dart point medial fragments (Figure 2j-k). Two others are made on recycled unifaces. The two dart points are clearly pre-colonial in age. The temporal affiliation of the two reworked unifaces cannot be established, although they may also represent pre-colonial era artifacts.

The two dart point fragments have use wear on their bifacially flaked lateral edges. The wear consists of moderate crushing and step fracturing beginning in the center of the edge and extending more heavily onto one face. The flake scar ridges on the two faces of the medial fragments also exhibit some rounding and light polish. The two recycled unifaces have been reflaked into small rounded to roughly rectangular shapes. They each have one edge that exhibits the crushing and step fracturing characteristic of gunflints. In both

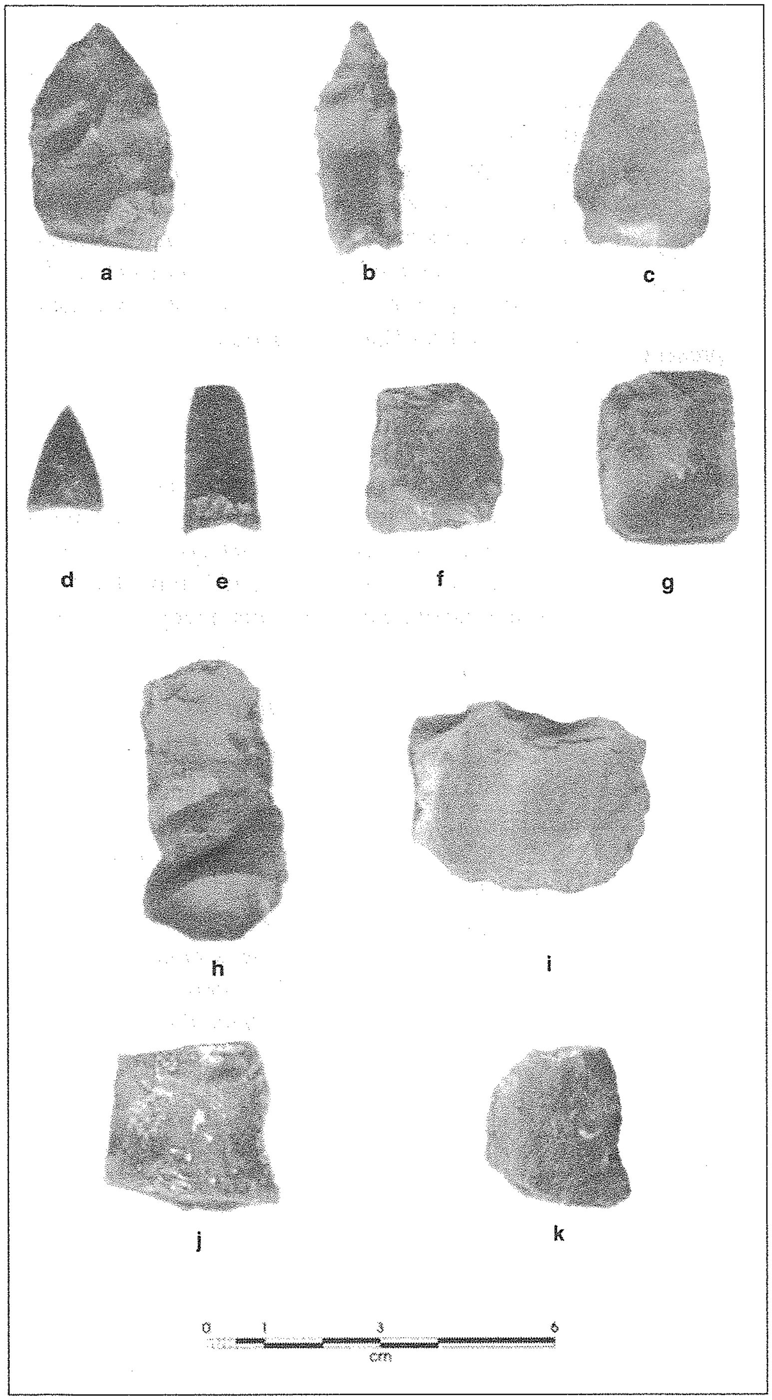


Figure 2. Chipped lithic artifacts from Mission San José: a-c, arrow point blanks; d-e, Guerrero arrow points; f-g, gunflints; h-i, strike–a–lites; j-k, gunflints made on dart point medial fragments.

specimens, the step fracturing extends onto the flat ventral surface of the uniface.

Sixty-seven percent of the gunflints are rectangular while only six are square or nearly square. Some are fully bifacially flaked while others are bifacially flaked only along the margins.

One of the strike–a–lites is a tertiary blade (see Figure 2h) while the other is a thick secondary flake (see Figure 2i). Three of the blade edges are heavily crushed and step fractured. The step fracture scars are deeper and longer and the crushing more extensive than noted on the gunflints. The secondary flake has one heavily crushed and step fractured edge. Of the 18 gunflints and two strike–a–lites, 50 percent are made on flake blanks, 20 percent are made on blades, and the nature of the blank could not be determined on the other 30 percent.

### *Scrapers*

Twenty-five scrapers have been identified in the collection. Of these, only four are formal scrapers with at least one extensively flaked working edge. One of the four formal scrapers also has a second working edge that has only minimal retouch. Eight (32 percent) scrapers have working edges created through minimal retouch. An additional 11 (44 percent) are expedient end or side scrapers; that is, flakes/blades used without retouch. The final two scrapers have two working edges each, one edge created through minimal retouch and the other utilized without initial retouch (i.e., expedient). Of the 25 scrapers, 14 (56 percent) are made on secondary or tertiary flakes, 10 (40 percent) are made on blades, and the blank could not be determined on the remaining specimen.

### *Graver*

A single graver made on a biface thinning flake was recognized in the collection. It has two engraving tips along one edge. The edges were alternately flaked to produce the working tips.

### *Knives*

A total of nine specimens have been identified as knives based on the minutely scalloped acute working edge matching macroscopic use–wear derived from cutting or sawing (see Table 1). One of the nine specimens has a serrated cutting edge (i.e., minimal retouch), while the other knives represent the expedient use of unretouched working edges. Six of the nine knives are made on blades, and the remaining three are made on flakes.

### *Indeterminate Unifaces*

The largest artifact category from San José consists of indeterminate unifaces (n=42). These include unifacially flaked items that lack use wear or tool fragments that are too small to be classified into functional tool categories.

One of the indeterminate unifaces is a small coarse–grained chert pebble that has been unifacially flaked into a wedge shape. It has a plano–convex cross section, and is entirely corticate on one face and at one end (see Table 1). Another six specimens are small unifacially retouched flakes/blades lacking use wear. The remaining unifacially flaked fragments are too small to determine whether they represented end, side, or combination end/side scrapers. Seventeen of the indeterminate unifaces are blade fragments, five are flake fragments, one is a small pebble, and the remaining 19 are too small to determine the nature of the blank employed in their manufacture.

### *Indeterminate Bifaces*

A total of 11 specimens are included in this category (see Table 1). Only one of these, a small pebble with a single bifacially flaked edge, is complete. It resembles a miniature chopper but it is too light for this purpose. It may have been used as a small wedge, although no use wear was observed in support of this possibility. The remaining bifaces are manufacture rejects in various stages of reduction. Six are early reduction failures and two are late reduction stage fragments. The stage of reduction could not be determined on two small fragments.

### *Cores*

A total of 15 cores have been recovered to date from San José excavations. Eight of these are large primary and secondary flakes that were further reduced to produce small expedient tool flake blanks. Four cores are chert nodules, one of which is considered exhausted based on its size and the number of flake removal scars present on its surface. The three final specimens are split pebble cores subsequently used for flake production.

### *Adze*

A single bifacially flaked Guadalupe adze was recovered. It is a well resharpened use–broken distal fragment. The specimen does not exhibit obvious signs of reworking (e.g., differential patina), but it may nonetheless represent a recycled item.

### *Unmodified Debitage*

A total of 601 unmodified pieces of lithic debitage have been found in the mission excavations. The breakdown of cortex categories among these specimens indicates that tertiary flakes constitute a slightly higher percentage than secondary flakes (Figure 3). Primary flakes are a small portion of the collection. However, the combined percentage of primary and secondary debitage is nearly equal to the percentage of tertiary flakes. The distribution of debitage by size classes indicates that 11–20 mm and 21–30 mm specimens dominate (Figure 4). The smallest size class (1–10 mm) may be under–represented primarily because of the 1/4-inch hardware cloth used in screening the bulk of the matrix.

The distribution of platform facet counts indicates that single faceted flakes are the most common among the platform–bearing flakes (complete and proximal fragments, Figure 5). Importantly, corticate platforms are the second most common type, further indicating the relative scarcity of flakes with highly prepared platforms. Platform–bearing flakes with two or more facets represent a relatively small proportion of the collection. This pattern stands in strong contrast to debitage collections dominated by bifacial reduction, where multi–faceted striking platforms greatly outnumber corticate and single faceted specimens (Tomka 1989).

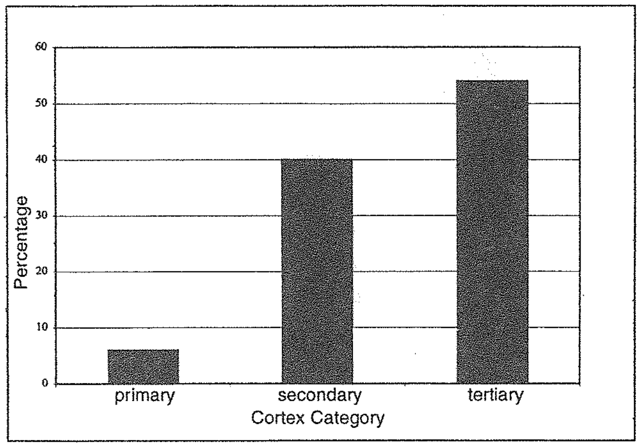


Figure 3. Breakdown of cortex categories among unmodified debitage.

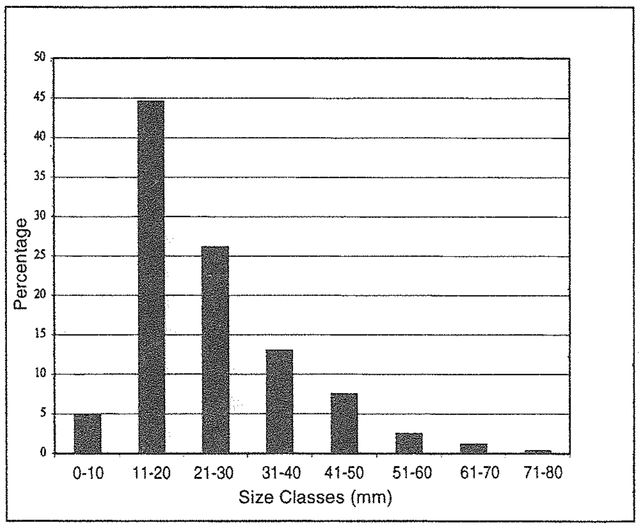


Figure 4. Breakdown of unmodified debitage by size classes.

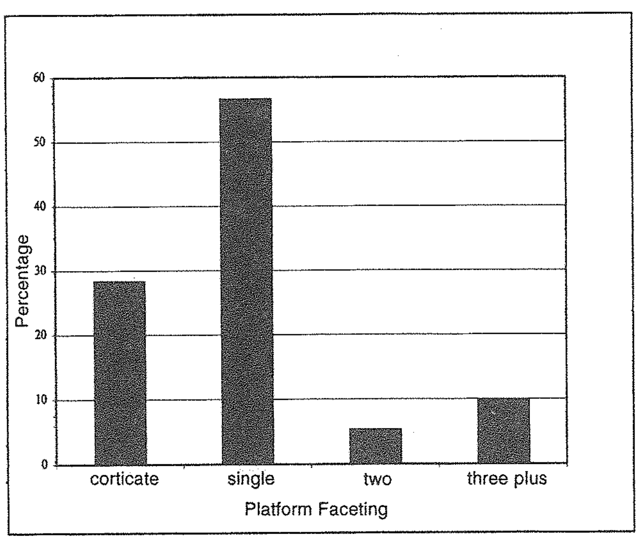


Figure 5. Distribution of unmodified debitage platform faceting counts.

Finally, the breakdown of the debitage in terms of flake types indicates that 28 percent (n=169) of the specimens could not be assigned to a particular category. An additional two percent (n=12) consisted of angular debris. Core/platform preparation flakes constitute the largest proportion of the remaining 420 specimens (Figure 6). Given that, as mentioned before, a large percentage of the platform–bearing flakes are single faceted or corticate, and many of the specimens have blade or bladelet–like morphologies, it is likely that most of these flakes derive from the preparation of uni– or bi–directional cores rather than bifacial core reductions (e.g., bifaces). Blades and bladelets constitute the second largest percentage of the identifiable debitage. Flakes derived from bifacial reduction (e.g., biface manufacture and thinning types) constitute a slightly higher proportion of the collection than debitage derived from unifacial reduction (e.g., uniface manufacture and resharpening). However, neither of these two reduction strategies are common. The scarcity of biface flakes corresponds to the relative emphasis on uni– and perhaps bi–directional blade production at the mission (see also D. Fox 1979:37; Hester 1977a). The scarcity of debitage derived from uniface manufacture and resharpening is somewhat surprising given the apparent emphasis on blade production. It is possible that some of the blades were used in the manufacture of tool forms other than unifacial scrapers. On the other hand, it is also likely that the debitage resulting from the making of minimally retouched scrapers and the use of expedient scrapers would be relatively small and would not be recovered in 1/4-inch screening.

## THE ORGANIZATION OF LITHIC TECHNOLOGY

### San José Lithic Technology in a Broader Context

Overall, the lithic technology evident in the San José lithic artifacts is characterized by local or nearby raw material procurement; a tool kit composed primarily of expedient tool forms (e.g., expedient scrapers); and the continued manufacture of stone arrow points

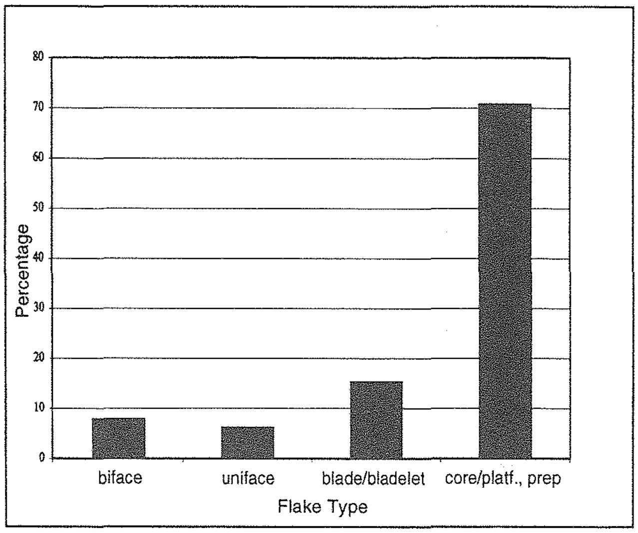


Figure 6. Distribution of unmodified debitage flake type categories.

even though metal points and guns have already been adopted. Raw material reduction strategies are dominated by uni-directional core reduction to produce blades and probably gunflint blanks. Bifacial reduction appears to be employed in arrow point manufacture and the shaping of some gunflint blanks.

Overall, the richness and diversity of lithic tool forms is rather limited. In this respect, the San Jose collection is less diverse than many other Texas mission assemblages where a relatively broad range of tool forms continue to be used by mission indians (Hester 1977a, 1989, 1998). The tool and debitage assemblages also indicate a de–emphasis on the manufacture of large bifacial tool classes such as knives (Inman 1997:132-133). While the bifacial reduction of small arrow points continues, the small debitage generated during these efforts is absent from most debitage collections obtained from matrix screened through 1/4-inch hardware cloth. Combined with the absence of bifacial reduction debitage from the manufacture of large bifacial artifacts, the collection contains large proportions of blades or blade–like flakes removed in blade manufacture and blade core preparation. In addition, with the exception of the arrow points, all other tool classes are dominated by expediently manufactured and expediently used forms.

The lack of bifacial reduction debitage and large bifacial tool classes in combination with the expedient nature of the tool forms is in general agreement with patterns noted in many other parts of North America that begin in the Late Archaic and continue into the Late Prehistoric and protohistoric periods (Hester and Shafer 1975; Koldehoff 1987:155; Odell 1985; Sullivan and Rozen 1985). During these periods, the more systematic bifacial and core reduction strategies were replaced by an expedient core reduction or casual flaking technique. This reduction strategy is characterized by little regard for the standardization of the flake blanks produced, the selection of appropriately shaped tool blanks from among the bulk debitage, and the total absence or only minimal retouch of flake blanks prior to use as tools. The cores from which these flake blanks are produced are amorphous in shape, exhibit multi-directional flake removals, and lack concern with standardized sequential flake removals (e.g., blade production). In summary, there was a shift away from bifacial reduction, bifacial tool manufacture, and standardized blade production to a strategy in which both tool blank production and tool manufacture had a very expedient character. Parry and Kelly (1987:285) attribute this shift to decreased mobility, and do not see local conditions (e.g., raw material availability), other technological changes (e.g., bow and arrow and ceramics), or the introduction of agriculture as responsible for the pattern (see Abbott et al. 1998 for an alternative perspective).

## An Alternative Perspective on Tool Forms

Parry and Kelly (1987) argue that although expedient tools and tool kits have some significant advantages over formal ones—including sharp working edges and lower manufacture costs—they have high transportation costs. In contrast, bifacial tools are more expensive to make, use, and maintain, and are less effective. Nonetheless, because they are multi–functional and multi–use implements, bifacial tools have overall lower transportation costs. Therefore, the tool kits of highly mobile hunter–gatherers are dominated by bifacial tools, particularly in raw material–poor regions. However, in regions with abundant and ubiquitous raw materials, the lithic technology should remain relatively expedient because raw materials will always be available where needed.

Parry and Kelly (1987) provide an explanation for a generalized trend in reduction strategies and point out that the shift in reduction techniques was nowhere absolute. Underlying their explanation is a specific relationship between mobility and tool form, itself conditioned by raw material availability. In this article, I propose an alternative explanation for variability in tool forms. I suggest that the choice between formalized versus expedient tools is conditioned not by mobility, but by the amount or quantity of labor to be performed in a given time. Specifically, tool-using contexts that require the processing of large quantities of resources in a relatively limited time favor the use of formal hafted tools. On the other hand, tasks and/or activities that involve the processing of smaller quantities of resources favor the use of expedient technologies. Here, expedience and formalization refer to the amount of effort that is invested in tool manufacture. Standardization, on the other hand, refers to similarity in manufacture techniques and processes as well as to a formal similarity in the final products. To support this proposition, I discuss the comparative effectiveness and superiority of hafted tools over expedient tools in the performance of lengthy and repetitive tasks; review examples of semi–sedentary Late Prehistoric and Protohistoric groups with tool kits composed of formalized hafted tools, as well as Late Prehistoric lithic assemblages rich in bifacial and unifacial formal tools in a lithic raw material-rich region; and review the prehistoric archeological record to demonstrate the strong correlation between heavy dependence on bison procurement and the incidence of bifacially flaked hafted cutting tools and formal hafted unifaces.

Many deer and other medium-sized and small mammalian species have been butchered by archeologists using replicas of prehistoric tools (Brose 1975; Elliott and Anderson 1974; Hester et al. 1976; Jones 1980; Odell 1980; Patterson 1975). In general, these experiments indicate that unretouched flake edges are more effective than bifacially retouched edges, particularly in cutting muscle (Walker 1978:711). Furthermore, the results of the experiments suggest that a deer or other medium–sized ungulate can be butchered with as few as one to three flakes (Odell 1980:43).

While these types of replication studies are indispensable for understanding the formation of use wear on stone tools, they cannot accurately replicate the full range of prehistoric tool-using circumstances. For instance, many of the experiments involve a single or a small number of small to medium–sized animals. The limitations imposed by prey size and quantity leave one to question the applicability of the results to prehistoric contexts involving a large number of prey or large–bodied prey. Some of the doubt comes from the fact that a number of the experimenters report discomfort and lack of control in using expedient and small bifacial hand–held cutting tools (Jobson 1986:15, 17; Jones 1980:153-165; Odell 1980:41; Elliott and Anderson 1974:5). In contrast, larger tools that can be more firmly held and better controlled are more effective than small flake tools held between the fingers. Similarly, hafted tools allow one to apply greater leverage, force, and control in the butchering task and are therefore more effective, particularly in the performance of lengthy tasks. For instance, Walker and Long (1977:613) report that the most comfortable load at which hand–held obsidian flake tools could be used was 4 kg, and as the load increased to the maximum of 7 kg, the tool became very difficult to control (Walker and Long 1977:611). On the other hand, hafted tools (e.g., a steel knife) could be used at loads of up to 12 kg without affecting tool control. Although prehistoric mastic and/or bindings may not have been as secure as modern rivets, hafted prehistoric tools should still have allowed greater loading stresses to be exerted compared to the use of expedient flakes. I suspect that higher loading translates into higher cutting/scraping power, which in turn suggests that the greater efficiency of expedient flake tools may be overcome by the use of bifacial hafted tools.

I suggest that the less hand strain and greater leverage provided by hafted tools translate into significant advantages when the tool user is faced with the performance of lengthy and/or physically stressful tasks, such as the butchering of large–bodied animals or a large number of butchering events. Therefore, while a small number of flakes may be adequate to butcher a single deer or a small number of animals, the processing of a large number of large–bodied prey, such as bison, would be approached not with expedient tools but with formal bifacially flaked hafted tools. Similarly, while a rabbit or deer hide may be processed without great difficulty using a flake, it would be much more effective and efficient to process a mountain of bison hides obtained during the summer bison hunt with hafted end scrapers rather than expedient tools.

Parry and Kelly (1987) and Parry (1987) suggest that under decreased or restricted mobility (i.e., less frequent and shorter distance movements), the lithic technology should be dominated by expedient tools. They cite Late Prehistoric Puebloan and Plains Village groups as examples of the shift from formal to expedient technologies through time (Parry and Kelly 1987:289–293). A look at the tool kits of some Late Prehistoric Puebloan and Plains Village agriculturalists involved in seasonal bison procurement provides further insights.

For instance, studies of stable isotope ratios of the Pecos population (Spielmann et al. 1990) indicate that bison was part of the diet throughout the site's occupation. Kidder's (1932:196) description of the presence of bison bone throughout the midden deposits also support this interpretation. Interestingly, mule deer, rabbits, and antelope made up the majority of the bone from the middens, and bison bone was relatively common only in the upper deposits dating to the later part of the 15th century. Bison bone was also present in the middens of Gran Quivira National Monument in New Mexico, a second border pueblo excavated by Hayes et al. (1981). Here, bison bones appear to increase in frequency in the late 15th and early 16th century middens (Spielmann et al. 1990:748). Spielmann et al. (1990) imply that much, if not all, of the bison at a number of the eastern–border trading pueblos derived from trade with hunter–gatherers of the Plains. This perspective differs from Kidder's views, who suspected that Puebloan inhabitants were directly involved in bison hunting along the eastern frontiers.

Excavations at both Pecos and Gran Quivira pueblos recovered a number of formal hafted tools most likely associated with bison processing. In addition to leaf–shaped bifacially flaked specimens that may have been knives, Kidder (1932:15, 30–34) recovered 50 two–edge beveled and 10 four–edge beveled knives. With the possible exception of two specimens, the majority appear to be made of Alibates dolomite. All but two of the beveled knives are from the later deposits (Glaze V and later, A.D. 1600–1750). Based on the quantity of debitage of the same material found throughout the middens, Kidder (1932:31) believed that even though the knives were of imported raw material, they were made at Pecos Pueblo. In addition to the beveled knives, Kidder (1932:15) also recovered 185 "snub–nosed" end scrapers made of Alibates dolomite. These specimens are heavily retouched and well standardized and are morphologically identical to hafted end scrapers used by Plains bison hunting groups.

Excavations of Mound 7 at Gran Quivira yielded a similar lithic assemblage. Hayes et al. (1981:110) identified 54 projectile point that may have also been knives, seven knives, and 110 un–notched knives. A number of these un–notched knives are described as long, lanceolate to sub-rectangular blades with beveled edges (Hayes et al. 1981:110). In addition to the knives, a large number of end scrapers also were recovered (Hayes et al. 1981:111). Unfortunately, lacking the necessary use wear analysis, it is not known at present how many of the 374 so-called "unhafted" unifaces were actually hafted.

Puebloan peoples who moved onto the western edge of the Llano Estacado between the 13–16th centuries also relied on agriculture and seasonal bison hunting (Pearce 1936; Collins 1968). Lithic assemblages from Ochoa phase sites on the Llano Estacado contain arrow points, beveled knives, and end scrapers (Collins 1968). Late Prehistoric (A.D. 1100-1541) Plains Village groups of the Canadian and North Canadian river drainages in western Oklahoma and the Texas Panhandle had a similar mixed economy (Brooks 1989; Habicht-Mauche et al. 1994; Lintz 1986). Typical Antelope Creek phase (A.D. 1200–1450, see Lintz 1986) and Washita phase (Bell 1984) tool kits consisted of triangular arrow points, beveled knives, and standardized hafted end scrapers (Lintz 1990:Appendix B, n.d.; Studer 1934).

One of the key factors conditioning the formal properties of tools of mobile hunter–gatherers is raw material availability. Parry and Kelly (1987) assume that since bifacial tools represent a strategy that is employed to reduce transportation costs, few formalized tools should be used, even by highly mobile groups, in regions where lithic raw materials are abundant. Therefore, one way to examine the nature of the interrelationship between mobility and tool form is to investigate the tool forms used by mobile hunter–gathers in raw material-rich areas.

Many of the Edwards Group Formations of the Edwards Plateau are rich in high–quality raw materials (Frederick et al. 1994:Figure 1.1; Frederick and Ringstaff 1994:Figure 6.2). In addition, both the eastern margins of the Plateau and the neighboring Blackland Prairie have been prime bison hunting country for groups beginning about A.D. 1250 and continuing through the Historic period. The Toyah phase (Prewitt 1981) is one of the well-studied Late Prehistoric archeological entities most directly associated with bison hunting in these regions. Although disagreements persist as to the origins of the adaptation and its appearance in Texas (Black 1986, 1989; Prewitt 1985), it is clear that between A.D. 1200/1300–1500/1650 (Johnson 1994), human populations were engaged, at least on a seasonal basis, in bison hunting throughout much of the Southern Plains and the Blackland Prairie (Johnson 1994:Figure 105).

An examination of Toyah components from various sites (41TG91, Creel 1990; 41KM16, Johnson 1994; 41HI1, Jelks 1962; 41TV42, Suhm 1957; 41JW8, Black 1986; Hester 1977b; 41LK201, Highley 1986; 41SS20, Green and Hester 1973; 41BX528, Ahr 1998; 41TG346, Quigg and Peck 1995; 41HY209T, Ricklis 1994) indicates that, although not the predominant tool types, most Toyah components consistently contain two tool forms: beveled knives (two– or four–beveled) and end scrapers. These tools are two of the diagnostic elements of bison hunting complexes throughout the Southern Plains and Central Texas (Creel 1991; Poteet 1938). Although few of the beveled knives have been subjected to extensive use–wear analysis, the limited data available indicates that at least the two–beveled knives were hafted (Shaller et al. 1997). From the limited number of specimens I have examined, it is my impression that four–beveled knives were also hafted. My microscopic examination of a large number of "snub–nosed" end scrapers also indicates that Toyah phase end scrapers were hafted. Examples of early historic Plains hide scraper hafts support this observation (Metcalf 1970; Wedel 1970). Given Parry and Kelly's (1987) proposed relationship between raw material availability, tool form, and mobility, and since the region is rather rich in lithic raw materials, the presence of formal bifacial and unifacial tools does not fit expectations. Formal tools are present in these collections because they represent the most effective tool forms employed in bison butchering and hide processing.

Finally, a look at regional subsistence practices during the Late Archaic and Late Prehistoric periods indicates that hunter–gatherer groups were, to a greater or lesser extent, engaged in bison procurement during portions of both periods. During the Late Holocene, bison were present in Central Texas at two times: (1) 2000 B.C.-A.D. 200, during the Late Archaic (Collins 1995:Figure 2; Dillehay 1974); and (2) A.D. 1250–1550, during the later part of the Late Prehistoric (Collins 1995:Figure 2; Dillehay 1974). In addition, Collins (1995) suggests that bison also were present in Central Texas in the Early Archaic period (ca. 4000–3000 B.C.).

I have already described the emphasis of hunter–gatherers on bison hunting during the Late Prehistoric period. During the Late Archaic, bison hunting appears to have flourished between 1000 B.C. and A.D. 100. Archeological sites containing Marcos, Montell, and Castroville projectile points—as well as Ensor, Frio, and Fairland types—commonly contain bison bones in addition to the remains of other ungulates. As in the case of the Late Prehistoric Toyah phase tool assemblage, two tool forms are consistently present in assemblages containing these point types: bifacial knives and end scrapers. Unlike any preceding time in prehistory, the manufacture and use of specialized hafted bifacial knives appears to have flourished during the Late Archaic. A number of bifacial knives make their appearance, including corner–tang knives, "short–stemmed" knives, and San Gabriel bifaces.

The corner–tang bifaces tend to occur in sites with Castroville, Marcos, Montell, Ensor, and Frio points (Saner and Tomka 1998). In Central Texas, they appear to be distributed on the eastern margins of the Edwards Plateau and along the Blackland Prairie (Patterson 1936:Figure 3). Their distribution extends outside of Texas and follows the Central Plains region (Kraft 1994:Figure 7). It has been suggested that these tools may not have been hafted (McReynolds 1984). An examination of a number of specimens from the Edwards Plateau indicates clear haft wear, sometimes in combination with probable mastic residue, on all but the manufacture-broken specimens (Saner and Tomka 1998).

A second bifacial knife found on Late Archaic sites is large triangular bifaces with short stems (Hester 1995; Hester and Green 1972). Like the corner–tang knives, wear analysis of these specimens shows that they were used as hafted knives (Hester and Green 1972:345). These hafted knives, and other large well-made and very thin triangular bifaces, are consistently found in Late Archaic sites

(Hester 1995). Although the triangular haftless specimens may represent "trade blanks" (Hester and Barber 1990), some of the specimens exhibit considerable use wear, such as the heavily edge–polished specimen recovered from a Late Archaic burial in Wilson County, Texas (Labadie 1988). Although use wear analyses on these specimens have not been performed, it is suggested that the degree of wear exhibited by many of these triangular specimens would have developed only if these knives were hafted while in use. Finally, while these specimens are found primarily in South and south central Texas, an additional triangular form, the San Gabriel biface (Prewitt 1982), was their equivalent in Central Texas during the Late Archaic. These triangular and well–thinned bifaces co–occur with Late Archaic Ensor points, and although use wear analyses have not been completed, they appear to be finished tool forms rather than preforms.

## SUMMARY AND CONCLUSION

Bifacial knives and hafted end scrapers tend to be associated with periods of bison presence in Central Texas. However, these examples were highlighted simply because they are the most clear cut. That is, the manufacture and use of bifacial hafted knives is not assumed to be necessarily restricted to periods of bison presence. Rather, it is suggested that formalized and standardized hafted tool forms would be consistently manufactured and used at any time the resources procured were sufficiently large to necessitate more efficient processing technologies than could be obtained by expedient flake tools. This situational relationship between tool form and amount of labor can easily account for the presence of both formal standardized hafted tools and their expedient functional equivalents on many sites. This co–occurence should not necessarily be taken as participation in on–site tasks. On the other hand, there is no particular reason why they could not have been employed in different tasks. Expedient tools are more than adequate in the performance of many domestic and maintenance tasks carried out at residential camps. However, certain tasks may require greater strength/leverage or better control of the tool, and in these circumstances hafted tools would be most effective and desirable.

Having provided the broad theoretical outlines of an alternative to Parry and Kelly's (1987) relationship between tool form and mobility, what does this have to do with mission lithic assemblages? Previously, formal variability in tool kits and assemblages tended to be interpreted as signaling variability in mobility strategies. If, however, tool form is conditioned by the amount of work that is to be performed, it may be possible to use the ratio of formal to expedient tools in an assemblage to gauge the proportion of bulk resource procurement and processing activities engaged in by prehistoric or historic Native groups. Such a relationship places the variability in mission lithic assemblages in a new light by allowing the exploration of which groups were more or less dependent on mission resources as opposed to wild resources, and more precisely determining the degree to which wild resources were procured in small packages dispersed over time, or as large packages or quantity obtained in a short episode.

Using this approach, it is likely that the Indian population from Mission San José was to a large part dependent on the animal resources of the mission rather than hunted resources. This impression is in part confirmed by the account that of the seven cows slaughtered each week at the mission, four were designated for consumption by those living within the compound (Habig 1968a:52). A similar pattern appears to be evident from Mission Refugio, where preliminary indications are that much of the lithic technology was also expedient in nature and dominated by blade core rather than bifacial reduction strategies. The large size of most of the cow bones recovered from Refugio may be an indication of sufficient meat for mission consumption to reduce the need for systematic hunting of wild resources. The same pattern appears to hold for the lithic assemblage from the Alamo (see Lohse, this volume). The non-debitage artifact types recovered from the Alamo are not unlike those from Mission San José. Interestingly, however, about nine percent of the relatively sizable unmodified lithic debitage collection from the Alamo consists of biface thinning flakes. This percentage is much higher than the two percent recovered from Mission San José. However, 33 flakes have been identified as representing biface manufacture (e.g., early and middle reduction stage, thinning, and resharpening) in the San José collection. This number represents eight percent of the identifiable flake types (n=420, excluding angular debris and indeterminate specimens). Overall, then, little difference appears to exist between the three mission assemblages. The chipped lithic assemblages from Mission San José and Refugio are primarily expedient in nature, suggesting yet again that there was little need for highly formalized tool kits because the resident Indian population depended primarily on the missions' livestock for meat protein.

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# Lithics from the San Antonio de Valero Mission: Analysis of Materials from 1979 Excavations at the Alamo

*Jon C. Lohse*


## ABSTRACT

A lithic assemblage collected during excavations conducted at the west wall of the Alamo mission complex in San Antonio is analyzed in this paper. Much of the collection was associated with a bone midden, and represents Native American subsistence activities in a European context. Interpretations are offered according to the results of the analysis, as are suggestions for future directions in analyses of lithics from mission studies in South Texas and Northern Mexico.


## INTRODUCTION

While fascination with Texas' archeological past has always been strong, interest in the legacy of the Colonial era in particular has enjoyed a recent surge. During that time, the Indians of Southern Texas and Northern Mexico experienced a disruption in their native lifeways as they endured a dramatic increase in European, and especially Spanish, contact and interaction. The experiences of Native American groups ranged from adjustments to new neighbors to outright relocation, sometimes into the setting of a mission. In either case, this was the beginning of a long era of gradual disenfranchisement, as first Europeans and then Anglo-Americans pushed into the "unsettled" frontier. The manner and degree to which the many Native American groups adapted to a new way of life, either within the walls of a particular mission or away from their traditional homelands, is still poorly understood. Recent archeological (e.g., Inman 1997; Ricklis 1998; Walter 1997) and ethnohistorical (Salinas 1990) work across Southern Texas and Northern Mexico (Figure 1), though, is shedding light on the beginnings of this protracted cultural diaspora and its long-term effects.

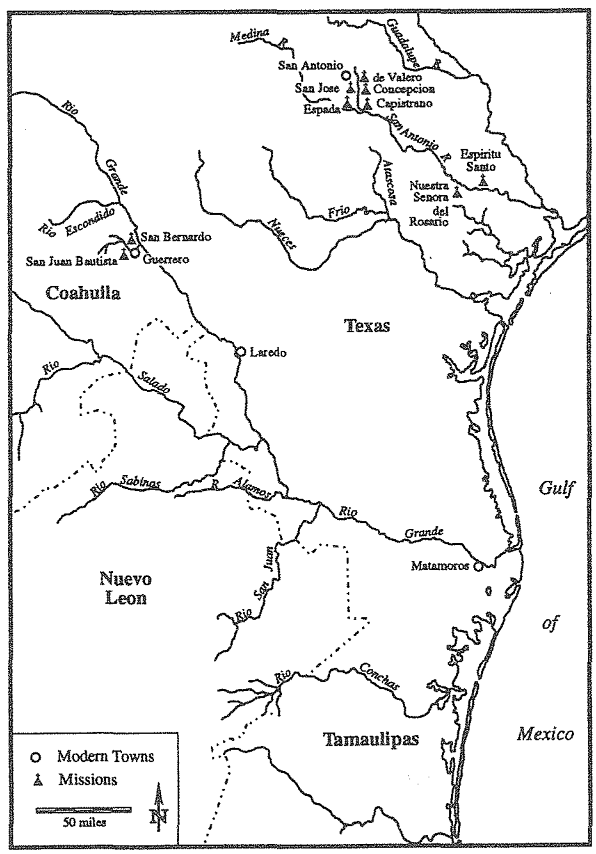


Figure 1. Area map of Southern Texas and Northern Mexico showing some of the missions that have been investigated in recent years (after Salinas 1990: Map 1).

This paper examines a collection of lithic artifacts recovered during excavations conducted by the University of Texas at San Antonio in 1979 at the Mission San Antonio de Valero, also known as the Alamo. These excavations were conducted beneath the old Radio Shack building formerly at that location, and uncovered areas inhabited by the Native American neophytes of the mission along the mission's west wall (Figure 2). A bone midden was associated with these living quarters that contained domesticated fauna such as cattle, goat, and sheep (Anne Fox, 1990 personal communication). The lithic assemblage presented here was derived largely from this context, and may be taken to represent the remains of many of the daily activities of the mission's native inhabitants.

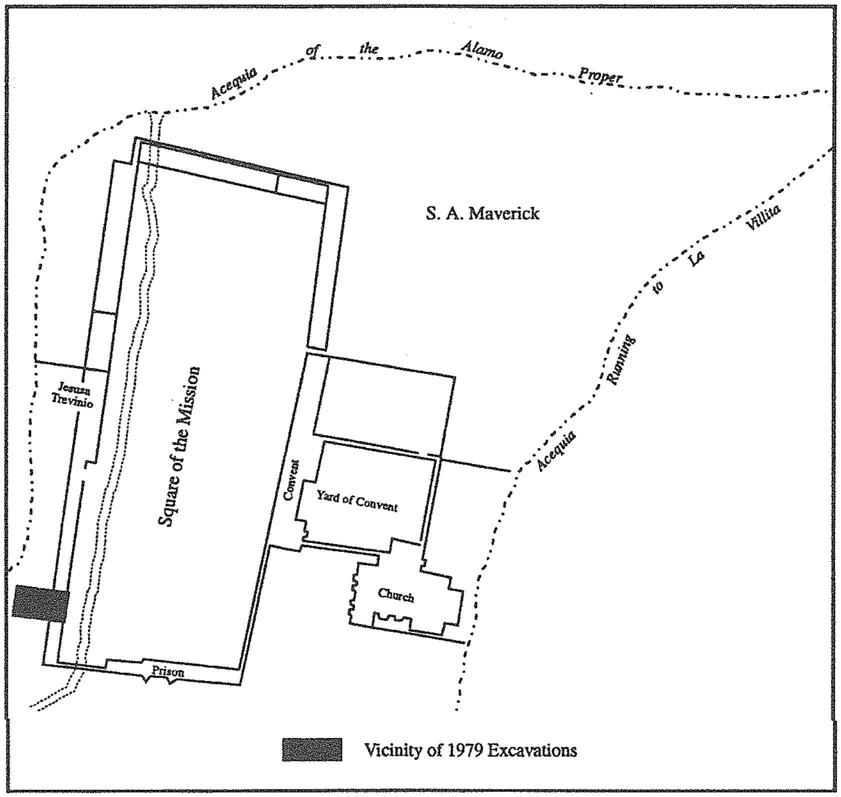


Figure 2. Plan of the Alamo in 1849 (after Fox et al. 1976:Figure 5).

Questions that may be addressed by this analysis, and by investigations at mission sites elsewhere, include the degree to which native lithic technologies were maintained in the face of assimilation into European culture. Also, given the widespread popularity of a style of arrow point common to mission assemblages, the Guerrero point (cf. Turner and Hester 1993:216), archeologists may hope to demonstrate routes of trade or communication between both the missions and the Indian groups that inhabited them. Finally, by comparing mission assemblages such as this one to others from non-mission contexts dating to the Late Prehistoric and Protohistoric periods, we may better understand the activities and movements of other Native American groups in the region. Especially important are groups associated with the Toyah horizon (cf. Black 1986; Hester 1995) and Rockport phase ( Hester and Shafer 1976; Ricklis 1992).

## THE LITHIC ANALYSIS

The Radio Shack excavations, as this project became known, produced a sizable lithic assemblage consisting of 2,078 pieces of both modified and unmodified chert. The collection was separated and analyzed according to morphological criteria. Debitage, or the waste by-product of lithic reduction and stone tool manufacture, was divided into flakes and non-flakes. Flakes are further separated by two criteria: (1) the amount of their surface covered by cortex; and (2) whether they represented the final reduction stage of bifacial tool manufacture. Flakes retaining some cortex on their dorsal, or outer, surfaces were categorized as either primary (30-100 percent cortex) or secondary (1-29 percent cortex) flakes. Tertiary flakes contained no cortex on their outer surfaces, while biface thinning flakes were tertiary flakes that were manufactured (most likely) by pressure flaking techniques that left a characteristic "lip" on the ventral (inner) side of the platform, and may show evidence of careful platform preparation (cf. Crabtree 1982:55).

Non-flake debitage included those pieces that (a) were fractured by exposure to extreme heat; (b) represented flake fragments that lack evidence of either a bulb of percussion or a striking platform (called "chips"); and/or (c) larger, amorphous "chunks" that showed no diagnostic evidence of intentional fracture (i.e., prepared striking platforms or negative bulbs of percussion). The difference between chips and chunks is, admittedly, somewhat subjective, although both categories may be the result of opportunistic lithic resource collection and exploitation strategies focused on medium-sized cobbles found either on the surface or in river channels near the mission.

This morpho-technological system of debitage classification is consistent with that used previously by Fox (1979). In his analysis of lithics from other mission contexts, Fox (1979:9) notes that "the morphologically defined categories may be representative of products (chipped stone specimens that functioned as tools) and by-products (chipping debris and other lithic forms which became detached from the continuum) of lithic tool production."

Non-debitage stone artifacts were also identified and placed into categories. These include formal tools; trimmed or retouched unifacial flake tools; a single hammerstone; and flake cores, some of which also appear from wear patterns to have been used as chopper-like implements. Formal tools include scrapers, of both end and side varieties; arrow points; prismatic or ridge blades, some of which show distinct macroscopic wear patterns along their lateral edges; and an Archaic period Guadalupe tool (cf. Turner and Hester 1993:256-260) that was apparently carried into the site (Thomas R. Hester, 1990 personal communication).

This collection includes a relatively large number (n=15) of gunflints, which are also classified as formal tools. These artifacts are present in other historic era assemblages from Mission San Bernardo and perhaps Mission San Bautista in Northern Mexico (Inman 1997:43, 70-71); Espiritu Santo (final location) and Nuestra Señora del Rosario in Goliad County (Mounger 1959; Inman 1997:Table 19; Ricklis 1998:Tables 1 and 4); San Lorenzo de la Cruz in Real County (Tunnell and Newcomb 1969); and Missions San Jose (Hard et al. 1995), San Juan Capistrano, and Concepcion (Fox 1979:Figure 11 and Table 2) in San Antonio. Gunflints have been reported from other locations within the Alamo mission complex as well (e.g., Fox et al. 1976:73 and Figure 26i; Fox 1979:Table 2). Analytical categories defined in this analysis are depicted in Figure 3, and Table 1 shows the breakdown of the 1979 assemblage by artifact type and frequency.

## THE ASSEMBLAGE

### Debitage

By far the largest analytical category of this assemblage is unmodified debitage. Of the 2,078 pieces included in this collection, a total of 2,009 are debitage (Table 2). It is important to note that a number of debitage specimens, while unmodified, did show macroscopic edge damage. Utilized flakes and flake fragments form an integral part of many Native American tool kits, and generally should be included in comprehensive lithic analyses. However, because of the long-term storage of this collection, it was not considered well suited to a detailed use wear analysis, and so

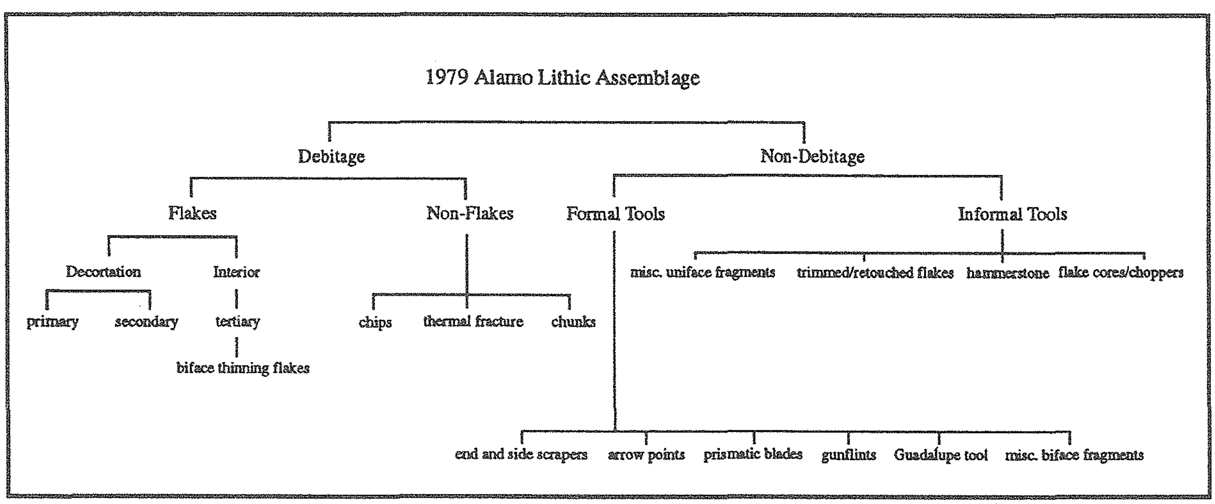


Figure 3. Classificatory scheme used for 1979 Alamo lithic assemblage.

**Table 1. Artifact Types and Frequencies Recovered During 1979 Excavations at the Alamo**

| Artifact type | Quantity | Percentage of Collection |
|---|---|---|
| Debitage | 2,009 | 96.7% |
| Arrow Points | 23 | 1.1% |
| End and side scrapers | 11 | 0.5% |
| Gunflints | 15 | 0.7% |
| Prismatic Blades | 7 | 0.3% |
| Bifaces | 4 | 0.2% |
| Guadalupe Tool | 1 | 0.05% |
| Unifaces | 2 | 0.1% |
| Hammerstones/choppers/cores | 6 | 0.3% |
| Totals | 2,078 | 99.95% |

**Table 2. Debitage Recovered during 1979 Excavations at the Alamo**

| Debitage Category | Number of of Pieces | Percentage of Debitage Sub-assemblage |
|---|---|---|
| Primary Flakes | 276 | 13.7% |
| Secondary Flakes | 352 | 17.5% |
| Tertiary Flakes | 489 | 24.3% |
| Biface Thinning Flakes | 170 | 8.5% |
| Thermally Fractured | 358 | 17.8% |
| Chips | 283 | 14.1% |
| Chunks | 81 | 4.0% |
| Totals | 2,009 | 99.9% |

expediently utilized pieces are not separated in the counts presented here.

## Non-debitage Artifacts

Among the 69 artifacts in this category are completed formal tools, informal bifaces and unifaces, flake cores, choppers, and a hammer-stone. In some cases these artifacts (especially formal tools) represent the finished product of a deliberate reduction sequence, and belong to recognizable types that are found in other mission and non-mission contexts. Other artifacts—such as flake cores and the hammerstone—are included here because they do not represent the waste by-product of stone tool manufacture. Also, the multiple use wear patterns visible on these artifacts suggest that they were indeed important components of the overall toolkit.

### *Arrow Points and Point Fragments*

There were 23 points and point fragments included in this collection (Figure 4a-b). All but two of the specimens fall into the Guerrero point type (Hester 1977; Turner and Hester 1993), which is most commonly found at the Spanish missions in Texas. Guerrero points are finely worked and sometimes exhibit parallel flaking. They have either parallel or slightly contracting sides, and often have a sharply concave base (Turner and Hester 1993:216).

One of the two non-Guerrero specimens is a Perdiz arrow point (Turner and Hester 1993:227-228) made of vitreous glass; the distal tip is missing from this artifact (Figure 5). While this projectile point style is characteristic of the earlier Late Prehistoric period, its manufacture of historic glass indicates that it was made during the mission era. The other non-Guerrero specimen appears to be an Ensor point (Turner and Hester 1993:114). This artifact has shallow side notches and is missing its distal tip. Table 3 provides metric data on the assemblage's projectile points.

### *End and Side Scrapers*

These tools were made on flakes or blades, occasionally show cortex, and may have been used for scraping or cutting activities in the processing of plant and animal remains (Figure 6). There are 11 specimens in this collection (a 12th was removed earlier and is not included in this analysis). Among the scrapers, 82 percent show either macroscopic edge damage on the distal end or on their lateral edges, and 73 percent were used on both the end and edges. Edge angles range between 55-116$^0$ (Table 4).

Of interest regarding the scrapers is that at least three (specimens A/C-4, 12-3, and 39-BB-4) appear to have been made on blades. Blade technology is a

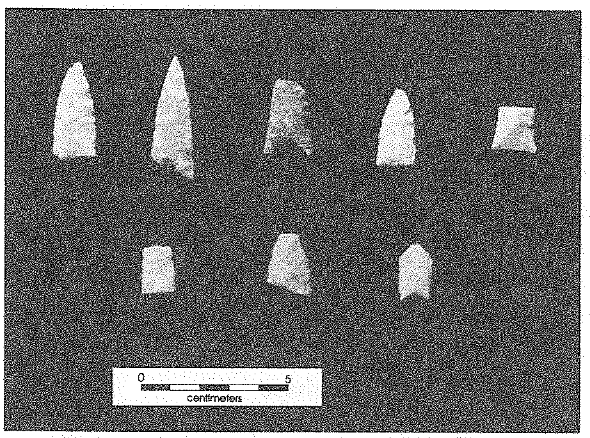

Figure 4a. Guerrero points recovered during 1979 excavations at the Alamo (specimens top row: 82-5B, 108-2, 93-BB-1, 47-BB-1; 2nd row: 47-BB-2, 42-5, 39-4, L to R).

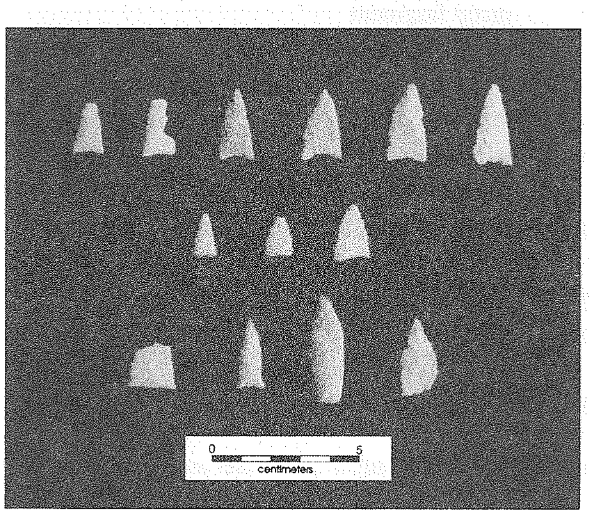

Figure 4b. Guerrero points recovered during 1979 excavations at the Alamo (specimens top row: 84-6, 57-5-Aa, 34-B-4, 48-7, 28-5, 18-5; 2nd row: 43-4, 73-3, 57-5-Ab; 3rd row: 87-5-A, 9-FF-4, 9-3, 62-7, L to R).

defining characteristic of Toyah horizon lithic industries (Black 1989), and is also common in mission assemblages (Hester 1989).

### *Gunflints*

A total of 15 chipped stone artifacts were recovered from the Alamo excavations that were recognized as gunflints. These artifacts may be produced through a variety of techniques, and specimens include those made by Native American occupants of the mission as well as those imported from Europe, most likely France (Thomas R. Hester, 1998 personal communication). Gunflints of both Native American and European manufacture have been reported from numerous other missions (cf. Fox 1979; Hester n.d.; Inman 1997; Tunnell and Newcomb 1969; Walter 1997). Manufacturing techniques for gunflints vary, with specimens showing unifacial, bifacial, and alternate-edge beveled flaking. Many retain intact striking platforms and bulbs of percussion, indicating that they were crafted from interior flakes, while others were made of pre-existing bifaces.

Kenmotsu (1990) conducted a study of historic and replicated gunflints, and determined that they derive from three possible sources, depending on material type and techniques of manufacture.

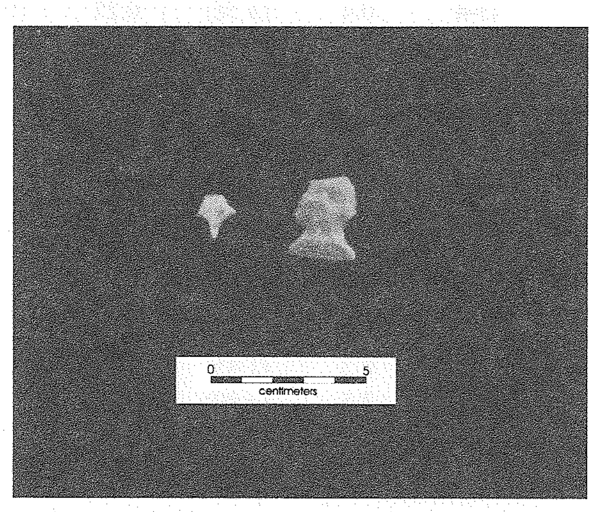

Figure 5. Perdiz and Ensor points included in 1979 Alamo collection.

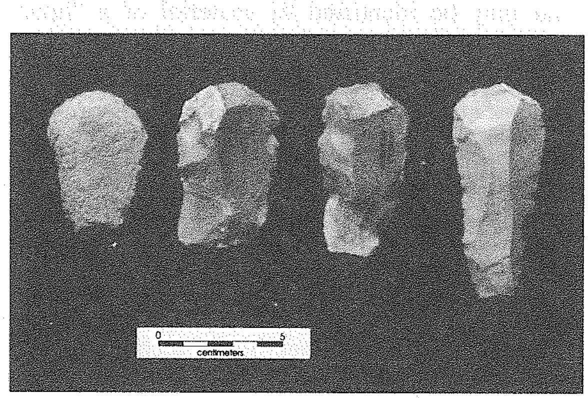

Figure 6. Examples of side and end scrapers recovered during 1979 excavations at the Alamo. Three specimens to right are fashioned on blades (specimens 44-BB-2, 12-3, 39-BB-4, A/C-4, L to R).

**Table 3. Metric Data and Comments for Arrow Points Recovered during 1979 Excavations at the Alamo***

| Specimen | Weight | Length | Thickness | Width | Comments |
|---|---|---|---|---|---|
| 47-BB-2 | 0.9 | (1.4) | 0.4 | (1.5) | triangular, straight base, distal portion missing |
| 108-2 | 2.2 | 4.2 | 0.4 | 1.4-1.1 | triangular, concave base |
| 42-5 | 1.3 | (1.9) | 0.4 | (1.4) | triangular (?), medial fragment |
| 43-BB-1 | 1.8 | (2.3) | 0.4 | (1.7) | triangular, concave base, distal tip missing |
| 53-8 | 0.7 | (1.5) | 0.3 | (1.6) | triangular (?), medial fragment |
| 82-5B | 2.2 | (3.3) | 0.4 | (1.4) | intact, lanceolate shape |
| 47-BB-4 | 1.4 | (2.5) | 0.4 | (1.3) | triangular, straight base, distal tip missing |
| 39-4 | 0.7 | (1.9) | 0.2 | 1.9 | contracting edges, concave base |
| 9-FF-4 | 0.7 | 2.53 | 0.34 | 0.96 | intact, concave base |
| 9-3 | 1.7 | 3.77 | 0.30 | 0.96 | intact, concave base |
| 73-3 | 0.5 | (1.41) | 0.30 | 1.70 | contracting edges, straight base |
| 43-4 | 0.4 | (1.56) | 0.27 | (0.86) | distal fragment |
| 34-B-4 | 0.7 | 2.52 | 0.25 | 1.23 | complete, triangular, concave base |
| 48-7 | 1.3 | 2.46 | 0.37 | 1.40 | complete, triangular, concave base |
| 84-6 | 0.5 | (1.86) | 0.30 | 1.11 | distal tip missing, triangular, concave base |
| 62-2 | 1.4 | 2.72 | 0.43 | (1.27) | unfinished, broken base |
| 18-5 | 1.2 | 2.88 | 0.32 | 1.47 | triangular, concave base |
| 87-5A | 1.0 | (1.75) | 0.32 | (1.72) | proximal fragment, triangular, straight base |
| 28-5 | 1.4 | (2.83) | 0.37 | 1.43 | lanceolate, concave base |
| 57-5-Aa | 0.7 | (2.07) | 0.24 | (1.29) | distal fragment |
| 57-5-Ab | 0.7 | (2.14) | 0.26 | (1.23) | proximal fragment, triangular, concave base |
| 63-9 | 0.3 | (1.45) | 0.21 | 1.29 | Perdiz point, made of glass |
| 39-6 | 3.5 | (2.80) | 0.52 | (2.02) | Ensor point, distal tip missing |

* Length and maximum width values given in parentheses indicate fragments. Weights in all tables are given in grams, with other dimensions given in cm.

Gunflints from France are common in assemblages, and may be identified by material of a "honey-yellow or blond" color. English-made gunflints generally appear in archeological sites dating after 1790, and are characterized by "very dark, nearly black, translucent flint to a gray, opaque flint with inclusions" (Kenmotsu 1990:95-96). European gunflints were mass-produced using a technique by which a macro-blade would be manufactured, then broken into regular-sized fragments. These would then be unifacially trimmed around the edges to create the final tool form. This "snap-blade" technique results in a fairly standardized tool size, and may be recognized through the presence of blade ridges, or arises, along the dorsal side of the artifact (Kenmotsu 1990). Gunflints of Native American manufacture are frequently more standardized in form, "with all four edges carefully worked to an edge by secondary chipping" (Witthoft 1966:22, as cited in Kenmotsu 1990:97). These may be made of a wider variety of material types, depending on what is locally available, and frequently they show bifacial edge modification.

The gunflints recovered from the 1979 excavations range in size from 3.71 x 3.62 cm (specimen 59-7) to 2.04 x 1.55 cm (specimen 73-5) (Figure 7 and Table 5). Differences in size may reflect the type of weapon in which the gunflint was used (such as a musket or pistol, Thomas R. Hester, 1998 personal communication), and the Radio Shack gunflints have been separated into three informal size gradients that reflect these differences. The largest size grouping includes specimens 59-7 and 7-1, while the second group (n=4) includes

**Table 4. Metric Data and Comments on Side and End Scrapers Recovered During 1979 Excavations at the Alamo**

| Specimen | Weight | Length | Thickness | Width | Edge angle -average | Edge angle -range | Comments |
|---|---|---|---|---|---|---|---|
| A/C-4 | 39.2 | 8.6 | 1.2 | 3.6 | 68.83° | 55°-89° | Made on blade |
| 44-BB-2 | 26.9 | 5.8 | 1.2 | 3.9 | 81.75° | 78°-89° | Made on primary flake |
| 47-BB-4 | 37.8 | 5.0 | 2.1 | 3.3 | 78.4° | 73°-82° | Heavily rejuvenated |
| 12-3 | 58.5 | 6.6 | 1.9 | 4.1 | 73.66° | 62°-84° | Very light use wear |
| 43-BB-2 | 68.6 | 7.9 | 1.7 | 4.4 | 76.8° | 73°-83° | Very light use wear |
| 39-BB-4 | 42.5 | 6.9 | 1.5 | 3.6 | 76.43° | — | — |
| 102-PH2-4 | 105.1 | 7.8 | 1.8 | 6.1 | 73.6° | 69°-84° | Limited edge suitable for use |
| 44-6 | 4.6 | 3.6 | 0.7 | 1.3 | 88.6° | 76°-116° | Heavily used and reworked |
| 42-6-W | 66.3 | 6.8 | 1.5 | 5.0 | 71.75° | 64°-79° | Heavy wear on distal edge |
| 37-BB-3 | 63.4 | 8.7 | 1.4 | 4.5 | 66.14° | 55°-82° | Low edge angle |
| 42-9 | 22.1 | 3.5 | 1.4 | 4.0 | 75.75° | 66°-91° | Heavily used distal fragment |

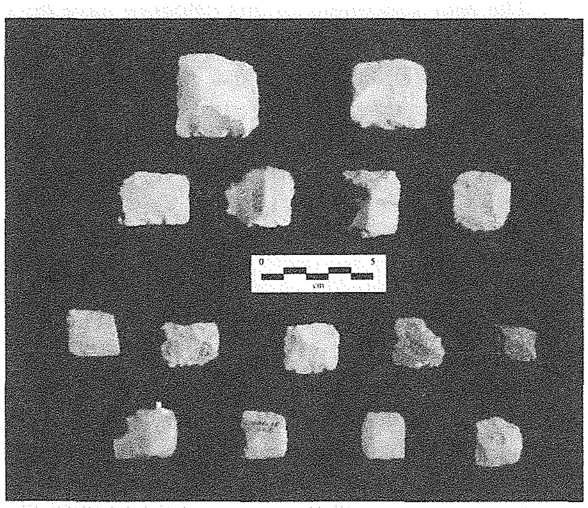

Figure 7. Gunflints recovered during 1979 excavations at the Alamo (specimens top row: 59-7, 71; 2nd row: 10-2a, 87-5A, 32-4, 87-5B; 3rd row: A-1, 38-7, 73-6, 10-2b, 73-5; 4th row: 63-9, 37-8, 59-8, 58-6-N, L to R).

specimens 10-2a to 87-5B, and the smallest size grouping (n=9) begins with A-1 and concludes with 58-6-N. Distinctions between trimming and flaking are subjective, and reflect differences in the intensity of edge modification. Also, comments in Table 5 addressing origin of manufacture are based on material types as described by Kenmotsu (1990). Finally, specimen 59-7 is significant in that it was made on an existing biface; edge retouch for the manufacture of this gunflint overlaps onto a highly patinated surface.

### *Prismatic Blades*

A total of seven prismatic blades were found at the Mission San Antonio de Valero during the 1979 excavations (this count does not include the blades that were used to fashion scrapers, as mentioned above). The blades in this assemblage all exhibit fairly low edge angles that are well suited for cutting activities. Each specimen was viewed under an 80X microscope to detect obscure traces of use wear, and all show signs of usage (Figure 8 and Table 6).

These artifacts were the result of a deliberate process of platform preparation and the delivery of a controlled blow to produce a flake of particular dimensions. Blades are defined as a "specialized flake with parallel or sub-parallel lateral edges... (with) the length equal to or more than twice the

**Table 5. Metric Dimensions and Comments for Gunflints Recovered from 1979 Excavations at the Alamo**

| Specimen | Weight | Length | Thickness | Width | Comments |
|---|---|---|---|---|---|
| 59-7 | 21.8 | 3.71 | 1.25 | 3.62 | Bifacially flaked, patinated surface |
| 7-1 | 14.6 | 3.52 | 0.91 | 3.09 | Unifacially flaked |
| 10-2a | 9.6 | 3.3 | 0.98 | 2.42 | Bifacially flaked on two lateral edges |
| 87-5A | 11.4 | 2.84 | 1.06 | 3.22 | Unifacially flaked, percussion bulb intact |
| 32-4 | 9.5 | 3.08 | 1.27 | 2.74 | Bifacially flaked |
| 87-5B | 5.4 | 2.73 | 0.66 | 2.64 | Bifacially trimmed |
| A-1 | 2.9 | 2.15 | 0.5 | 2.26 | Bifacially flaked |
| 38-7 | 4.7 | 2.64 | 0.8 | 2.02 | Bifacially flaked |
| 73-6 | 6.1 | 2.42 | 0.96 | 2.23 | Bifacially flaked |
| 10-2b | 2.7 | 2.33 | 0.43 | 2.3 | Unifacially flaked |
| 73-5 | 2.4 | 2.04 | 0.61 | 1.55 | Unifacially flaked, English manufacture? |
| 59-8 | 2.2 | 2.08 | 0.38 | 1.92 | Unifacially trimmed, French manufacture |
| 63-9 | 5.4 | 2.27 | 0.81 | 2.92 | Unifacially flaked, French manufacture |
| 37-8 | 3.1 | 2.11 | 0.53 | 2.12 | Bifacially flaked |
| 58-6-N | 5.1 | 2.19 | 1.06 | 2.34 | Bifacially trimmed |

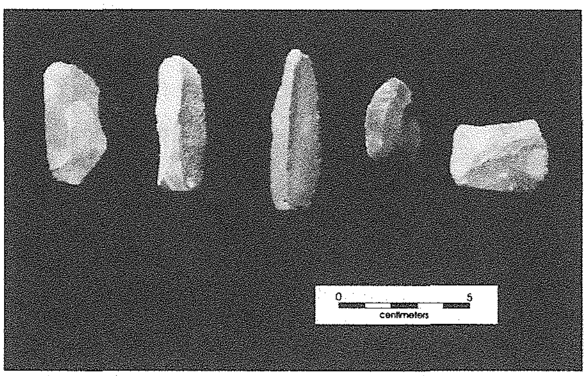


Figure 8. Examples of prismatic blades and biface fragments included in 1979 Alamo collection (blade specimens: 62-10, 5-53, 89-6; biface fragments: 110-3, 22-2, L to R).

width" (Crabtree 1982:16). This technology is designed to achieve a long, fairly straight cutting edge, and also results in a high ratio of cutting edge-to-flake mass. The skill necessary to prepare a platform, the uniform dimensions of these artifacts, and the fact that they represent such a small percentage (0.3 percent) of the overall collection suggest that blade technology represents at least a low level of specialized skill among the mission Indians at the Alamo.

### *Bifaces*

The four specimens in this category have been worked on both sides in order to create an edge suited for utilitarian tasks. One of the bifaces (specimen 70-7) appears to be the distal tip of a dart point, while the others represent fragments of indeterminable origin (see Figure 8). Metric dimensions for bifaces are provided in Table 7.

### *Guadalupe Tool*

This specimen is a Guadalupe tool as defined by Turner and Hester (1993:256-260), and clearly dates to the Early Archaic period. Heavy patination on this specimen, and its presence out of primary temporal context, suggests that it was transported into the mission site. However, there is light retouch along its edges, and so it appears to have undergone at least some use in its present context. Metric dimensions for the Guadalupe tool are provided in Table 8.

### *Unifaces*

The two unifaces in this collection each show a degree of working only on one side of the artifact

**Table 6. Metric Dimensions and Comments for Blades Recovered during 1979 Excavations at the Alamo**

| Specimen | Weight | Length | Thickness | Width | Edge angle - average | Edge angle -range | Comments |
|---|---|---|---|---|---|---|---|
| 105-3 | 9.8 | 4.5 | 0.8 | 2.2 | 64° | 58°-68° | heavily used on lateral edge |
| 47-BB-3 | 11.2 | 5.2 | 1.0 | 2.1 | 58° | 50°-63° | polish noted at 80X |
| 5-S3 | 8.4 | 5.2 | 0.9 | 1.9 | 52.83° | 45°-69° | light use wear |
| 74-7 | 13.8 | 5.3 | 0.8 | 2.2 | 72.6° | 67°-76° | heavy polish on lateral edge |
| 63-10 | 5.6 | 4.8 | 0.5 | 2.0 | 42.2° | 34°-58° | light use wear left lateral edge |
| 9-3 | 43.3 | 7.5 | 1.1 | 3.9 | 66.63° | 57°-80° | light wear on lateral edges |
| 89-6 | 11.0 | 6.1 | 0.9 | 1.8 | 57.16° | 50°-62° | medium use wear on lateral edges |

**Table 7. Dimensions and Comments for Bifaces and Fragments Recovered from 1979 Excavations at the Alamo**

| Specimen | Weight | Length | Thickness | Width | Edge angle -average | Edge angle -range | Comments |
|---|---|---|---|---|---|---|---|
| 110-3 | 3.8 | 3.2 | 0.5 | 2.0 | 56.67° | 48°-60° | possible preform |
| 70-7 | 5.4 | 3.1 | 0.7 | 3.0 (base) | 65.2° | 56°-74° | distal fragment |
| 89-4 | 4.1 | 2.3 | 0.6 | 2.5 | 66° | 66°-67° | medial, lateral fragment |
| 22-2 | 7.9 | 2.7 | 0.5 | 3.7 | 60.33° | 54°-65° | medial fragment |

**Table 8. Metric Dimensions and Comments for Guadalupe Biface Recovered during 1979 Excavations at the Alamo**

| Weight | Length | Thickness | Width | Edge angle - average | Edge angle -range | Comments |
|---|---|---|---|---|---|---|
| 73.7 | 8.2 | 2.0 | 4.1-3.6-2.0 | 74.22° | 68°-83° | reuse in mission context appears light |

Note: Width values are taken at distal, medial, and proximal points

(Table 9). Both appear to have been heavily modified, but the purpose for which they were intended is unclear. One specimen (47-BB-3) is simply a flake that was unifacially trimmed to provide two distinct working edges. These artifacts do not resemble formal tool types recognized elsewhere in Texas during this time period, and likely represent heavily but expediently utilized flakes that underwent some degree of tool modification.

### *Hammerstones, Choppers, and Cores*

A total of six specimens from these three classes were included in this collection. These tool types are presented together here because several of these specimens show multiple wear patterns, suggesting that they do not easily conform to a single artifact type. Flake cores are relatively easy to recognize; they show evidence of prepared platform areas, and perhaps negative bulbs of percussion that relate morphologically to the ventral sides of the flakes removed. However, the technique of bifacial flake removal may also produce a rough edge useful for certain tasks. Observed wear in the form of battered and crushed edges implies use of these artifacts as chopper-like implements. The core-chopper continuum has been described previously for the San Antonio missions (Fox 1979) and elsewhere (e.g., Aoyama 1994) and appears to have been commonplace in the pre-Columbian New World.

In addition to the three core-chopper tools, one specimen (specimen 35-2) appears to have served as a core and a hammerstone as well (Figure 9). Weights in grams, and comments, are provided for hammerstones, cores, and choppers in Table 10, and Figure 10 is a hammerstone recovered during the excavations.

## DISCUSSION OF EXCAVATED CONTEXT FOR 1979 ASSEMBLAGE

As mentioned earlier, the lithic assemblage described in this article was collected from deposits immediately outside the west Alamo wall. Construction of a commercial building in the late 1800s protected these deposits from disturbance (J. Ivey, field notes on file at the Center for Archaeological Research, The University of Texas at San Antonio). During the field work, excavators recorded a midden of faunal material located behind what was the outer wall of the neophyte residential area. Figure 11 shows the excavation units and the location of the bone midden, as well as an adobe wall remnant that indicates the former location of Native American occupation areas within the mission. The midden assemblage consists of larger fauna such as goat, sheep, and cattle (Anne Fox, 1991 personal communication), and the kinds of lithic artifacts found in association with this midden provide an indication of the

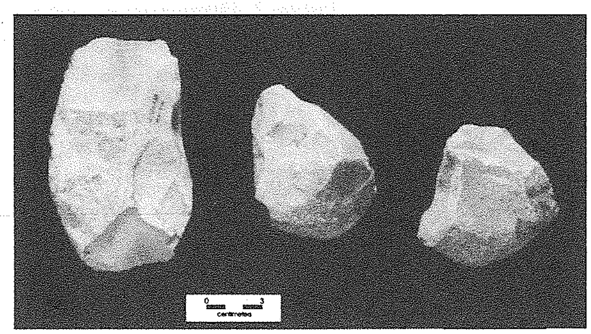

Figure 9. Examples of chopper-core tools recovered during 1979 excavations at the Alamo (specimens: 42-7-W, 35-2, 10-2, L to R).

**Table 9. Metric Data and Comments for Unifaces Recovered during 1979 Excavations at the Alamo**

| Specimen | Weight | Length | Thickness | Width | Edge angle - average | Edge angle -range | Comments |
|---|---|---|---|---|---|---|---|
| 59-8 | 11.5 | 2.8 | 1.5 | 2.8 | 73.2° | 70°-77° | heavily reworked |
| 47-BB-3 | 10.4 | 5.2 | 0.7 | 1.6 (mid) | 68.4° | 64°-74° | heavy use wear |

**Table 10. Weights and Comments for Hammerstones, Choppers, and Cores Recovered During 1979 Excavations at the Alamo**

| Specimen | Weight | Comments |
|---|---|---|
| 43-BB-2 | 304.5 | pitting in concentrated areas indicates use as a hammerstone |
| 35-2 | 354.7 | some crushing seen along ridges either for platform preparation or from use as hammerstone |
| 59-6 | 561.4 | large (8 cm) flake scars; pitting suggest some use as a hammerstone |
| 10-2 | 369.9 | crude bifacial edge shows heavy crushing wear |
| 42-7-W | 609.0 | crude bifacial edge shows heavy crushing wear |
| 77-2 | 247.0 | flake core with bifacial edge; no use wear |

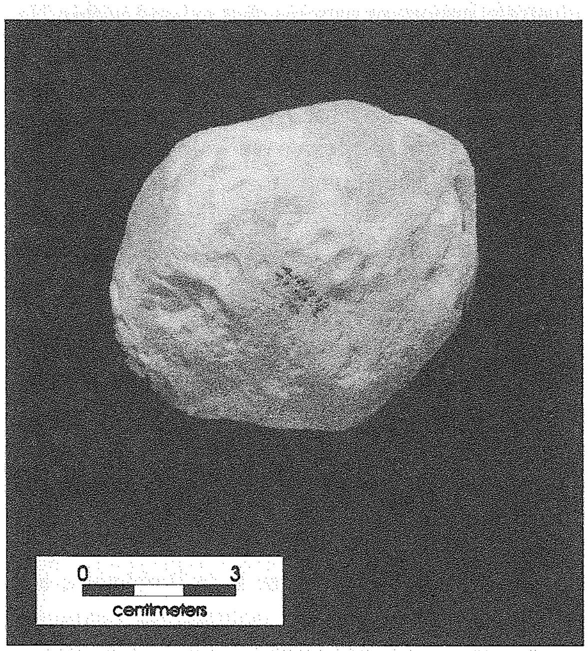

Figure 10. Cobble used as a hammerstone (specimen 43-bb-2).

subsistence practices of the neophytes in an otherwise European cultural context.

The artifacts directly associated with the bone midden represent only a small percentage of those recovered during the 1979 excavations. By no means do they reflect the total range of lithic production behavior that took place at this site. Further, many of the artifacts not found in association with the midden are also likely to represent important tools used in daily subsistence. However, the information provided in Table 11 does allow some tentative conclusions concerning the degree to which Native American lithic industries were employed in a European mission setting.

First, the low ratio of gunflints present implies a continued reliance on traditional arrow points for hunting. Many of the gunflints recovered during these excavations may have been deposited during the 1836 Battle of the Alamo, rather than during the mission occupation (Thomas R. Hester, 1998 personal communication). This conclusion is supported somewhat by the relatively high proportions (35 percent) of arrow points in the bone midden (see Table 11).

The general prevalence of Native American arrow points, especially the Perdiz style point made of glass, in addition to the frequency of side and end scrapers in the midden, is also indicative of the retention of traditional technologies over newly available European materials. Some archeologists (e.g., Ricklis 1998) have suggested that Native American mission occupants may have incorporated metal implements into their toolkits rather than traditional tool forms; the present analysis would seem to imply that the adoption of new technologies may not have been universal. Stronger support for this interpretation may come from future studies of microscopic use wear on blade tools, scrapers, and expediently utilized debitage.

Finally, the relatively low frequency of prismatic blades (14 percent) found with this midden would seem to imply that these tools may not have been integral to the processing of large fauna. No evidence is currently available to refute this impression. However, future studies of mission assemblages should include microscopic use wear studies of both formal tools (such as prismatic

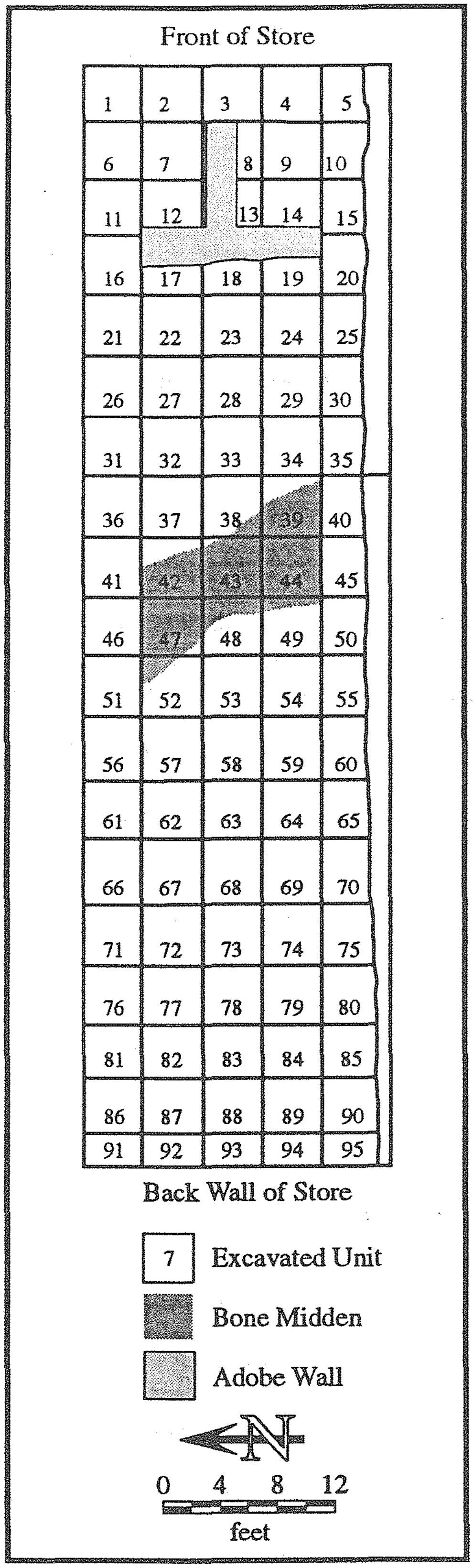


Figure 11. Plan of test units excavated outside of west wall of the Alamo, 1979 (after Meissner 1998:Figure 14).

blades) and expediently used debitage. These studies may identify shifting trends in subsistence behavior in light of the introduction of new materials and resources into Native American toolkits during the mission era, as well as potential changes in subsistence resources that were available.

## DISCUSSION AND CONCLUSIONS

The lithic artifacts recovered during 1979 excavations at the Mission San Antonio de Valero represent an important aspect of mission studies across Southern Texas and Northern Mexico. They illustrate important patterns that existed within Native American mission lithic assemblages, and can help in documenting changes in subsistence behavior through regional comparisons across Southern Texas and Northern Mexico (see Inman, and Tomka, this volume). Such comparisons of mission assemblages may help our understanding of the success or failure of the Spanish advance during the Colonial era.

Through the current analysis, certain fundamental traits can be used to characterize mission lithic industries. These include the Guerrero arrow point type, prismatic blade technology, formal end and side scrapers that are frequently made on prismatic blades, gunflints, and in some cases the presence of core-chopper tools (cf. Hester [1989, n.d.] for discussions of mission lithic toolkits). Many of these traits also characterize Late Prehistoric and Protohistoric, non-mission occupations belonging to the Toyah horizon (Black 1986, 1989; Hester 1977, 1989, 1995; Hester and Hill 1975; Ricklis 1992) and the Rockport phase (Hester and Shafer 1976; Ricklis 1992, 1998). Artifacts diagnostic of these earlier time periods include beveled knives, Perdiz points, bone-tempered ceramics, the reintroduction of blade technology, and drills and perforators made on flakes (Black 1989; Ricklis 1998:109). Artifact types found in missions such as prismatic blades, scrapers, and especially the Perdiz point provide strong evidence of cultural continuity from the Protohistoric into the Historic period.

In the current assemblage, as well as in others available for comparison (e.g., Fox 1979; Inman 1997; Tunnell and Newcomb 1969; Walter 1997), there is evidence of earlier, Archaic material mixed in with the Historic era collections. In many cases,

**Table 11. Artifact Recovery by Unit Number from 1979 Alamo Excavations***

| Unit Number | Arrow Points | Side and End Scrapers | Gunflints | Prismatic Blades | Unifaces | Hammerstones, Choppers, Cores |
|---|---|---|---|---|---|---|
| 38 | 0 | 0 | 1 | 0 | 0 | 0 |
| 39 | 2 | 1 | 0 | 0 | 0 | 0 |
| 42 | 1 | 2 | 0 | 0 | 0 | 1 |
| 43 | 2 | 1 | 0 | 0 | 0 | 1 |
| 44 | 0 | 2 | 0 | 0 | 0 | 0 |
| 47 | 2 | 1 | 0 | 1 | 1 | 0 |
| 48 | 1 | 0 | 0 | 0 | 0 | 0 |
| 49 | 0 | 0 | 0 | 0 | 0 | 0 |
| 52 | 0 | 0 | 0 | 0 | 0 | 0 |
| Totals (percentage) | 8 (35%) | 7 (63%) | 1 (6%) | 1 (14%) | 1 (50%) | 2 (40%) |

* Specific artifacts may be identified in previous tables by their specimen number, which consists of the unit level from which they were recovered.

these artifacts appear to have been curated into mission settings, and several have clearly undergone reuse. Two general implications may be drawn from this behavior. As no Archaic period sites have been reported to underlie the missions, neophyte groups occupying Spanish colonial missions may have been allowed to come and go with relative impunity. Ricklis (1996) has demonstrated how this freedom of movement for the Karankawa Indians of the Gulf Coast allowed them to incorporate nearby Spanish missions into their seasonal subsistence procurement schedule. Also, the preference for chipped stone tools, even those gathered from outside the mission context, may provide another line of evidence against the ready acceptance of European metal implements. These two points argue for the complexity of the relationship between European missionaries and their contemporary Native American neighbors.

Important differences between mission assemblages and those of the Late Prehistoric and Protohistoric periods seem to focus on the shift from Perdiz to Guerrero arrow points, and the presence of gunflints. However, changes are also evident that suggest a closer look is warranted at mission lithic assemblages. As one moves south from the San Antonio missions into Mexico, the frequencies of Guerrero points (cf. Inman 1997; Mounger 1959; Ricklis 1998) show a demonstrable percentage increase in the assemblages. The rapid spread of this style, then, may perhaps be understood either as a sub-regional response to changes in the subsistence base, or to the presence of Native American styles that predominated in Northern Mexico, and that were able to spread into South Texas along with Spanish influences.

The relatively low frequency of formal end and side scrapers in certain missions has been explained by the introduction of functionally equivalent tools made of metal (Ricklis 1998). The strong association between stone scrapers and large faunal remains found during the 1979 Alamo excavations provides an opportunity to reevaluate this conclusion. To explain the relative frequency of these tools in other mission assemblages, one could instead examine how populations of bison and other large fauna were affected during this era, or their representation in midden deposits associated with mission neophyte residential areas, as in the Radio Shack excavations near the west wall of the Alamo.

An additional line of evidence supporting a changing subsistence base is the continuity of prismatic blade technology in some missions. Thus, while formal scrapers were particularly well-suited for processing the bison that inhabited the corridor to the east of the Edwards Plateau (cf. Dillehay 1974), these tools are absent at certain sites. However, the continued use of prismatic blade technology in these same assemblages (e.g., Ricklis 1998) seems to argue for a shift away from large game as an important resource.

Finally, the presence of a core-chopper continuum may be diagnostic of a toolkit based largely on expediently used flakes and flake fragments, thus accounting for the relatively low frequency of formal tools in the Alamo collection discussed here. This pattern pervades domestic toolkits further south in pre-Columbian Mesoamerica (Aoyama 1994; Lohse n.d.). Implications from this observation are (1) that wear patterns on debitage may provide significant information concerning the resources that would have provided important dietary supplements or staples, and (2) that microscopic use wear studies should comprise an integral part of future analyses of mission lithic assemblages.

The Radio Shack collection from Mission San Antonio de Valero has provided an excellent opportunity to examine lithic industries employed by Native Americans in Europeanized contexts. Given the patterns evident is this collection, additional work is warranted in other mission locations throughout Southern Texas and Northern Mexico to determine if the trends suggested here are accurate, because they hold important implications for understanding the acculturation of Native American groups during their protracted diaspora in the Spanish Colonial era.

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# Analysis of Vertebrate Faunal Remains from a Spanish Colonial Deposit at Mission San Antonio de Valero (the Alamo)

*Barbara A. Meissner*

## ABSTRACT

In 1979, the Center for Archaeological Research, University of Texas at San Antonio, completed excavations beneath the floor of a building constructed in 1875 on the west side of Alamo Plaza, in downtown San Antonio, Texas. The building had been constructed over the remains of the west wall of Mission San Antonio de Valero, the first of five Spanish missions in the area. Placement of the building had preserved a well-stratified deposit of 18th and 19th century artifacts. During the excavations, a large undisturbed Spanish colonial period bone bed was discovered, comprised of more than 12,000 bones in excellent condition. This article will report the results of a recent analysis of the contents of this bone bed.

## INTRODUCTION

In July 1979, the Center for Archaeological Research (CAR), of the University of Texas at San Antonio, began excavations inside a building that had been built over the remains of a portion of the west wall of Mission San Antonio de Valero (41BX6; Figure 1). This mission, the first of five Spanish missions along the upper San Antonio River, later became known as the Alamo (Figure 2), and was the site of a world-famous battle during the 1836 Texas Revolution.

The excavations were part of a project to link the city's two most popular tourist attractions: Alamo Plaza and the Riverwalk. The project involved tearing down several buildings along the southern part of the west side of Alamo Plaza to create a park-like link to the Riverwalk, known as the Paseo del Alamo. The building to be excavated had most recently housed a Radio Shack store. It was important because it was the only building along the west side of the plaza that did not have a basement. Originally built around 1870, the building was believed to straddle part of the west wall of Mission San Antonio de Valero (Figure 3). It was considered possible that the building had unintentionally served as a protective barrier over almost 300 years of cultural remains. Although the area was known to have once been part of Mission San Antonio, the building was given a different site number, 41BX438.

Excavations, directed by Jake Ivey, proved that the building did indeed hide a rich deposit of artifacts, ranging in age from the Spanish Colonial period to the late 19th and early 20th centuries, including evidence of the battle in 1836 that had made the old mission world-famous (I. W. Cox, 1996 personal communication). The west wall of the mission, constructed of adobe, was discovered during the excavation. Outside this was a small depression, apparently an arroyo, filled with bone and other refuse, beginning about 2 feet below the original ground surface (Figure 4). When excavation of this feature was complete, a small silver coin was discovered directly beneath the lowest level of bone. It was identified as a 1 real piece, minted in Mexico City in 1748 (Figure 5), conveniently providing a *terminus post quem* for the bone bed date.

The results of the Radio Shack excavations were not published. The bone from the bone bed remained in storage at the CAR curation facility for about 16 years. In 1996, I began an analysis of the bone from the bone bed for a Master's Thesis (Meissner 1998a). This article will present a summary of the results of that analysis, and will

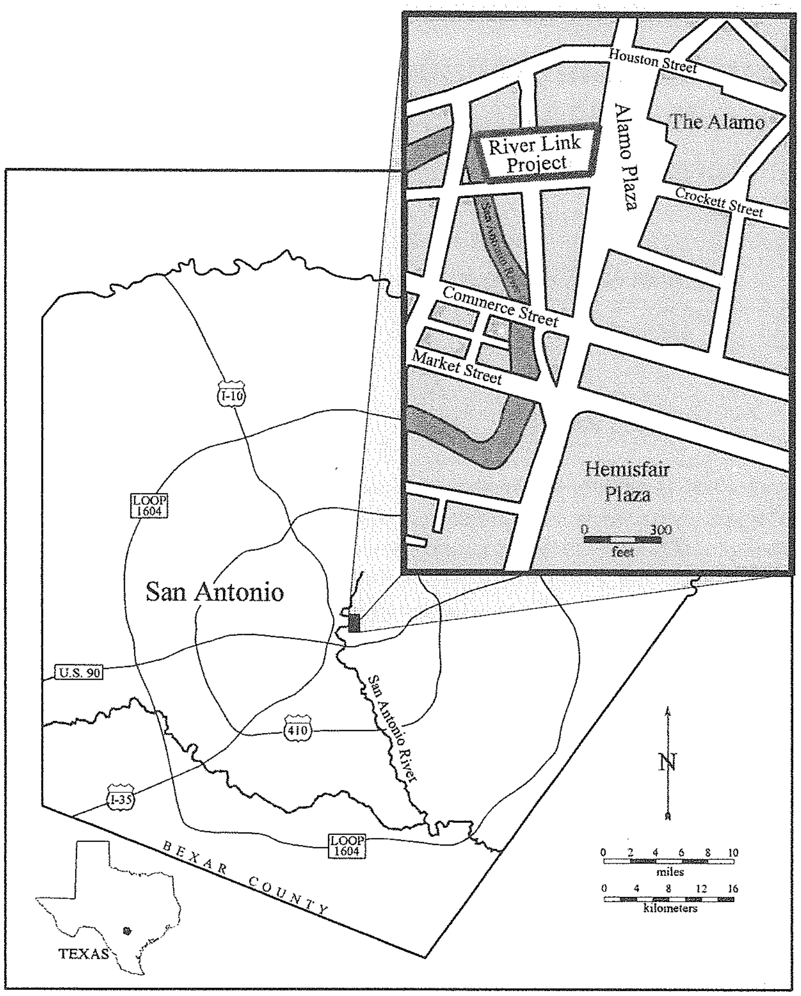


Figure 1. Project location map.

consider how those results can help to reconstruct the lifeways of the people who left the bone there.

## A BRIEF HISTORY OF ALAMO PLAZA

### The Mission (1718-1793)

In 1718 Fray Antonio de San Buenaventura y Olivares finally achieved a decade-long dream: to move the rapidly failing Mission San Francisco Solano from its location on the Rio Grande to a site near San Pedro Springs (de la Teja 1995:8; John 1975:206-207). The location, at the border between the dry lands of what is now southwest Texas and northern Mexico and the relatively wet lands of East Texas, was highly strategic. A mission, presidio, and civilian community were established near the head of the San Antonio River to provide a secure way-station between the Rio Grande and the East Texas missions (Habig 1968:38). Together these three communities formed the nucleus that would become San Antonio, Texas.

Sometime before January 1719, the mission site was moved to the east side of the river, south of the present location, near where Commerce Street crosses the river today (Cox 1994:1). By 1721, 240 Indians were living at the mission. However, in 1724, a hurricane devastated the mission buildings, and it was moved to its present location (Habig 1968:43).

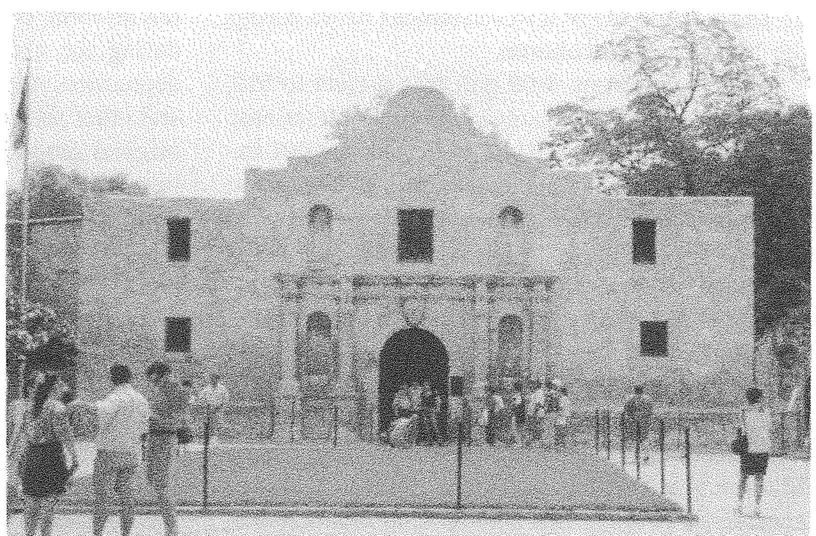

Figure 2. The Church of Mission San Antonio de Valero, now known as the Alamo.

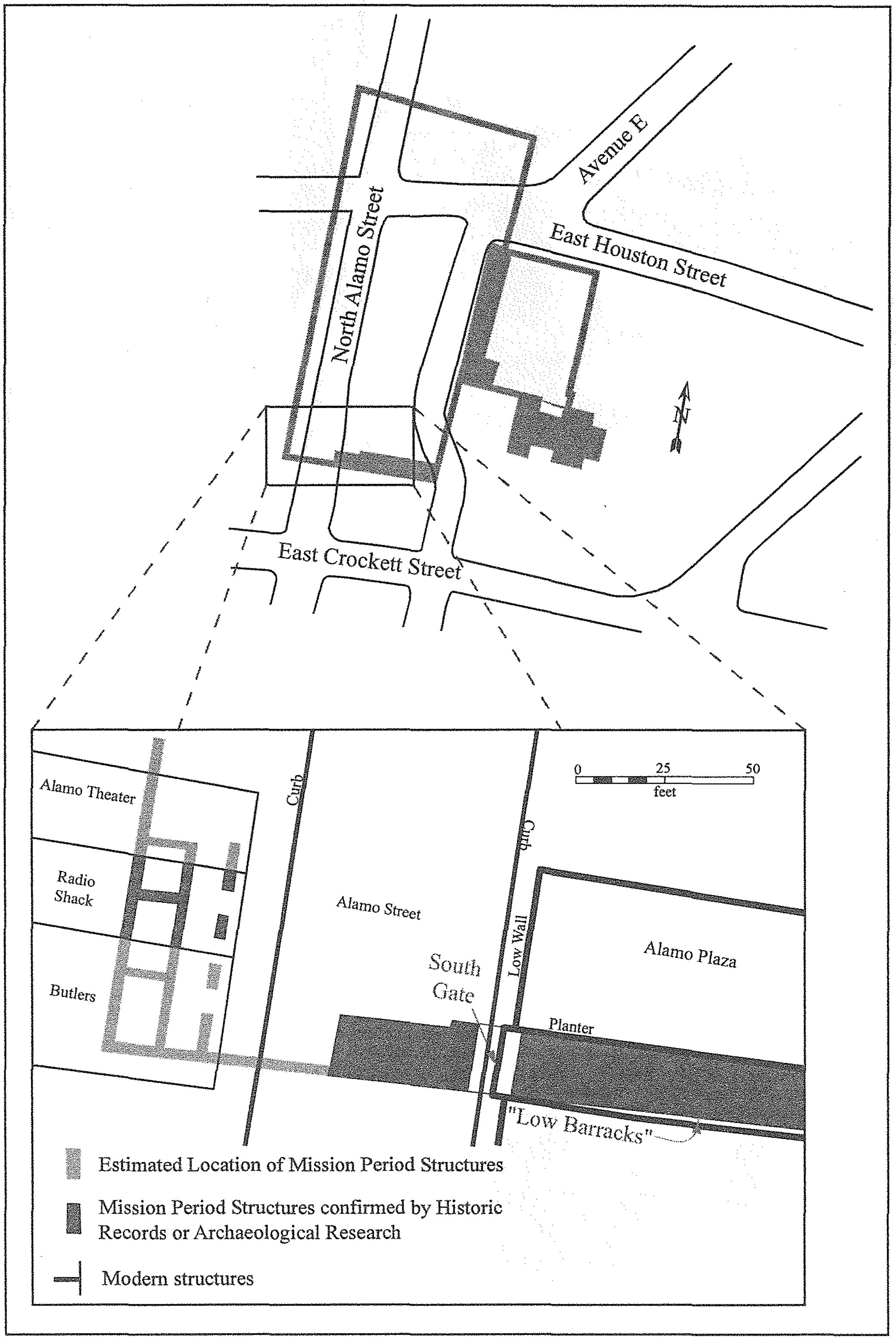


Figure 3. Alamo Plaza, showing modern streets and the outline of the compound of Mission San Antonio de Valero (in gray). The inset shows the southwest corner, with buildings present in 1979, and known and suspected Colonial walls.

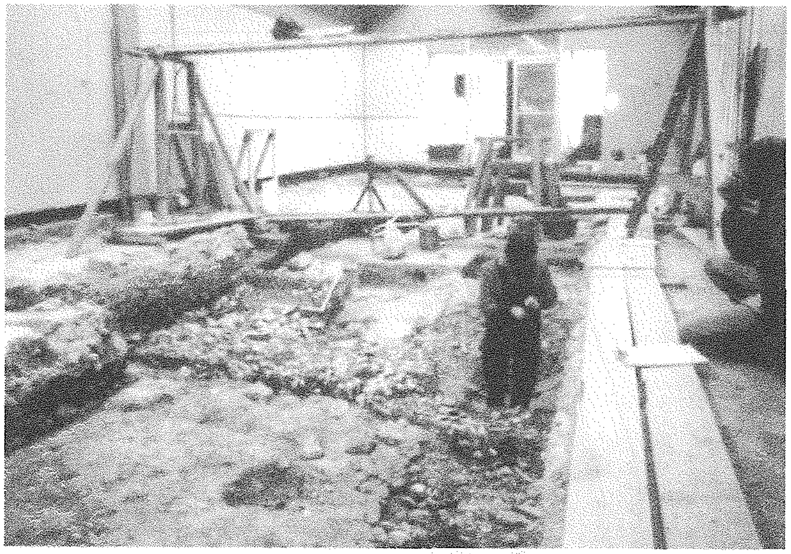

Figure 4. The bone bed.

In 1745, work began on a permanent stone church for the mission. Fray Lopez reported in 1789 that the building had once been completed, but had shortly afterwards collapsed. The rebuilding had been completed to the height of the cornices, but "at this point construction stopped many years ago for lack of qualified workmen. For this and other reasons...it cannot now be carried to completion" (Habig 1968:64-65). By this time, the mission was clearly failing, with only 52 Native Americans in residence (Habig 1968:65). In 1793, a royal decree secularized Mission San Antonio de Valero, and the mission lands were divided among the remaining mission inhabitants and other local citizens.

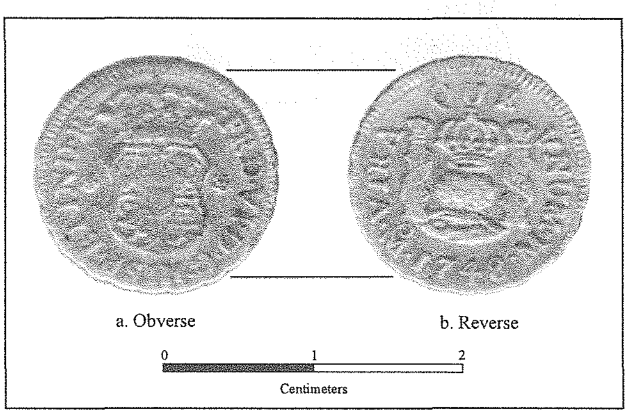


Figure 5. The 1748 silver real found below the bone bed.

## Afterwards: Battleground and Commercial Center

Beginning in 1803, the old mission grounds served as a garrison of the Spanish Army through years of revolutionary turmoil, which did not end even after Mexico won its independence from Spain in 1821. In December 1835, the garrison was captured by Texans seeking independence from Mexico. For 13 days in February and March of the next year, the grounds were held by about 200 men against an army of Mexican soldiers. The siege ended on March 6th, when the Mexican Army overwhelmed the old mission and killed all the defenders (Fehrenbach 1968:185-215). In the aftermath of that war the mission grounds were left in ruins (Cox 1994:7-9).

After a decade of existence as an independent nation, Texas was annexed by the United States. In 1849, the U.S. Army leased the Alamo church and convento from the Catholic church, and began restoring some of the buildings for use as a Quartermaster's Corps depot (Cox 1994:12). There was some question whether the old church should be torn down or repaired; the latter course was taken, not out of respect for its antecedents but as an economy measure (Young 1991:5).

By 1850, the army had repaired the old convento building, built a number of small outbuildings in the old convento patio, put a roof on the old church (its first successful covering after more than a hundred years of existence), and put a cap over the original facade of the building. It is this cap that forms the most famous architectural outline in Texas.

The presence of the army depot increased traffic around Alamo Plaza enormously. In 1876 the army moved out of the Alamo and into the new facilities at Fort Sam Houston (Story 1938:45). The main post office was moved to Alamo Plaza in 1877 (Cox 1994:22). The old convento was being used as a general store, while the church building, which was leased from the Catholic Church, served as the store's warehouse until 1883, when the Texas State Legislature decided that the Alamo church should be purchased by the state. The city of San Antonio agreed to assume upkeep of the building, a responsibility that was later given to the Daughters of the Republic of Texas (Story 1938:54).

Throughout the late 19th century Alamo Plaza continued to develop as an urban center. In the 1880s, the Crockett Block was built along the west side of the plaza, and in 1886 the Grand Opera House was built (Cox 1994:23). The small store between these imposing structures had been built around 1870, and expanded in 1880 (Fox and Ivey 1979); it was in use as a barber shop in 1877 (Meissner 1998a:21). According to the 1923-1927 Sanborn insurance map, the small building was being used as a clothing store, while other buildings along that side of the street were also used for commercial purposes.

During the years before World War II, the park in Alamo Plaza underwent numerous changes (Cox 1994:30). For the centennial of the Battle of the Alamo, the Daughters of the Republic of Texas, with state and federal aid, completely renovated the Alamo grounds, put a new roof on the church, and built the Museum/Gift Shop. The Cenotaph memorial was constructed in 1940 (Cox 1994:33). At about the same time, plans to make a commercial and tourist attraction out of the riverbank in downtown San Antonio were made, and the early stages carried out. However, the beginning of World War II cut off further development of the area, and it was not until the mid-1960s that the Riverwalk was once again set for development (Cox 1994:33). A decade later the plaza was redesigned again. An outline of the "Low Barracks" was reconstructed on the foundations, and used as a flower box (Cox 1994:33; Fox et al. 1976; see Figure 3). The next major change in the structure of the plaza was the Alamo-River Linkage Project, begun in 1979.

Alamo Plaza began as the compound of a mission, became an unsuccessful fortress, lay deserted for a time, and then became one of the major commercial centers of a growing city. Today it functions as a tourist center, and home of numerous commercial enterprises, but also serves as a monument to those who died in the famous battle, and as a reminder of the long history of San Antonio.

## METHODS

### Field Methodology

As mentioned above, the 1979 excavation took place inside a building that had most recently housed a Radio Shack store. With the cooperation of the city, lights and air-conditioning were available. Once the floor and support beams had been recorded and removed, the excavation grid was established (Figure 6). The units were 4 x 4 feet in size, and were numbered consecutively from the northwest corner of the building (Ivey 1989). After the interior excavations were complete, the building was torn down and debris removed. The remains of the west wall were protected, and can be seen today, still in situ, inside a display case at the entrance of the Paseo del Alamo.

The units were excavated in a checkerboard pattern in order to allow profiles to be made of all four walls of each unit. Sixty-five units were excavated during the project. The bone bed was found first in Unit 43, at a depth of approximately 2 feet below the ground surface. As the number, size, and condition of bone was recognized, the decision was made to number each bone before it was removed.

After Unit 43 had reached sterile sediments, adjacent units were excavated down to the level of the bone bed. Only when the extent of the bone bed had been determined was the first layer of bone in the other units removed. All in situ bones visible in a layer were numbered in black India ink (Figure 7), and the ink covered with a layer of polyvinyl acetate (PVA) to seal it (J. E. Ivey, 1998 personal communication). Bones that appeared very fragmented were mended with PVA in situ. Numbered bone was then removed, wrapped individually in aluminum foil along with a paper tag that provided provenience information, including unit, bone layer, and bone identification number. The bone was then placed in paper bags. The next layer of bones was then cleaned. All matrix was screened through 1/4-inch screens. Bone found in the screened matrix was bagged together by provenience, but was not numbered. The bone was stored at the CAR curation facility.

### Laboratory Methods

The bone was washed in tap water, and lightly brushed with soft brushes when needed. Matrix

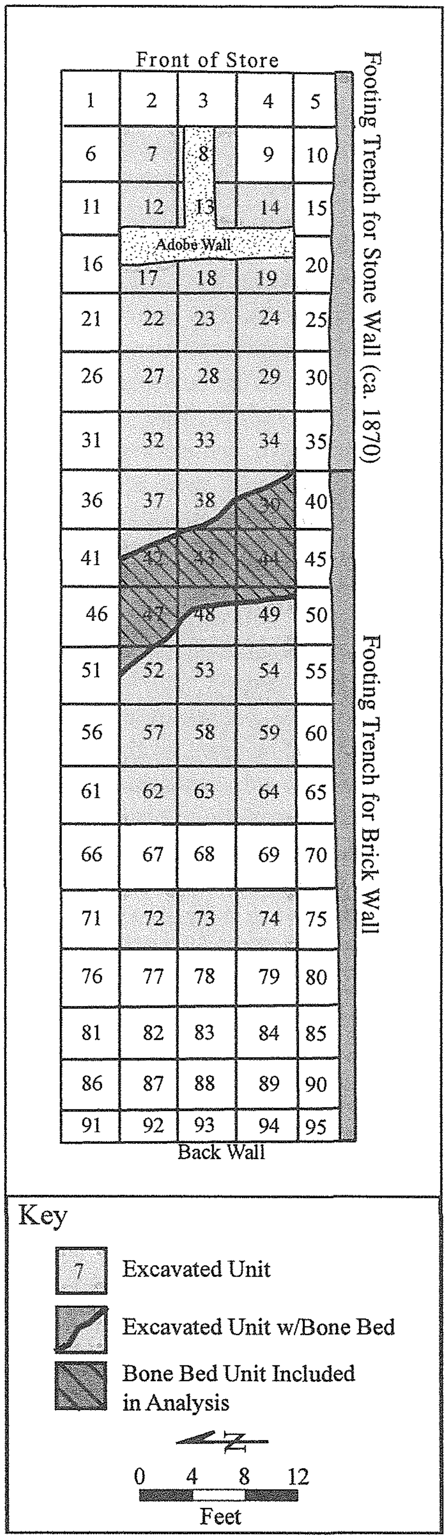


Figure 6. Map of excavation grid inside the Radio Shack building, showing location of west wall and bone bed.

was removed from cavities with dental tools. Care was taken to insure that provenience tags remained with the bone. The bone was air dried, then placed in plastic bags, with provenience tags. Each numbered bone was placed in a separate bag, and unnumbered bones were bagged by unit and layer.

Bone from six of the nine units that contained the bone bed were examined, roughly 97 percent of the total. The unexamined bone was from three units with only a small part of the periphery of the bone bed (see Figure 6).

The bone was identified by the author to the most specific taxon possible using the comparative collection at CAR, as well as several standard reference texts (Balkwill and Cumbaa 1992; Boessneck 1970; Gilbert 1990; Hildebrand 1955; Hillson 1986; Olsen 1960, 1964, 1968; Schmid 1972). Identifications were conservative; that is, bone that appeared to be cow-sized was not identified as cattle (*Bos taurus*) unless it could be differentiated from *Bison* and *Equus* (horse) species. Bone that could be identified to the order taxonomic level was given an ID number in the lab if it did not already have such a number.

The differentiation of *Bos* and *Bison* presents an analytical challenge. The post-cranial skeletons of these two genera are very much alike. Recent work by Balkwill and Cumbaa (1992) has added considerably to the data provided by Olsen (1960), and their work provides a set of characteristics for each post-cranial element that can be used to differentiate *Bos* and *Bison*. While these references have made the task of differentiation easier, a comparative skeleton for both bovids must also be available in order to correctly distinguish between them. Differentiation is still difficult in many cases, however, especially in fragmented bone.

Coding sheets were used to facilitate data collection. The data collected from all bone included: taxon, count, weight, evidence of exposure to heat, and evidence of gnawing. In addition, on bone that could be identified to at least the order taxonomic level, the following data were collected, whenever possible: element; portion of element; whether the portion appeared to have been deliberately butchered (i.e., was the portion the result entirely of butchering practices?); side; criterion used to estimate age; estimated age class; whether the bone had been broken, and if so, whether it was broken while the bone was fresh, while the

Figure 7. CAR staff placing identification numbers on bone.

bone was dry, or both; whether any pathologies were evident, and a description; and the degree of changes due to exposure to atmospheric weathering. When bone exhibited evidence of modification by humans, additional information was collected: the type of modification, location of the modification, and the number of that type of modification at that location.

After examination, each bone was replaced in plastic bags with tags identifying unit, layer, and identification number, if present. The bags were placed in boxes, and the collection is presently stored at CAR. All data was placed in a computer database, designed by the author, using Claris Filemaker Pro 4.0 software. The raw data is available in an appendix in Meissner (1998a).

## Analytic Methods

This section will describe the methods used to analyze some of the categories of data that were recovered during this project. From the beginning, it must be remembered that the bone being examined is only a sample, and a sample biased by many different factors, most of which cannot be controlled (Figure 8). Beginning with the animals available for use by humans, the combination of cultural and non-cultural taphonomic factors that affect the number and identifiability of bone are many and varied. Archeological techniques, including choice of excavation units and recovery methods, have an important effect on the available data. Even the choices made concerning what type of data will be collected, how that data will be categorized, how it will be analyzed, and, as Davis (1987:22) points out, what will be published, can affect the nature of the information that is eventually available to the archeologist.

Although faunal analysis is a relatively young sub-specialty in archeology, there has been a great deal of work done to attempt to sort out the information available from bone, and a large number of possible analyses are available in the literature. Before beginning, it must be decided what exactly one wishes to learn from a particular collection. The research design must take into consideration the context within which the bone was recovered, its condition, methods used to recover it, and time available to collect and analyze data, and then it must be decided what questions will be asked and what data must be collected in order to address those questions. For this paper, two major questions will be addressed: (1) what animals are present in the bone bed and how important was each to the diet of the inhabitants; and (2) what function did the bone bed serve?

### *Relative Abundance and Relative Importance*

Estimation of the relative abundance of taxa in a collection is a subject of major concern in faunal analysis (Baker et al. 1997; Grayson 1984; Lyman 1994a; Reitz and Scarry 1985:16-19). One is faced with the problem of assessing what animals are present in the collection, and ranking the importance of each in the diet of the people who deposited them in the site. The first part of the question concerns not merely identifying the individual bone. Among other things, it is necessary to consider how

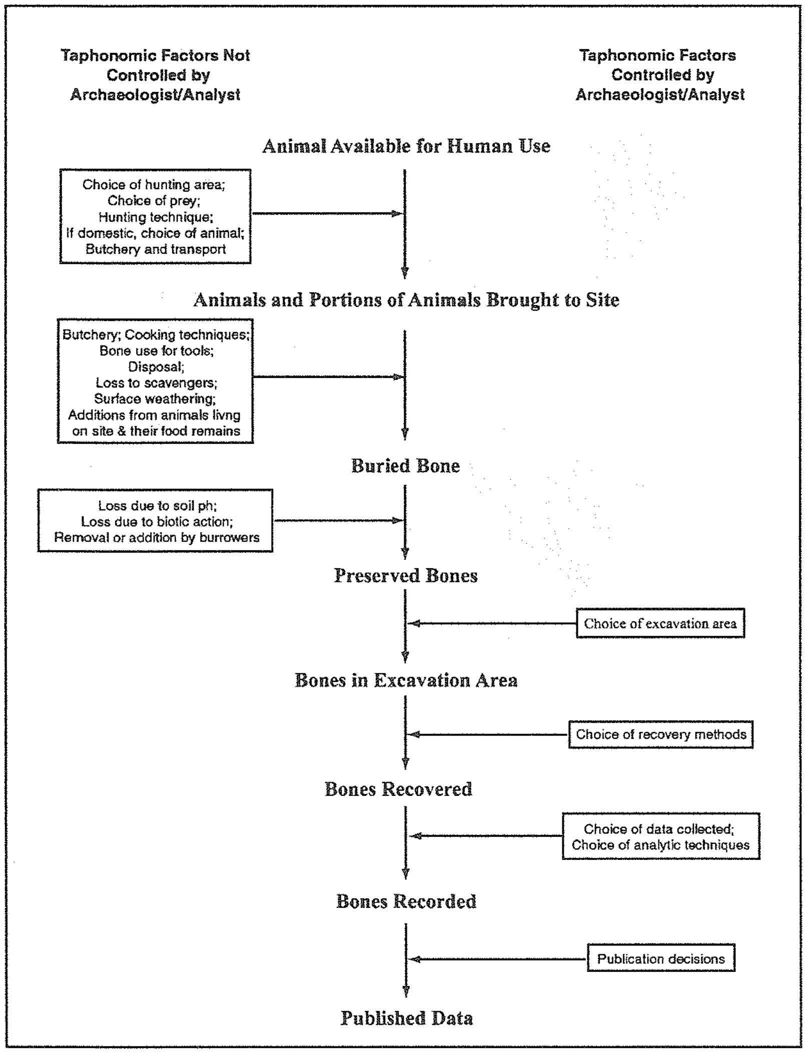


Figure 8. Factors affecting recovery and analysis of faunal data, adapted from Davis (1987:22)

taphonomic changes, both cultural and non-cultural, have affected identifiability.

For the second part of the question, namely what is the relative importance of each taxa, the problem is compounded by the fact that in many cases, it is the bone that is not present—the bone that was taken away from the deposit—that was the most important to the diet. Thus, it is necessary to consider the nature of the deposit: is it bone left at a kill site, a kitchen midden, or a casual scatter? Methods for estimating actual meat and other nutrients represented by bone have been developed (Binford 1978; Casteel 1978; Reitz and Scarry 1985:17-19; White 1953) but each has problems.

### *NISP and MNI*

The relative abundance of animal taxa in a collection is usually estimated by the Number of Identified Specimens (NISP) or the Minimum Number of Individuals (MNI), or often both (Lyman 1994b). NISP is the easiest, as this is simply the count of identified specimens (Lyman 1994b:43). "Identified" is not strictly defined, however, and may be used to mean all bone identified to any given taxonomic level. Usually NISP is limited to bone identified to the genus and/or species level, although it may include bone identified only to family or even order. In this article, NISP will be defined as the number of specimens identified to the genus or species taxonomic level.

Serious problems, however, are associated with using NISP alone to quantify and compare taxa in a faunal collection. Grayson (1984:20-24) identified 11 most-cited criticisms of specimen counts as a method of estimating relative abundance. Of these, the most important are:

1. NISP counts are not independent. Thirty specimens of a given taxon may represent 30 individuals or 30 bones from a single individual, or possibly even a single element. This lack of independence invalidates most statistical methods.

2. The use of NISP assumes that all specimens are equally affected by taphonomic factors, from weathering to butchering practices (Grayson 1984:21). This is not the case. The survival and identifiability of bone is mediated by (among other things) the size of the bone (Von Endt and Ortner 1984), and the bone density of various parts of the skeletal element (Brain 1967; Lyman 1994a:234-235; Lyman and O'Brien 1987). NISP is affected

by butchering and transportation practices, so that differences in specimen counts may simply reflect the fact that some butchering techniques may lead to more bone fragmentation (Grayson 1984:20).

3. Numbers of readily identifiable specimens vary greatly from taxa to taxa, so animals with distinctive bones will be identified more often than animals with less distinctive bones (Grayson 1984:21). For example, turtle carapace of the genus *Trionyx* (soft-shelled turtles) is easily identified even in tiny fragments, while much larger fragments of the carapace of most other turtles are needed to identify the genus (Sobolik and Steele 1996). Thus, the relative abundance of soft-shelled turtles in a collection may be overestimated by NISP.

In order to solve some of these problems, the MNI is often preferred. This is the number of individuals of a given taxa needed to account for the identified bone, as a measure of relative abundance. This value is derived by dividing the identified specimens of a taxa into left and right elements (or portions of elements, such as distal femora, proximal humeri, etc.), and using a count of the most abundant of the elements as the MNI represented by the identified bone (Lyman 1994b:43). In addition, observations can include specimen size and/or age to determine the MNI: if there are three adult left proximal tibia and two right proximal tibia, one of which is immature, the MNI would be four (the three adult proximal left tibias plus an immature animal). MNI has many advantages over NISP, especially in that the counts are all independent of each other; that is, it is safe to assume that each left distal femur represents one and only one animal (Grayson 1984:28).

There are, however, grave problems with MNI as well. Grayson (1984:29-49) has pointed out the MNI of a taxa can be greatly altered, depending on how the faunal collection is aggregated during analysis. That is, a large difference in MNI numbers can be produced depending on how the specimens from a site are grouped: the entire site taken as a unit, or divided by excavation unit, feature, arbitrary level, natural level, or any other division (see Grayson 1984:34-49). MNI also tends to overemphasize the value of small animals (Reitz and Scarry 1985:17). In addition, it must also be remembered that an MNI of three for a given taxa does not mean that three whole animals were present on the site (Reitz and Scarry 1985:17), since in both historic and prehistoric sites some animals may have arrived in the site only as portions of carcasses. Another problem is that MNI almost always reduces the size of the data set to the point that statistical analysis becomes difficult (Grayson 1984:50).

Grayson (1984:92) believes that MNI is a poor method to estimate relative abundance because there is no way around the aggregation problem unless it is known exactly how the site was formed and what parts of the site accumulated at the same time. All things considered, Grayson prefers NISP to MNI for estimates of relative abundance, since they provide "the best unit we have available for measuring the relative abundance of vertebrate taxa in archaeological sites" (Grayson 1984:92).

Although Grayson's arguments against the use of MNI are persuasive, it is a value that is often used in faunal analyses. MNI values will be included in this article in order to facilitate use of this data by other analysts, as well as to estimate the number of each element which should be present in the bone bed.

### *Bone Weight and Biomass*

One way around the problem of NISP and MNI is to consider that the main reason (at least in this case) that we want to know the relative abundance of a taxon is that we want to understand its relative importance in the diet. Neither NISP or MNI should be used for this purpose. Clearly a high NISP or MNI of rats in a site does not necessarily mean that rats composed a high percentage of the nutrition in a diet, both because rats may or may not have been eaten (especially in historic sites) and because rats are very small mammals compared to a deer or cow.

Estimates of meat weight represented by bone in an assemblage may be a better method for estimating relative importance in a diet, since meat is the primary (although not only) goal of dietary animal utilization. Specific methods for doing this, however, are problematic. For instance, early versions of this method were based on generic estimates of the percentage of live weight of animals that was edible (White 1953) multiplied by the MNI, to give an estimate of total meat weight represented by the bone (Davis 1987:36). These studies were seriously flawed, because of the questionable accuracy of MNI as well as the fact that in many sites only portions of a given animal were ever at the site and were eaten (Reitz and Scarry 1985:18).

Reitz and Scarry (1985:18) describe a method of estimating meat weight (biomass) that is based on the fact that the amount of meat carried by a bone increases exponentially as the bone weight increases (Casteel 1978). The method uses an allometric equation based on the weight of the bone to estimate biomass represented by the bone in question. The curve described by the equation is different for different taxa (Reitz and Scarry 1985:67 and Table 9). Reitz and Scarry (1985:19) believe that this method results in a more accurate estimate of meat weight represented by bone. They admit, however, that bone weight itself can be influenced by many taphonomic variables and suggest that it be used only for comparing relative importance within a site, where such factors can be considered to have affected bone more or less equally (Reitz and Scarry 1985:19).

Although the method Reitz and Scarry (1985:19) use to estimate biomass represented by bone weight is tempting, it has several problems. In the first place, the assumption that taphonomic factors affecting bone weight are likely to do so equally (i.e., as an equal or nearly equal percentage of the bone weight of each bone) is invalid. As mentioned above, bone density has a considerable affect on how susceptible a given bone or portion of bone may be to such factors as weathering and leaching (see Brain 1967; Lyman 1994a:234-235; Lyman and O'Brien 1987). In addition, the absolute size of the bone, and whether the bone is whole or broken, will also influence the degree to which taphonomic factors affect the bone (Lyman 1994a:421-422; Von Endt and Ortner 1984).

A more serious problem, however, is the nature of the equations used to estimate biomass. Although adjustments are made to describe the relationship of bone weight to biomass for different taxa (Reitz and Scarry 1985:67 and Table 9), the equation assumes that that relationship is the same for all bones in the animal. Yet it is clear that this is not the case. The heavier, denser bones of the lower legs of most animals do not, in fact, carry a great deal of usable meat and thus represent body areas of relatively low nutritional value, compared to much lighter ribs and vertebrae. The equations used to estimate biomass are based on the ratio of meat weight to bone weight averaged over the whole animal (Casteel 1978). The solution to this problem is to divide the bones of the body into groups with roughly similar nutritional value (e.g., lower legs, thoracic vertebra, upper legs, etc.), and use ratios of biomass to bone weight in each as the basis for adjusting allometric equations used to estimate biomass. Unfortunately, the data needed for this solution are not available at this time. While the method described by Reitz and Scarry (1985) is very useful to more accurately estimate the relative importance of taxa from different classes, it is problematic when used to estimate relative importance among mammals alone.

Given the foregoing discussion, the decision was made to use simple bone weight to estimate relative importance in the meat diet of the bone studied from the Radio Shack excavations at the Alamo. The use of bone weight alone has many of the same problems that calculation of biomass has. As mentioned above, bone weight is differentially affected by taphonomic factors, depending on size and density of the individual bone. And, like estimates of biomass, bone weight also over-emphasizes taxa represented by large percentages of dense lower limbs compared to taxa represented largely by ribs and vertebra. The difference is that bone weight, used alone as a measure of relative importance, does not attempt to estimate the actual amount of meat represented by the bone.

Used together, NISP, MNI, and bone weight can provide a picture of the relative importance of a taxon to the diet. Each measure provides both information and a check against some of the problems that plague the others. Use of all three together does not allow for a straightforward ranking of taxa importance, however. The ability to do this accurately in all situations awaits new analytic techniques.

## Describing Butchery

### *What is butchery?*

Lyman (1987:252) has defined butchering as "the human reduction and modification of an animal carcass into consumable parts [where] 'consumable' is broadly construed to mean all forms of use of carcass products including but not restricted to consumption of products as food." Binford

(1978:48) notes that "butchery is not a single act but a series of acts beginning when the animal is killed and continuing at varying junctures until the animal is totally consumed or discarded." Of interest in the faunal analysis is what particular parts of the animal the butcher exploited, and for what, and what processes were used to extract them (Lyman 1994a:295). An underlying assumption of studies of butchery is that it reflects the pragmatic and efficient human use of the animal carcass (Lyman 1994a:296).

Butchery is a process that uses different techniques depending on the intended use of various parts of the animal carcass, the size of the carcass, transportation logistics, and the tool technology available to the butcher. Lyman (1994a:300) has divided the process into a set of stages: (1) kill-butchery, which involves slaughter of the animal and any preliminary butchery done at the kill site (such as gutting, partial disarticulation, and skinning) before transport of some or all of the carcass; (2) secondary stage butchery, in which the carcass is further processed, and some secondary transportation of the carcass parts takes place, even if only the distribution of parts to a different area of the site (to a cooking area, for instance); and (3) final butchery-consumption stage, in which final processing and use of the various parts takes place. Any unwanted parts will be discarded at each of these stages.

One of the questions that must be considered during analysis of butchery is: What is here, what is not, and why? Human beings sometimes kill, process, eat, and dispose of an animal in the same location, but usually at least some transportation of at least some parts of the carcass takes place between the death of the animal and the final disposal of all products acquired from it (Lyman 1994a:299). Analysis of what parts of the carcass of each taxa were present, and how each part was processed can suggest what behaviors resulted in the presence of bone in the excavated area.

### Coding Bone Modifications

The choice of what data to collect in order to study butchery in a faunal collection can be difficult. In a collection of any size, the time it takes to collect needed data from an individual bone for a very detailed study of butchery practices can be prohibitive. The problem faced in this situation is the coding of locations, type, and count of bone modification in as efficient a manner possible, given realistic time constraints, and most importantly, the amount of information that is needed to pursue the research design.

Methods used to understand the butchery of animals in an archeological site can range from mere mention that a bone displays some kind of butcher mark to detailed descriptions of all modifications, including the nature, counts, exact location, and direction of such modification, and an analysis of the presumed purpose (e.g., dismemberment, flaying, filleting, processing for bone grease, etc.) that each identifiable modification represents (Binford 1978, 1981). There have been several attempts to develop such a system of coding (see Baker and Shaffer 1991; Lyman 1994a: 297-306). One of the most detailed is that of Shaffer and Baker (1992). This system allows detailed coding of exact descriptions and locations of bone modifications and includes advice about the use of computer database systems for collection and analysis of data.

The system proposed by Shaffer and Baker (1992) has the advantage of completeness and flexibility. The location codes identify exact areas on bone, such as "acetabular end of ischium," "horizontal ramus with diastema," and "semi-lunar notch only" (Baker et al. 1997:310 and Table 13.3). However, the number of bones to be examined from the Radio Shack excavations made use of this highly detailed method daunting, and the research design in this analysis made it unnecessary. The major question to be asked of the data was: are any particular butchering patterns evident in this assemblage? In order to answer this question the data needed was the number and type of butcher marks on bone identifiable to the order taxonomic level, and a general idea of the location of these marks. The author and a colleague, Johanna Hunziker, developed a series of line drawings representing stylized bovid bones with general locations numbered on each. The location of each modification was coded by (1) element; (2) view (e.g., dorsal, anterior, lateral, etc.); and (3) numbered location of modification. Figure 9 shows an example of location codes for two bones, a femur and a scapula.

Bone modification type was categorized as thin cut (superficial), thick cut (superficial), chop (deep), or impact scar; no saw-cut bone was recovered from the bone bed. Chop marks were characterized

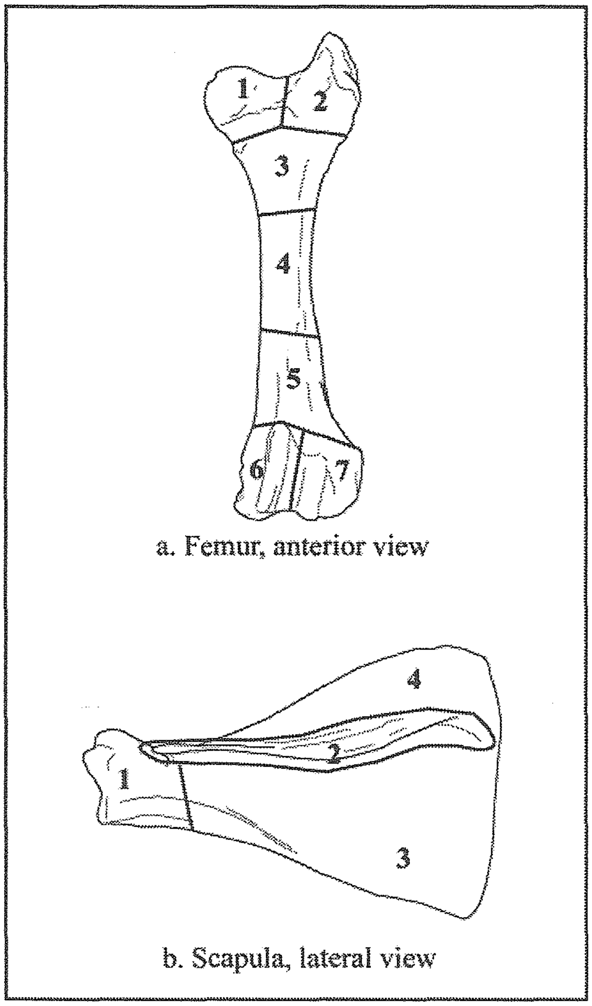


Figure 9. Sample of butcher mark location coding sheets.

as rough or clean-edged. Generally speaking, clean-edged chop marks are almost certainly made with metal tools, while rough-edged marks are more likely (but not certainly) to have been made with a stone tool (Binford 1981:105). Blumenschine et al. (1996) have shown that such determinations can be reliably made with the aid of low-powered magnification. During the analysis, it was noted if characteristics of a rough-edged chop were such that it was probably (as opposed to possibly) made with a stone tool.

## RESULTS OF THE FAUNAL ANALYSIS

A total of 11,142 animal bones, weighing 100,011.42 g, was analyzed from the Radio Shack excavations (Table 1). A total of 3,179 (28.5 percent) was identified to at least the order taxonomic level and 1,881 (16.9 percent) were identified to one of 37 genera. The bone was, in general, in an excellent state of preservation. Very few showed evidence of having been seriously damaged. Not infrequently, bone was broken either in the process of excavation or during packaging or transportation; however, as the fragments of such bones were packed together, wrapped in aluminum foil, broken bones could be rejoined, so little or no information was lost.

More than 97 percent of the bones identified to class are mammalian. Reptiles are the next largest class, with 1.2 percent, followed by birds with 1 percent. Fish and amphibians each comprise less than 1 percent. In fact, only a single amphibian bone was identified.

There were 38 bones found articulated with at least one other bone (excluding unsealed epiphyses still articulated to metaphyses). All but one set of articulated bones were portions of the lower legs of animals. Most were cattle (*Bos*), however, deer (*Odocoileus*) feet and portions of the feet of a young black bear (*Ursus*) were also found articulated. The single set of articulated bones that was not lower legs was three vertebrae from a young alligator. Although articulated bones were found in all levels, the majority were found in the uppermost layer of bone, Level 1, and thus were deposited last.

### Identified Taxa

Table 2 lists all bone identified to the genus taxonomic level, with NISP, MNI, and bone weight. Thirty-seven different taxa are listed, including 20 mammalian taxa, three bird taxa, eight reptilian taxa, one amphibian taxon, and five fish taxa.

#### *NISP*

Cattle (*Bos*) is by far the most common identified taxa, representing 47 percent of the total NISP (see Table 2). Bison is the next most common, with black bear third. The low numbers of other taxa is striking. Thirteen taxa (34.2 percent) are represented by less than five identified bone and 22 (57.9 percent) are represented by less than 10 bones.

**Table 1. Identified Taxa**

| Taxon | Common Name | NISP |
|---|---|---|
| Mammalia | Mammals | |
| *Antilocarpa americana* | Pronghorn antelope | 1 |
| Artiodactyl | Deer, antelope, goat, or sheep | 142 |
| *Bison bison* | American bison | 230 |
| *Bos taurus* | Domestic cattle | 885 |
| Bovinae | Cattle or bison | 1256 |
| *Canis* cf. *familiaris* | Dog | 1 |
| *Canis* cf. *lupus* | Wolf | 12 |
| *Canis* sp. | Dog, coyote, or wolf | 15 |
| *Capra hircus* | Domestic goat | 21 |
| *Capra/Ovis* | Goat or sheep | 15 |
| Chiropterae | Bats | 14 |
| *Didelphis virginiana* | Opossum | 9 |
| *Equus* cf. *caballos* | Horse | 10 |
| *Equus* cf. *asinus* | Donkey | 42 |
| *Equus* sp. | Horse family | 15 |
| *Lepus californicus* | Blacktailed jackrabbit | 3 |
| *Mephitis mephitis* | Striped skunk | 2 |
| *Neotoma* sp. | Wood rats, packrats | 4 |
| *Odocoileus virginianus* | White-tailed deer | 46 |
| *Ovies aries* | Domestic sheep | 52 |
| *Pecari tajacu* | Javelina | 4 |
| cf. *Puma concolor* | Puma | 11 |
| *Sciurus* sp. | Tree squirrels | 6 |
| *Sigmodon hispidus* | Hispid cotton rat | 3 |
| *Sus scrofa* | Domestic pig | 36 |
| *Sylvilagus* sp. | Cottontail rabbits | 4 |
| cf. *Ursus americanus* | Black bear | 199 |
| *Urocyon cinereoargenteus* | Gray fox | 3 |
| | Total Identified Mammals | 3041 |
| | Very small mammals | 15 |
| | Small mammals | 15 |
| | Medium mammals | 39 |
| | Large mammals | 160 |
| | Very large mammals | 1350 |
| | Mammal, size indeterminate | 6093 |
| | Total Mammals | 10,713 |
| Aves | Birds | |
| Anatidae | Ducks and Geese | 1 |
| *Branta* cf. *canadensis* | Brant goose | 5 |
| *Gallus domesticus* | Domestic chicken | 7 |
| *Meleagris gallopavo* | Turkey | 7 |

**Table 1.** *(Continued)*

| Taxon | Common Name | NISP |
|---|---|---|
| | Total Identified Birds | 20 |
| | Very small birds | 4 |
| | Small birds | 36 |
| | Medium birds | 29 |
| | Large birds | 15 |
| | Very large birds | 8 |
| | Total Birds | 112 |
| Reptilia | Reptiles | |
| *Alligator mississippiensis* | Alligator | 8 |
| *Chelydra serpentina* | Snapping turtle | 1 |
| *Crotalus atrox* | Western diamondback rattlesnake | 17 |
| *Lampropeltus getulus* | Bull snake | 1 |
| *Pituophis* sp. | Rat snake | 2 |
| *Pseudemys* sp. | Pond sliders | 39 |
| *Terrepene* sp. | Box turtles | 5 |
| *Trionyx spiniferus* | Spiny softshelled turtle | 3 |
| *Trionyx* sp. | Softshelled turtle | 8 |
| | Total Identified Reptiles | 84 |
| | Unidentified turtles | 53 |
| | Total Reptiles | 137 |
| Amphibia | Amphibians | |
| *Bufo* sp. | Toads | 1 |
| | Total Amphibians | 1 |
| Osteichthys | Fish | |
| *Aplodontus grunniens* | Freshwater drum | 7 |
| *Ictalurus* sp. | Catfish | 11 |
| *Lepisosteus* sp. | Gars | 9 |
| *Micropterus* sp. | Black bass | 1 |
| *Pylodictus punctatus* | Flathead catfish | 2 |
| | Total Identified Fish | 30 |
| | Unidentified fish | 18 |
| | Total Fish | 48 |
| | Unidentified Vertebrates | 131 |
| | Total Bone | 11,142 |

**Table 2. NISP, MNI, and Bone Weight**

| Genus | NISP | Percent | Weight (g) | Percent | MNI | Percent | Notes |
|---|---|---|---|---|---|---|---|
| *Antilocarpa* | 1 | 0.05 | 24.13 | 0.04 | 1 | 1.7 | |
| *Bison* | 230 | 12.2 | 12,943.65 | 18.9 | 3 | 5.2 | 1 immature |
| *Bos* | 885 | 47.1 | 52,259.83 | 76.2 | 13 | 22.4 | 6 immature |
| *Canis* | 28 | 1.5 | 97.85 | 0.1 | 2 | 3.5 | 1 dog, 1 wolf |
| *Capra* | 22 | 1.2 | 242.72 | 0.4 | 2 | 3.5 | 1 immature |
| *Didelphis* | 9 | 0.5 | 5.66 | 0.01 | 1 | 1.7 | |
| *Equus* | 67 | 3.6 | 988.67 | 1.4 | 2 | 3.5 | 1 horse, 1 donkey |
| *Lepus* | 3 | 0.2 | 4.42 | 0.01 | 1 | 1.7 | |
| *Mephitis* | 2 | 0.1 | 2.94 | <0.01 | 1 | 1.7 | |
| *Neotoma* | 4 | 0.2 | 0.51 | <0.01 | 1 | 1.7 | |
| *Odocoileus* | 46 | 2.5 | 724.88 | 1.1 | 2 | 3.5 | 1 immature |
| *Ovis* | 52 | 2.8 | 651.66 | 1.0 | 4 | 6.9 | 1 immature |
| *Pecari* | 4 | 0.2 | 12.01 | 0.02 | 1 | 1.7 | |
| *Puma* | 11 | 0.6 | 73.08 | 0.1 | 1 | 1.7 | 1 immature |
| *Sciurus* | 6 | 0.3 | 1.33 | <0.01 | 1 | 1.7 | |
| *Sigmodon* | 3 | 0.2 | 0.47 | <0.01 | 1 | 1.7 | |
| *Sus* | 36 | 1.9 | 143.32 | 0.2 | 1 | 1.7 | |
| *Sylvilagus* | 4 | 0.2 | 1.30 | <0.01 | 1 | 1.7 | |
| *Ursus* | 199 | 10.6 | 144.64 | 0.2 | 1 | 1.7 | 1 immature |
| *Urocyon* | 3 | 0.2 | 5.55 | 0.01 | 1 | 1.7 | |
| *Branta* | 5 | 0.3 | 0.95 | <0.01 | 1 | 1.7 | |
| *Gallus* | 7 | 0.4 | 6.10 | 0.01 | 1 | 1.7 | |
| *Meleagris* | 7 | 0.4 | 17.45 | 0.03 | 1 | 1.7 | |
| *Alligator* | 8 | 0.4 | 34.99 | 0.05 | 1 | 1.7 | 1 immature |
| *Chelydra* | 1 | 0.05 | 6.06 | 0.01 | 1 | 1.7 | |
| *Crotalus* | 17 | 0.9 | 5.43 | 0.01 | 1 | 1.7 | |
| *Lampropeltus* | 130 | 6.9 | 0.05 | <0.01 | 1 | 1.7 | |
| *Pituophis* | 2 | 0.1 | 0.61 | <0.01 | 1 | 1.7 | |
| *Pseudemys* | 39 | 2.1 | 96.06 | 0.1 | 1 | 1.7 | |
| *Terrepene* | 5 | 0.3 | 7.80 | 0.01 | 1 | 1.7 | |
| *Trionyx* | 14 | 0.7 | 27.25 | 0.04 | 1 | 1.7 | |
| *Bufo* | 1 | 0.05 | 0.14 | <0.01 | 1 | 1.7 | |
| *Aplodontus* | 7 | 0.4 | 1.07 | <0.01 | 1 | 1.7 | |
| *Ictalurus* | 11 | 0.6 | 5.30 | 0.01 | 1 | 1.7 | |
| *Lepisosteus* | 9 | 0.5 | 1.31 | <0.01 | 1 | 1.7 | |
| *Micropterus* | 1 | 0.05 | 2.56 | <0.01 | 1 | 1.7 | |
| *Pylodictus* | 2 | 0.1 | 2.40 | <0.01 | 1 | 1.7 | |
| Totals | 1881 | 100.0 | 68,544.15 | 100.0 | 58 | 100.0 | |

Both bison and bear display the problem in using NISP for assessing relative abundance. More than half (124 of 230) of the bison bones are from a single, highly fragmented skull. The bear bone consists of a highly fragmented skull and the bones of the feet, including the unsealed epiphyses of the metapodials and a distal radius, probably from a single individual. While bison is one of the more abundant taxa according to MNI and weight (see below), the high NISP of the bear is misleading. If NISP percentages were used without consideration of MNI and bone weight, the result would be an inaccurate estimate of relative abundance.

The way that these bones were excavated and stored permits an adjustment of the raw NISP numbers to allow, to some extent, for fragmented bones. Bones with ID numbers were packaged separately, so even if they were fragmented during excavation or afterwards, they retained a single ID number. For instance, the cow skull labeled 884 in the field was very fragile, and in the process of excavating, storing, and cleaning it, it was broken into 232 pieces. These fragments were kept together, and still have a single ID number. Another example is the goat radius labeled 941, which is broken in four pieces. The computer database makes it possible to find those bones that had ID numbers, and were fragmented. For each of these, the NISP could be adjusted to 1. Of course, only bone that had been numbered and packaged together could be treated in this fashion. Table 3 shows the bone identified to one of the mammal genera, with NISP and adjusted NISP. The percent of the total listed in Table 3 is probably a more accurate estimate of the relative abundance of mammals in the bone bed than the percentage of raw NISP. Bison is only about half as

**Table 3. NISP and Adjusted NISP of Mammalian Genera**

| Genus | NISP | Percent | Adjusted NISP | Percent |
|---|---|---|---|---|
| *Antilocarpa* | 1 | 0.1 | 1 | 0.1 |
| *Bison* | 230 | 14.2 | 67 | 7.3 |
| *Bos* | 885 | 54.8 | 534 | 58.0 |
| *Canis* | 28 | 1.7 | 25 | 2.7 |
| *Capra* | 22 | 1.4 | 19 | 2.1 |
| *Didelphis* | 9 | 0.6 | 7 | 0.8 |
| *Equus* | 67 | 4.1 | 41 | 4.5 |
| *Lepus* | 3 | 0.2 | 2 | 0.2 |
| *Mephitis* | 2 | 0.1 | 2 | 0.2 |
| *Neotoma* | 4 | 0.2 | 2 | 0.2 |
| *Odocoileus* | 46 | 2.8 | 44 | 4.8 |
| *Ovis* | 52 | 3.2 | 41 | 4.5 |
| *Pecari* | 4 | 0.2 | 3 | 0.3 |
| *Puma* | 11 | 0.7 | 10 | 1.1 |
| *Sciurus* | 6 | 0.4 | 6 | 0.7 |
| *Sigmodon* | 3 | 0.2 | 3 | 0.3 |
| *Sus* | 36 | 2.2 | 35 | 3.8 |
| *Sylvilagus* | 4 | 0.2 | 4 | 0.4 |
| *Ursus* | 199 | 12.3 | 73 | 7.9 |
| *Urocyon* | 3 | 0.2 | 1 | 0.1 |
| Totals | 1615 | 100.0 | 920 | 100.0 |

abundant according to the percentage of adjusted NISP than in the raw NISP counts. The percentage of bear is also reduced. Cows, and deer, on the other hand, have a higher percentage of the total adjusted NISP (see Table 3). Differences for other taxa are small. The ranking of mammals by abundance after adjusting the NISP shows that cattle are by far the most abundant, with bear, bison, deer, sheep, and equids the next most abundant.

While this method of adjusting NISP did permit allowances to be made for some of the bone fragmentation, it did not solve all the problems associated with using NISP as a measure of relative abundance. The abundance of bear is, for instance, still overestimated by this method.

### *MNI*

Cattle also dominate the MNI, with 13 (see Table 2). The next highest MNI is sheep (*Ovis*) with four and bison (*Bison*) with three. Only four other genera had an MNI of two. However, MNI was calculated by aggregating the entire analyzed collection. It is possible that this is not how the bone bed accumulated, in which case these MNI would underestimate the actual abundance of some taxa.

### *Bone Weight*

Bone weight has the advantage of combining all identified bone, no matter how fragmented. If the bone weight is used as an estimate of relative dietary importance of the different taxa identified, the dominance of cattle is even more apparent than in MNI, NISP, or adjusted NISP. *Bos* bone is more than 76 percent of the weight of bones identified to the genus level. In comparison, *Bison* comprises about 19 percent, while only horse and deer were more than 1 percent of the weight of the total NISP (see Table 2).

Together, domestic animals make up 79.3 percent of the total identified bone weight. Bison is the only wild animal with a significant percentage of total bone weight.

## Cattle Elements Present

Table 4 shows the numbers of body parts of cattle compared to expected numbers of that body part, given an MNI of 13 (see Table 2). Complete long bones are listed twice, once for proximal and once for distal ends. There is a higher percentage of observed proximal metatarsals, compared to the expected number, than any other body part. Distal tibia, proximal radius, and proximal metacarpal have the next highest percentage of expected counts. All other body parts listed had less than half the expected counts. Distal ribs were the least represented in the bone bed, with only 0.3 percent of the expected numbers.

## Human Modification: Butchering and Burning

### *Butchering*

The only intact long bones of *Bos* or *Bison* were a radius and a number of metapodials. A total of 14 complete bovid metapodials were identified, three of which were articulated to the rest of the lower leg.

Figure 10 shows locations where at least two chop marks and/or impact scars were observed on the bones. This figure is only a guide to location of the butcher marks, however. It may appear, for instance, that the radius, ulna, and tibia were more heavily processed than the femur or humerus, but this is because, as mentioned earlier, there were many more examples of the radius and ulna in the collection (see Table 4). The near-absence of femora identified as *Bos*, for instance, makes it difficult to determine how they were routinely processed.

Crania were generally in very fragmented condition, but all appeared to have been chopped open down the middle (Figure 10a). Most marks on mandibles were either just posterior to the diastema or at the beginning of the ascending ramus. These breaks were either chopped or hammered, with chop marks either clean or rough (Figure 10b).

The pelvis was chopped just above the acetabulum, usually with a metal tool, and again at the neck of the illium. The pubis was either broken without leaving chop or impact marks, or was left intact (Figure 10c).

Only six scapula identified as *Bos* had chop or impact marks on them (Figure 10d). On five of these, the acromion process had been removed by a series of chops, usually rough-edged, from the dorsal end. The scapula were either chopped or

**Table 4. Expected Counts (MNI=13), Observed Counts, and Percentage of Expected Counts of *Bos taurus***

| Body Part | Expected | Observed | Percent of Expected |
|---|---|---|---|
| Ribs-distal | 338 | 1 | 0.3 |
| Distal Femur | 26 | 2 | 7.7 |
| Ribs-proximal | 338 | 27 | 8.0 |
| Thoracic Vertebrae | 169 | 19 | 11.2 |
| Proximal Humerus | 26 | 3 | 11.5 |
| Distal Humerus | 26 | 5 | 19.2 |
| Proximal Femur | 26 | 5 | 19.2 |
| Skull | 13 | 3 | 23.1 |
| Foot Bones | 312 | 72 | 23.1 |
| Pelvis | 26 | 7 | 26.9 |
| Distal Ulna | 26 | 7 | 26.9 |
| Scapula | 26 | 7 | 26.9 |
| Atlas | 13 | 4 | 30.8 |
| Axis | 13 | 4 | 30.8 |
| Mandible | 26 | 8 | 30.8 |
| Lumbar Vertebrae | 78 | 27 | 34.6 |
| Tarsals | 156 | 56 | 35.9 |
| Sacrum | 13 | 5 | 38.5 |
| Distal Metatarsal | 26 | 12 | 46.2 |
| Distal Metacarpal | 26 | 12 | 46.2 |
| Proximal Tibia | 26 | 12 | 46.2 |
| Proximal Ulna | 26 | 12 | 46.2 |
| Distal Radius | 26 | 12 | 46.2 |
| Cervical 3-5 | 39 | 19 | 48.7 |
| Carpals | 130 | 69 | 53.1 |
| Proximal Metacarpal | 26 | 14 | 53.8 |
| Proximal Radius | 26 | 14 | 53.8 |
| Distal Tibia | 26 | 15 | 57.7 |
| Proximal Metatarsal | 26 | 21 | 80.8 |

impacted about one-third of the way up from the articulation with the humerus. In some cases there were chop marks just dorsal of the articulation, or in the glenoid fossa itself, always with a metal tool, although these chops usually did not cut all the way through the bone.

Because only the proximal end and, in some cases, the distal half are distinctive in bovids, many rib fragments could not be identified to genus, *Bos* or *Bison* (Figure 10e). There were 17 proximal rib sections identifiable as *Bos*. All but four of these were chopped from the dorsal side, with either clean or rough-edged tools. Only a single distal rib could be identified as *Bos*. There were four clean chop marks near its proximal end.

There does not seem to be any pattern to the marks left on cervical vertebrae, as they appeared in no particular location. However, all but one of the chop marks were from metal tools. Thoracic vertebrae, on the other hand, show a distinct pattern

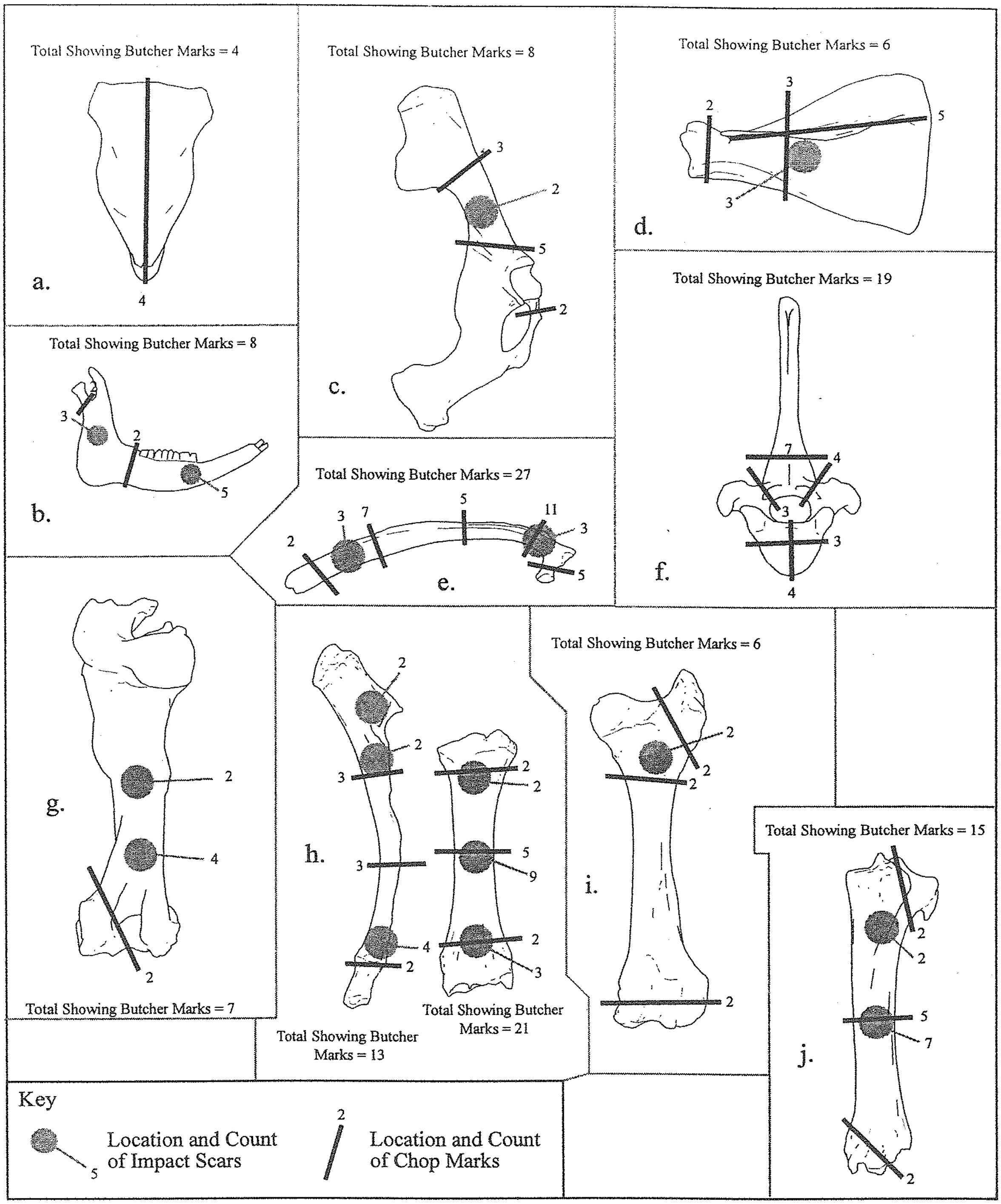


Figure 10. Location of butcher marks on cattle bone: a, cranium; b, mandible; c, pelvis; d, scapula; e, rib; f, thoracic vertebra; g, humerus; h, radius and ulna; i, femur; j, tibia.

of butchery. In most cases, the spinous process was broken or chopped off near the neural arch and the articulation with the ribs was chopped away, leaving only the neural arch and the centrum intact (Figure 10f). Most of these chops were probably made with metal tools. In some cases the centrum was split up the middle from the dorsal side, much as modern butchers do. In other examples, the centrum was chopped in half from the side. Chops through the centrum were always made with a metal tool.

Lumbar vertebrae were treated much the same as the thoracic vertebrae, with the breaking or chopping of the spinous process the most common mark seen, and the transverse processes, usually with part of the articular facet, also chopped or broken away, leaving the neural arch and centrum. Unlike the thoracic vertebrae, however, the chopping was more likely to be done with a rough-edged than a clean-edged tool.

The diaphysis of the humerus was broken open at the center or nearer the distal end. Chop marks were found at the distal end, always with metal tools (Figure 10g). The radius and ulna are fused together in adult bovids, but many of the cattle bone were from immature animals. Most of the radii had been broken at the center of the diaphysis, although some had been broken closer to the distal or proximal end. Most of the chop marks were clean-edged (Figure 10h). The ulna was usually broken or chopped just below the semi-lunar notch, and often at a point just above the distal epiphysis.

All but one of the chop marks on femora were from metal tools (Figure 10i). The diaphysis was broken near the proximal end in two cases. Most tibia were broken in the middle of the diaphysis, either by chopping or by impact fractures (Figure 10j). All but one of the chop marks on tibia were rough-edged.

### *Heat Alteration*

There is very little evidence of heat alteration in this collection. Only 1.6 percent (n=179) of the total bone showed evidence of having been exposed to heat. Of these only 16 (9 percent) were calcined or partially calcined, indicating exposure to high levels of heat for long periods of time. David (1990) has shown that bone is unlikely to become calcined under normal cooking conditions, and the presence of calcined bone can usually be attributed to deliberate disposal of bone by burning. Clearly this bone bed was not used as a location for the secondary deposition of previously burned bone. Most of the burned bone in the Radio Shack collection appears to be the result of cooking activities; however, little of the bone shows even this amount of heat alteration.

## Evidence of Non-Cultural Taphonomic Changes

### *Weathering*

Changes caused by exposure to atmospheric weathering were noted when possible on bone identified to the order taxonomic level (Table 5). Seventy-five percent (2023 of 2696) of this bone showed at least some evidence of exposure; however, of these, 68.5 percent exhibited only the earliest stages of weathering.

Examining the degree of weathering exhibited in each of the four bone bed levels (Figure 11), there is very little difference in the degree of weathering in the bone from each level. (Note that Stage 4 weathering was excluded from calculation in Figure 11 because it was all from 232 pieces of a single bovid skull in Level 2.) Levels 3 and 4 have less Stage 3 weathering than levels 1 and 2. Level 2 has the highest percentage of unweathered (Stage 0) bone, while level 3 has the highest percentage of Stage 2 weathered bone. However, none of these

**Table 5. Weathering Changes**

| Uniform Weathering | Count | Percentage |
|---|---|---|
| Stage 0 | 673 | |
| Stage 1 | 1386 | 68.5 |
| Stage 2 | 307 | 15.2 |
| Stage 3 | 209 | 10.3 |
| Stage 4 | 1 | 0.05 |
| **Non-Uniform Weathering** | **Count** | **Percentage** |
| Stage 0/1 | 14 | 0.7 |
| Stage 0/2 | 5 | 0.3 |
| Stage 1/2 | 54 | 2.7 |
| Stage 1/3 | 12 | 0.6 |
| Stage 2/3 | 33 | 1.6 |
| Stage 2/4 | 1 | 0.05 |
| Stage 3/4 | 1 | 0.05 |
| Total with Evidence of Weathering | 2023 | 75.0 |
| Total Observed | 2696 | |

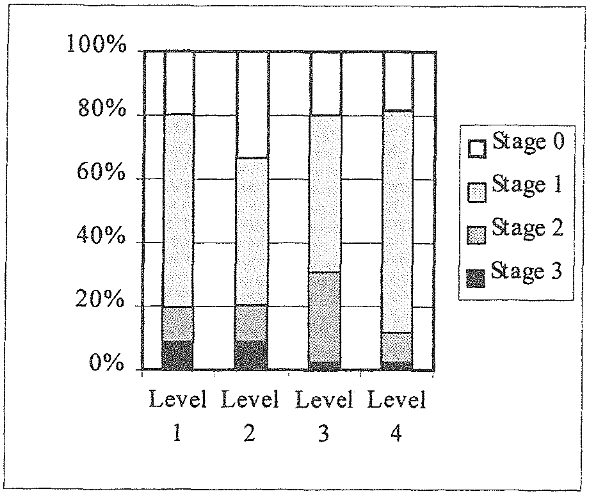


Figure 11. Degree of weathering by level.

differences appear significant. Roughly half of the bone shows Stage 1 weathering in each level. All levels have unweathered bone and all levels have 3 stages of weathered bone, although there is somewhat less Stage 3 bone in levels 3 and 4.

Bone that showed differential weathering (i.e., more weathering on one side or one end than on the other) is also listed in Table 5. While this bone comprises only 5.9 percent of the total weathered bone, it constitutes important evidence that, although most of the bone seems to have been buried fairly rapidly after deposition, at least some of the bone was partially exposed, either by incomplete initial burial or by erosion at some later date.

### *Gnawing*

All bone was examined for evidence of gnawing. A total of 41 bones (0.37 percent) shows evidence of rodent gnawing, another 118 bone (1.1 percent) had carnivore tooth marks, and two bones had some evidence of chewing, but the agent was not determined. Lyman (1994a:276) points out that although bone dragged away or eaten whole by carnivores cannot, obviously, be part of the assemblage, there should be plenty of tooth marks on bone from a ravaged assemblage. Epiphyses are the most desirable for gnawing, both because of their high grease component and their low density, making them easy to chew. In a ravaged assemblage there should be a notable lack of epiphyseal ends (Lyman 1994a:276).

The very low counts of rodent and carnivore-gnawed bone, and the very large number of ungnawed epiphyseal ends, strongly suggests that either the bone was buried shortly after it was deposited, or that it had been rendered undesirable to scavengers by some other means, such as boiling. As there is little evidence of bone grease extraction in this collection (see discussion below), it seems likely that the bone was buried shortly after deposition.

## DISCUSSION

In this part of the article, I will use the data presented above to consider: (1) what function within the community did the bone bed serve?; (2) as expressed by the bone in this location, what was the meat diet of the mission community?; and (3) what does the bone tell us about butchering and distribution practices?

### Bone Bed Function

The concentration of bone in one limited area suggested that this was a designated place to throw bone, but was it for dumping general garbage, or possibly a primary or secondary butchering area? One way to assess bone bed function is to examine what parts of the body of *Bos taurus*, by far the most common taxon, are represented in the bone bed. If the bone bed was an area designated during a (presumably brief and possibly intermittent) period for general dumping of garbage from the entire mission, then we would expect to see all body parts of cattle represented more or less as they occur in a complete body. That is, since the Spanish reports indicate that cattle were brought to the mission to be slaughtered (Habig 1978:135), if all the garbage from the mission during a particular period was dumped there, then we would expect to find most of the cattle bone from that period dumped in that area. If, on the other hand, the area was a dump near a butchering area, used primarily for disposal of unwanted parts of the slaughtered animals, then bone bearing the most meat should be missing from the area. A third possibility is that the area was a kitchen midden, at which remains from food preparation was left, in which case bone that carries large amounts of meat should be most common. Thus, estimates of the relative importance in the diet of various body parts, compared to the abundance of that part in the bone bed, will provide clues as to the function of the bone bed.

In order to estimate the relative importance of any given body part to a meat diet, Binford's (1978:19) Meat Utility Index (MUI) for caribou was used. This index is a straightforward assessment of the meat weight carried by each bone, with no consideration of the quality of that meat (Binford 1978:19-23). It was developed by calculating the gross weight (that is, dressed weight, exclusive of skin, blood, and internal organs) of each anatomical part (thoracic vertebrae, femur, carpals, etc.) as a percentage of the total gross weight of the animal, so that a measure of the proportion of the total animal that each part represents could be made (Binford 1978:19). Binford then multiplied this times the percentage of non-bone weight for each part. The index values were then standardized on a scale from 1 to 100. While there are clearly differences in body size between cattle and caribou, both Binford (1978:475) and Speth (1983:88) felt that there was enough general similarity in relative proportions of the body that the MUI for caribou could be used, with caution, to estimate bison MUI values. Cattle are, if anything, more like caribou in general body shape than bison are, so the caribou MUI was employed to estimate the relative utility of cattle elements.

Figure 12 shows a scatter plot of the percent of expected count (see Table 4) compared to Binford's MUI. This figure shows that, in general, the more meat utility a part has, the less likely it is to occur in a high percentage of the expected numbers. The body parts with the least meat utility are the most variable.

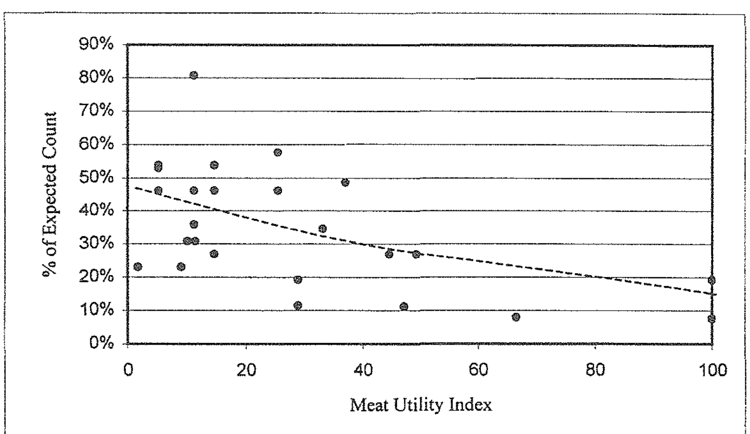


Figure 12. Scatter plot of the percentage of expected count vs. MUI.

Bone marrow is another important resource available in a carcass. To examine the bone bed compared to a bone marrow utility index, the values for calories produced per hour of processing time from various body parts were used (Jones and Metcalfe 1988:471 and Table 3). These values were standardized by dividing the calories per hour by the largest value and then multiplying the result by 100, in order to produce a Standardized Marrow Utility Index (SMUI) with values of 1 to 100. In addition, only broken metapodials were counted in the percent of expected count, since unbroken metapodials clearly had not been used for marrow production. The scatter plot in Figure 13 shows the comparison of the SMUI to the (modified) percent of expected count. There seem to be two trends depicted in Figure 13. First, the tibia, proximal metatarsal, and radius/ulna have a high utility value and a relatively high percentage of expected count. On the other hand, the femurs, humeri, and distal metatarsal have high marrow utility value and low percentages of expected count. The metacarpals have fairly low utility and low percentages of expected count.

This pattern can be explained if the butchers usually extracted marrow from tibias and radius/ulna and then discarded them, whereas the femur and humerus were distributed, and were not usually left in this area. Removal of marrow from the large cavities in these bones does not destroy their identifiability. In fact, all of the long bones left in the bone bed except some metapodials seem to have been routinely broken open, presumably to extract marrow. The presence or absence of bone in this bone bed may have little or nothing to do with the value of the marrow in them, and Figure 13 is a reflection of this fact.

The potential need to extract bone grease is an important analytical consideration for two reasons. In the first place, the extraction of bone grease is time, effort, and fuel-consuming and the yield is relatively small, but the value of that yield may be crucial in periods of food stress (Brink 1997:271). Speth (1983:143-159) has discussed the importance of

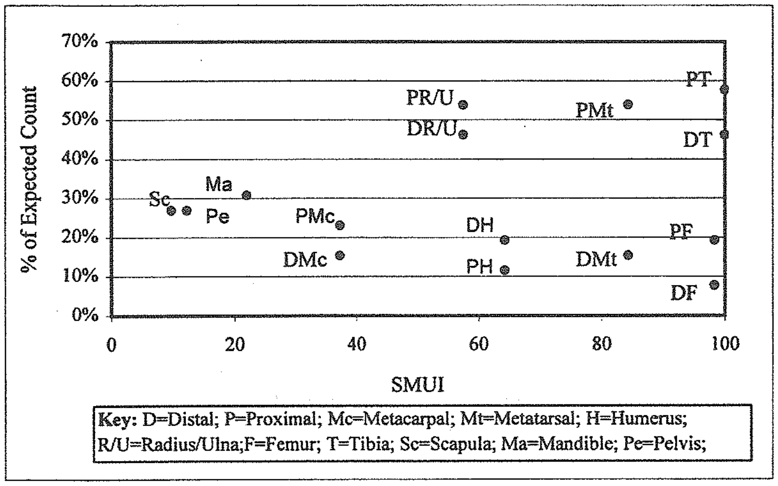


Figure 13. Scatter plot of the percentage of expected count vs. SMUI.

carbohydrates in terms of their value in the digestion and utilization of protein. Briefly, the human body cannot process protein without carbohydrates. Speth (1983:149-153) quotes a number of ethnographic reports that make it clear that even in situations where plenty of meat is available, people will lose weight and become ill if there is little or no fat or other carbohydrates included in the diet. During seasonal food shortages or in unusual circumstances such as droughts, both prey and predator will be lean (Brink 1997:271), and although the bone grease yield may be small, it is dependable, since it is the last fat to be used for energy by a starving animal. Bone grease can become of critical value in such situations.

The second consideration is that bone grease extraction will render bone "analytically absent" (Lyman and O'Brien 1987); that is, the breaking up of bone, especially epiphyseal ends, for bone grease extraction makes it difficult or impossible to identify. In addition, there is evidence that boiling bone makes it more friable in buried context, leading to even more breakage (Nicholson 1996). Vehik (1977) has presented characteristics one would expect to see in a collection that includes bone that had been processed for bone grease. These include large numbers of very small fragments of bones that appear to be from large mammals and an absence or near absence of identifiable long bone ends and the centrums of vertebrae. The latter characteristic is present because it is the epiphyseal ends and the centrums that have the most bone grease, and are most readily broken up (Binford 1978:33; Brink 1997:262; Vehik 1977). Thus, it is important to keep the possible extraction of bone grease in mind when examining a collection, in terms of what is not there. Absence of identifiable long bone ends, and large amounts of unidentifiable bone in small pieces, suggests (although certainly does not prove) bone grease processing (Vehik 1977:173; Meissner 1998b).

In order to examine the bone bed compared to a bone grease utility index, the weight of bone grease extracted from long bones (see Brink 1997:261 and Table 3) was standardized by dividing each value by the largest value and then multiplying by 100, to produce a Grease Utility Index (GUI). Figure 14 compares the percent of expected count to GUI. This is the most unambiguous of the scatter plots. The lower the GUI, the higher the percent of expected count. Unfortunately, bone grease utility is not independent from meat utility. The larger, heavier bones contain the largest amounts of bone grease, but they also carry larger amounts of meat (Brink 1997:264 and Figure 2). In fact, as will be discussed below, there is reason

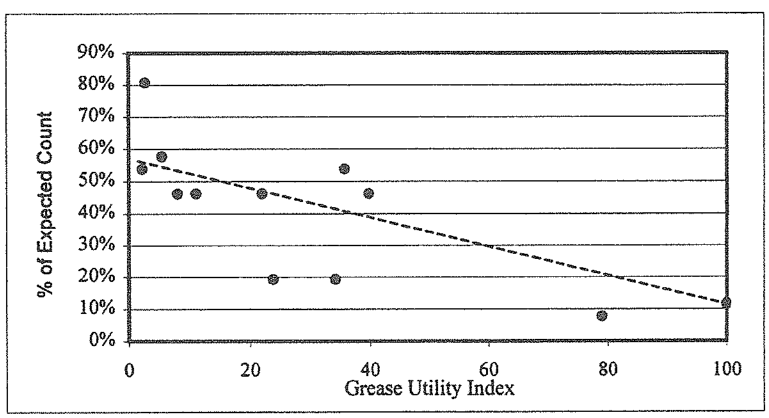


Figure 14. Scatter plot of the percentage of expected count vs. GUI.

to believe that little, if any, bone grease extraction was actually taking place during the time this bone bed accumulated. The apparent correspondence of low grease utility and high percentage of expected count is probably a reflection of the meat utility rather than grease utility of the bone elements.

In light of the discussion above, what can be said about the function of this bone bed? Clearly, it was a designated bone disposal area. Just as clearly, it was not where all the bone was discarded (see Table 4). The evidence suggests that this area was primarily a place for secondary processing of carcasses, and probably a distribution area. Some primary butchering probably took place in the area, however. The relatively small number of skulls (three of an expected 13), and relatively small numbers of foot bones (72 of an expected 312), suggest that slaughter and preliminary butchering, including removal of the head and feet, did not always take place in the area. The fact that almost all long bones present (with the exception of metapodials) were broken open, presumably to extract marrow, indicates that some processing of bone did take place in the area, but the relatively low percentages of expected bones that carry large amounts of meat (see Figure 12) suggest that these parts of the carcass were distributed, and the bone disposed of elsewhere. The presence of articulated feet (23 of 72 foot bones were articulated in six groups) indicates that the remains of early stages of butchering were sometimes, but not always, discarded here.

One more piece of evidence contributes to the assessment of the bone bed as primarily a butchering and distribution area where unwanted portions were discarded. As mentioned earlier, there is very little evidence of heat alteration of any kind. While it is likely that much of the meat was boiled in soups and stews (especially since the meat of these cattle was likely to be fairly tough), at least some evidence of roasting should be present on bone that had reached the household level of processing (see discussion of butchering and distribution below). There was, in fact, very little such evidence. This suggests that most of the bone in this bone bed did not reach the household level of processing, and was, in fact, discarded during the secondary butchering process.

Some general trash dumping also seems to have taken place at this bone bed. While some general trash such as ceramics and lithics may be present as a secondary deposit, accidentally included when the bone was buried, the fairly large numbers of ceramics, the presence of bison and deer bone, and the articulated bear feet, indicate that something other than cattle butchering was contributing to the accumulation of the bone bed.

### Meat Diet at the Mission

Reitz and Scarry (1985:84) have pointed out that features such as trash dumps or bone beds are not necessarily representative of the complete meat diet in historic sites. They emphasize that a complete assessment of diet requires samples from diverse contexts, and that "archaeologists working with the historic period must be alert to the hazards of confining subsistence analysis to single small features" (Reitz and Scarry 1985:84). When it is necessary to confine consideration of diet to a single feature, care must be taken to remember the possible limitations that are involved under those circumstances. The discussion of bone bed function made it clear that not all bone used at the mission during the period when the Radio Shack bone bed was being formed ended up in that bone bed. The following discussion must, as a result, be viewed with some caution, as it concerns only that bone found in this one location, in a single feature.

Another problem with assessing the meat diet at the mission, as represented by the bone bed, is that we know that this bone bed consists largely of bone associated with what, at least for the cattle, was not eaten. In addition, all the problems associated with attempting to estimate relative abundance and relative importance discussed earlier make such assessments difficult.

Issues of bone survival can be important, as well. For instance, most of the identified pig bone was from immature animals. Immature bone is well known to be more susceptible to damage from taphonomic factors than mature bone because of its relative size and its low density (Lyman 1994a:397; Reitz and Scarry 1985:11). There may be a great deal of pig bone that was not identifiable, due to differential damage to the immature bone, compared to the more mature sheep, goat, and deer.

Given these difficulties, we can still get a sense of the diet at the mission, at least as represented by this bone bed. Further analysis of bone from other contexts at Mission San Antonio de Valero, both already excavated and currently still in the ground, will be needed to complete the picture presented here.

Examination of the NISP, MNI, and bone weight makes is very clear that cattle were the dominant source of meat as represented by this bone bed. In fact, 33 (89.2 percent) other genera have less than 1 percent of the weight of bone identified to the genus level (see Table 2). Of all the other genera, only bison has enough bone weight to be considered an important component. The meat diet represented by this bone bed is, then, overwhelmingly beef, with some bison. All other sources of meat are unimportant.

Archival records tend to agree with this assessment. Guidelines written for missionaries at about 1760 advised, "Every week the missionary must see to it that the supply of beef cattle are brought to be rationed for the sustenance of the Indians...Generally, four or six are slaughtered when the natives are few" (Leutenegger 1976:19). In October 1755, a report from Mission San José noted "for the weekly ration 7 beef cattle are slaughtered, 4 for those living at the mission, 1 for the shepherds, 1 for the cowboys, and 1 which is made into jerked meat for the convalescents. Chicken and mutton are also given to the sick" (Habig 1978:135). The population of Native Americans at San José at the time of this report was 194 (Habig 1978:122). Even assuming that the cattle in question were small and fairly lean, this suggests that an enormous quantity of meat was being consumed, even without including other meat sources, such as sheep, goats, pigs, and non-domesticated animals. While this information concerns another mission, it is safe to assume that large amounts of meat were being consumed at Mission San Antonio as well.

There is indirect evidence that food supplies in general and meat in particular were plentiful during the time the bone bed was deposited. Most of the metapodials of cattle, sheep, and bison present in the bone bed are not broken. While these bones do not provide a great deal of meat, there is a significant amount of marrow available in them, especially in the metatarsal (see Jones and Metcalfe 1988:471 and Table 3). The failure to take advantage of this food resource certainly suggests that meat (and especially fat) supplies were more than adequate.

Other evidence that suggests that meat and fat supplies were plentiful is the lack of evidence for bone grease extraction. It is possible, given the fact that the bones with highest bone grease yields have the lowest percentage of expected count (see Figure 14), that these bones in particular were carried away (along with the large amounts of meat they carry), and utilized for grease extraction. If so, the detritus from this processing was not dumped in this bone bed. One piece of evidence against the idea that bone grease was being extracted is the relatively large numbers of tibias. Although tibias have only moderate meat utility value, the proximal tibia is ranked third in bone grease utility (Brink 1997:263 and Table 3). Yet 46.2 percent of the expected proximal tibias are present in the bone bed (see Table 5). It seems unlikely that extensive bone grease extraction was being carried out, presumably because the yield of fat from such activities was not worth the effort, given the presence of other sources of fat.

There is, then, considerable evidence in the archeological and archival records that meat and carbohydrates were abundantly available to the Native Americans at Mission San Antonio, and that the vast majority of this meat came from cattle. However, while there is no reason to doubt the importance of cattle to the diet of the missions, some caution must be introduced here. This bone bed does not, as has been discussed, seem to be a general bone dump. If, as is suspected, this dump is associated primarily with cattle butchering, then it is natural to find mostly cattle bone in it. The incidental inclusion of other bone will not necessarily occur in proportion to their actual use at the mission. In other words, a great deal more goats, sheep, pig, and deer may have made up part of the diet than is shown in this bone bed.

## Butchering and Distribution Practices

Archival records tell us that cattle were butchered weekly for distribution to the neophytes (Habig 1978:135; Leutenegger 1976:19). They do not tell us exactly how the cattle were butchered. Evidence from this bone bed suggests that, as both Binford (1978) and Lyman (1994a:300) have pointed out, butchering is a series of events that do not necessarily happen at the same place or time. The following consideration of butchering practices is, of necessity, based solely on evidence from this bone bed.

As has been discussed above on bone bed function, it appears that cattle were slaughtered some distance from the mission and the carcass moved (at least on some occasions) to an area near the wall, where secondary butchering took place, and waste discarded. It is interesting to note that beheading of cattle and other animals seems to have almost always been done with a metal tool, presumably an ax or hatchet. Skulls were chopped down the center, presumably to remove the brains. The carcass was then dismembered at the major joints. Marks of metal tools were common on the scapula at its articulation with the humerus and the pelvis at the acetabulum, indicating that legs were also removed with metal tools. The separation of uppermost leg bones from the rest of the leg then took place, probably more often with metal tools, although the scarcity of humerus and femur makes it difficult to be sure. Apparently these bones, presumably with their meat, were distributed at this point, as they were rarely found in this collection (see Table 4).

Marks indicating removal of carpals, tarsals, and metapodials from the rest of the leg are rare, and consist mostly of thin cut marks, not chop marks. The relative lack of foot bones indicate that either they were usually removed during preliminary butchering or that they were distributed. Since foot bones provide little utility in any nutritional category, the former seems most likely. In several cases, the metapodials, either whole or broken at the center of the diaphysis, were found still articulated to the feet.

The radius and humerus are fairly rare in the collection, indicating that these, too, were often distributed at this point. Tibias, on the other hand, were broken open, presumably stripped of meat, and left at the bone bed.

Portions of the pelvis were apparently distributed still attached to the meat, but it should be noted that the fragmented bovid pelvis is difficult to assign to *Bos* or *Bison* and thus would not be considered in the butchering study. If those pelvis fragments that were identified only as Bovinae are added to those known to be *Bos* (Table 6), it is clear that the lower part of the pelvis, the ischium and pubis, are relatively rare. Apparently the meat was stripped from the illium, and the bone remained at the bone bed, but the ischium and pubis were carried away with the meat. These portions of the pelvis were usually broken away from the acetabulum, not chopped.

The ribs present a similar identification problem. Although proximal and distal rib sections are fairly easy to identify to species, the remainder of the ribs are not easy to differentiate between *Bos* and *Bison*. As a result, only proximal ribs are included in the butchering marks study. Proximal ribs were one of the most poorly represented in the bone bed collection (see Table 4). Most proximal ribs were removed and disposed of elsewhere. Since the proximal rib carries a large and tender section of meat, this is not surprising. There were 93 medial sections of ribs identified as *Bos* or Bovinae. Clearly the medial section of rib was routinely removed and discarded at the butchering area.

The almost complete absence of distal ribs is something of a mystery. Only a single distal rib was identifiable as *Bos*. Only 9 of 240 (3.8 percent) bovid rib fragments are distal ends. Distal ribs do not, however, carry any large amount of meat, nor do they supply large amounts of marrow or bone grease. It does not seem likely that they would be distributed to the households when medial rib sections were not. Yet the distal ends of the ribs were obviously removed from the medial section of the ribs at some point before the latter were discarded. Two possible answers to the puzzle are: (1) the distal ribs were routinely cut off during the gutting of the animal, and were discarded where this process was carried out; and (2) the distal ribs are associated with a part of the cow which, while not especially nutritious, was popular. The fact that only one bovid sternum was identified makes the first possibility more likely. The distal ribs, and the sternum to which they were attached, could have

**Table 6. Portions of Bovid Pelvis Present**

| Element | Count | Percentage |
|---|---|---|
| Illium | 11 | 31.4 |
| Acetabulum | 15 | 42.9 |
| Ischium | 5 | 14.3 |
| Pubis | 4 | 11.4 |
| Total | 35 | 100.0 |

been cut away from the rest of the rib cage in order to open the thoracic cavity so that heart, mesentery, and lungs could removed. These organs are highly nutritious, and chopping away the sternum with distal ribs attached would make their removal much easier.

Thoracic vertebrae were present in much less than expected numbers (see Table 4). It seems likely that they were often distributed with the proximal ribs still attached. When present, the spinous process had almost invariably been chopped or broken off and often left at the bone bed (identified as Bovinae). Usually the articular process was also chopped or broken away in the process of detaching the ribs.

Lumbar vertebrae were somewhat more likely to be found in the bone bed (see Table 5), but they, too, usually had their spinous processes, as well as the transverse processes, broken away. Of the 156 transverse processes that should have been present on 13 cows, only five (3.2 percent) were actually recovered (identified as Bovinae). It appears that lumbar vertebrae were either distributed with the loin meat, or the meat was stripped off, with the transverse process included, leaving only the centrum and neural arch to be discarded.

Butchering at the mission seems to have been accomplished in stages. Cattle were slaughtered and some preliminary butchering took place, including the removal of the sternum and distal ribs. In the secondary processing location the carcass was dismembered and distributed. Removal of head and feet apparently sometimes took place at this time. Long bones that were not distributed were usually broken open, presumably to extract marrow, but they often did not bother doing this to the metapodials.

The removal of the head and legs seems to have been fairly routinely done with a metal tool, while other parts of the dismemberment process appear to have been done either with metal or stone tools. It is possible that metal tools were sometimes difficult to acquire. Letters from Governor Antonio Martinez in the early 1800s repeatedly begged for more iron, claiming that all available iron had already been used to repair cannon and small arms (Hatcher 1935:69, 141, 142, 146, 237). This was, however, after secularization and, in any case, is likely to be an exaggeration. The inventory of the mission done in 1772 lists 13 axes (Leutenegger 1977:33). It is probably more likely that for some parts of the butchering process, butchers at the missions preferred to use the stone tools with which they were familiar.

The remainder of the butchering process took place at what may be termed the household level, although, in fact, a certain amount of communal final butchering, cooking, and eating of the meat may well have taken place. Bones were then disposed of, usually not in the bone bed left by the earlier butchering process.

## Implications of Wasteful Butchering Practices

One of the most interesting facts determined by this faunal analysis is the apparently casual way that some body parts were discarded without processing. Several lower legs were discarded without any processing, and most of the metapodials present had not been broken open to remove marrow, even though the metatarsal is a richer source of calories per hour of processing than the humerus (see Jones and Metcalfe 1988:471 and Table 3). As mentioned above, bone grease, a small but potentially important portion of the total calories available from cattle, does not seem to have been an important consideration in carcass use.

The reason for this rather wasteful use of carcasses is probably the relatively great abundance of beef available. In addition, the evidence suggests that there were plenty of carbohydrates, either in the form of fats or as starches, available to the inhabitants of the mission. Of the resources available from cattle, it is the marrow and the bone grease, both very rich in fats, that appear to have been the least utilized. The missionaries reported that their irrigated fields were producing large quantities of corn as well as other crops (Habig 1978:101, 134, 157, 211), so this source of carbohydrates was available, as well as the fat in the meat of the cattle and other animals eaten at the mission.

## *The Decline of Texas Herds*

The apparent abundance of beef suggested by the failure to utilize the entire carcass may help us limit the time period in which the bone bed may have accumulated. There is evidence that several factors, including environmental as well as demographic and political, led to a decline of cattle populations in the latter part of the mission period.

Roundups at San José's ranch from 1749 to 1767 had produced an average of about 1500 head (Hard et al. 1995:81). Yet, in a 1785 report concerning a roundup of the herd, the missionary indicated that, after considerable effort on the part of the *vaqueros*, only 682 cattle were found, which "were all very lean. In the end it was necessary to set them loose. Things were so bad that by the present time many may have already died" (Habig 1978:244).

The inventory done at Mission San Antonio in 1772 claimed that a "fair estimate" of cattle at La Mora, the ranch belonging to the mission, was 4000 to 5000 head (Leutenegger 1977). This changed dramatically during the next ten years. Table 7 lists the total cattle counted during roundups for the years 1780-1782 (Jackson 1986: 220, 230, 245). Even assuming that the estimate in 1772 had been overly optimistic and the actual count was closer to 3000, the 1782 count was less than one-quarter of that. In fact, the count declined by more than half in just that three year period.

**Table 7. Cattle Counts from La Mora Ranch, 1780-1782 (data from Jackson 1986:222, 230, 245)**

| Year | Total Counted |
|---|---|
| 1780 | 1422 |
| 1781 | 820 |
| 1782 | 633 |

This was not a short-term problem. According to Jackson (1986:221, 224, 228, 248, 268, 293, 309, 346, 397), throughout the 1780s and 1790s inhabitants of the upper San Antonio Valley fought over herds of semi-wild cattle that were becoming more and more scarce. Things had become so serious by 1794 that Governor Munoz imposed a quota on cattle that could be slaughtered for family needs and banned the killing or export of breeding cows (de la Teja 1995:111). When the last of the missions in the area was secularized in 1794, Jackson (1986:411) notes "nothing remained of the once considerable wealth in livestock except a few milk cows." In 1803, Governor Elguezabal reported "There is a notable scarcity of cattle" (de la Teja 1995:112).

There appear to have been a number of causes of this cattle decline. One of them appears to be environmental. Tree ring data from East Texas show that the period between about 1770 and 1810 was unusually dry, with only two relatively wet years during the entire 40 year period (Stahl and Cleaveland 1988). This dry period could have been very hard on the cattle roaming on the large mission ranches. The semi-arid vegetation of the area tends to die back during dry periods, waiting for new rain to activate rapid growth (Wright and Van Dyne 1976). Cattle may have found it difficult to find enough food during extended dry periods, and their fertility would have been reduced. Additionally, they may have tended to wander farther than they ordinarily would, thus making them harder to find (Jackson 1986:127, 301).

Another reason for the decline may have been the increase in predation by all the inhabitants of the area. Apaches, and later the Comanches and other hostile Native groups, had been a constant drain on the cattle population from the beginning. By 1781, the Comanches in particular were causing so much trouble that most of the ranches, including mission and civilian ranches, were deserted most of the time, and the cattle left to fend for themselves (Jackson 1986:224).

The Spanish population of the valley was increasing. Cattle were often slaughtered indiscriminately. Sometimes meat hunters would kill many cattle and take only the very choicest portions back with them, leaving the rest to rot (Jackson 1986:16). In addition, ranchers were now rounding up herds of cattle, not for subsistence, but for driving to the markets south of the Rio Grande, such as Saltillo in Nuevo Leon (Jackson 1986:130). An estimated 18,000 cattle were driven to Coahuila and Nuevo Santander between 1779 and 1786 (de la Teja 1995:111).

Constant arguments between civilian ranchers and missionaries, as well as a need to increase revenues, led the Commander General of the Province, Teodoro de la Croix, to declare in 1778 that all adult unbranded cattle were the property of the king, and henceforth a license must be obtained and a fee paid before slaughtering or exporting such cattle (Jackson 1986:155). This edict made both civilian ranchers and missionaries very unhappy. They claimed that it was impossible to keep their cattle branded, due to a lack of manpower and the constant threat of attack by hostile Native Americans (Jackson 1986:220). Even unbranded cattle were in short supply (Jackson 1986:268). In 1785, one missionary lamented:

> In the past the income from the herds and the missionaries' allowance alone was enough to clothe the Indians and pay the expenses of the Divine Cult, now without [the cattle herds], there is not enough for either. As a result...these wretches are made to suffer and endure great sorrow, while they observe that the Apaches are allowed...to cause excessive damages to their cattle and that the soldiers and citizens are permitted to slaughter them (Dabbs 1991:453).

This statement was part of a plea for a change in de la Croix's edict, and can be assumed to be exaggerated, but it seems that, for the first time since their arrival in the valley, the missionaries were having trouble feeding their charges (Jackson 1986:294). They continued these complaints until the missions were secularized in 1793 (Mission San Antonio) and 1794 (the other four missions in the area) (Jackson 1986:410-411).

It is possible, given the failure to extract all the available fat resources from the cattle whose partial remains were discarded at the Radio Shack bone bed, that the bone bed dates before the 1780 period, when a combination of events led to a scarcity of cattle, both at the missions and throughout the immediate area. This is, of course, only a possibility, based on evidence of declining cattle herds, and on the assumption that the sample from the bone bed is representative of the general behavior of mission butchers at the time. As Reitz and Scarry (1985:81) have pointed out, it is important not to read too much into data from a single feature. Future data may help to resolve this issue.

## SUMMARY AND CONCLUSIONS

In 1979, a project to link Alamo Plaza and the Riverwalk was begun. During the initial stages of this project it was discovered that one building did not have a basement. This was important because the building was believed to straddle the remains of the west wall of Mission San Antonio de Valero, the first of the Spanish missions in San Antonio.

Subsequent excavation inside this building revealed undisturbed sediments containing cultural remains from approximately 250 years of habitation in the area, including intact Spanish Colonial deposits. A distinct bone bed in an old arroyo was discovered and excavated with great care. It can be dated between 1748 and about 1800 by the presence of a coin beneath the bone bed and the dates for the types of majolica recovered within the bone bed (M. Brown, 1998 personal communication). The bone bed was located only about 14 feet outside the west wall of the mission compound, near its southwest corner.

Bone from six of eight units within which the bone bed was excavated were analyzed, a total of 11,142 bones. These bones were, for the most part, in excellent condition, due in part to being covered by the building part of the time they had been buried. Not only did the presence of the building protect the bone from further disturbance, but it also provided at least some protection from leaching, and even possible erosion by rainwater. Evidence from the pattern of weathering and absence of scavenging suggests that this bone bed developed as a series of episodes of dumping, burial, and re-exposure by erosion. While it is clear that erosion at times exposed some of the bone to weathering damage, the presence of articulated bone in all levels suggests that erosion of the area was not severe.

Most of the bone was in large pieces, allowing 16.9 percent of it to be identified to the genus taxonomic level. Domestic cattle (*Bos taurus*) were by far the most common of the 37 genera identified, with 47 percent of the NISP of bone identified to genus and more than three times the number of MNI compared to the next highest, sheep (see Table 2). Bison has the second highest NISP and third highest MNI. Adjusting the NISP by reducing to 1 the counts of fragmented bone known to have been a single bone at the time of excavation increased the relative abundance of cattle somewhat and decreased the relative abundance of bison by almost half. When bone weight is considered, the dominance of cattle is very apparent. Among bone identified to the genus taxonomic level, only cattle (76.2 percent) and bison (18.9 percent) constituted more than 2 percent of the bone weight (see Table 3).

The presence of trash such as discarded lithics and ceramics, as well as the presence of so many different taxa, is evidence that the bone bed was used at least part of the time as a general trash dump. However, the cattle elements present in the bone bed indicate that the majority of the bone bed accumulated as a result of proximity to a secondary butchering area, where carcasses were dismembered, distributed, and the unwanted portions discarded. In general, elements with high meat utility are much less common in the bone bed than elements with low utility. Bones with low bone grease utility are much more abundant in the bone bed than bone with high bone grease utility, but there is evidence that this is related more to the close correspondence of meat and bone grease utility indices than to the actual processing of bone for bone grease. In fact, the only evidence that bones may have been processed for grease is that the bones with the highest bone grease utility are largely missing from the bone bed; the tibias are an exception. Although they are very high in bone grease utility, they are present in large numbers, suggesting that bone grease utility was not an important factor in the decision of what to throw away in this bone bed. In addition, the many small bone fragments that are the result of processing for bone grease are not present in the bone bed.

The failure to utilize some portions of the cattle carcasses indicates that meat supplies were abundant. The disposal of potential sources of fat such as marrow and bone grease is evidence that food, especially fat and starches, was plentiful during the time the bone bed was deposited. This abundant food was used by the missionaries to encourage the Native Americans to enter and to stay in the mission.

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# The Spanish Colonial Acequias of San Antonio

*I. Waynne Cox*


## ABSTRACT

The Spanish *acequias*, or irrigating ditches, constructed in the San Antonio River valley had a major impact upon both the development and physical layout of the city. The paths of the *acequia* were primarily responsible for the pattern of growth within the city, as well as its wandering roadways. I present a brief history of the development and growth of the missions in San Antonio and their irrigating systems, as well as the basic principles of their construction.


San Antonio has long been referred to as unique among American cities; one reason for this uniqueness is its Spanish heritage. The more visible symbols of this heritage are its five individual missions. However, there is an Hispanic contribution to San Antonio, now largely forgotten, that in many ways had a more dynamic impact upon the very fabric of the city, the *acequia* system. These wandering waterways made the missions possible, predetermined her seemingly random thoroughfares, dictated her settlement and growth patterns, and affected the lifestyle of the community until well into the 20th century. From its very conception the city of San Antonio has been irreversibly linked with the wealth of water from the Edward Aquifer. This aquifer, pulsing throughout the porous limestone below, is the source of the abundant springs that first attracted the indigenous natives, and later the Spanish, to induce man to call it a home for a continuous period in excess of 10,000 years.

The primary consideration of the Spanish was the relocation of these waters to those areas that would allow them to settle and occupy this fertile valley to their best advantage. The streams were conveyed across the land by diversion ditches called *acequias*. The courses of the *acequias* were dictated by the contours of the land, ever seeking a lower level. But this decrease must conform to a specific grade; too steep and the ditches would overflow and erode away their containment channels. Too shallow and the water would not produce sufficient flow to water its vital crops and would well up in stagnant pools. The *acequiadors*, canal makers, were generally expert in achieving this proper gradient; but just how they managed to engineer the miles of waterways is not recorded. Several theories have been advanced, varying from an equilateral triangle and plumb bob, a wine bottle half filled with water, to pure trial and error of opening a trench and following the flow. While this paints a colorful picture of the early settlers attempting to learn the essence of hydrology by trial and error, it is probably far from realistic. The essential principal of redirecting water for use had been established and published by Marcus Vitnrius Pollio as early as the first century before the Christian era. Hero of Alexandria, Greek engineer and mathematician, he later invented the *dioptra*, a device for measuring both vertical and horizontal angles adjusted by turning screws that engaged sprockets. Fitted with some water-filled glass tubes for leveling, it became an all-purpose instrument and a forerunner of the modern theodolite. This technology was not greatly improved by the 18th century (Hauck 1988:43-45). By whatever manner they created the *acequias*, they were extremely successful, for these waterways fulfilled their intended purposes with only minor alterations for more than 270 years.

The paths of the *acequias* caused the resultant fields that they nurtured to vary in area, dictating that if division of lands were to be distributed in an equitable manner, the drawing of lots or chances determined the recipient's *suerte* or luck. The roads and paths through the villa and to the missions followed the winding waterways, creating what later evolved into street patterns that failed to conform to a more logical grid pattern. The later division of lands and the development of the irregularly shaped plots created many of the unusually shaped buildings and curious orientation of many downtown blocks that add to the quaintness of the city. The growth of the city developed not toward the cardinal directions but along the canals that served to provide agricultural and landscape imgation, as well as drinking water. San Antonio's bountiful springs provided the impetus for its founding, but the *acequias* allowed for its growth and development.

Canal irrigation is a system of transporting water from a source by means of gravity through artificially constructed open canals. An *acequia* is often thought of as merely a ditch to convey water from one point to another. While this is essentially true, in actual function it is much more complex and requires a complexity of components and controls. The first is a device to contain and direct the water into the channel; this is usually accomplished by means of a diversion dam. A diversion dam, in contrast to a storage dam, does not impound water, but merely raises the level of a water source to allow it to be directed toward the withdrawal channel, and excess water is allowed to flow over the top without the use of floodgates or spillways. The principal channel is referred to as the *acequia madre*, or mother ditch. Near the point where the water is directed from the stream channel, a head gate is installed to control the flow into the *madre*. At the point where the flow is needed to irrigate the fields, distribution canals are constructed with the flow controlled by sluice gates. Often *desagues*, or discharge channels, are required to control flooding and excess flow. If the channel must pass over an obstacle, such as a stream or another *acequia*, an elevated structure, an aqueduct, is constructed to carry the flow over the obstruction. This can often be as simple as a *canoa*, a hollowed-out log, or as complex as the massive stone structure such as still functions near Mission Espada. Once the water reaches the field, it is distributed through field channels into the various agricultural plots by furrows. Another attribute of the *acequia* is that after it has been made accessible to all the required users, it must return to a primary source, usually the parent stream from which it originated. While this is often viewed as a conservation technique, it is instead a basic principle of *acequia* operation.

The water laws developed in the New World were a composite of Spanish laws, the new environment, and the interaction of both. The other colonial powers, England, France, and Holland, were generally conditioned to deal with an exccess of moisture, however, their primary concern was land; they were more concerned with water as a source of power and cheap transportation. Spain, by dint of her heritage of an arid environment, was obsessed with water as well as land; therefore, she brought with her colonies detailed and established regulations in the distribution and use of this essential commodity. Their land grants address the allowances of water because the amount of land to be allotted depended on the area that could be irrigated.The standard *dula*, or allowance, specified in the deed records of San Antonio is one-half day of water. In fact, the standard grant actually specifies the amount of water allowed "with the corresponding lands" (*con su tierra correspediente*) (Land Grants and Sales, Bexar County Archives). This same system of planting is still the basic pattern observed today in the fields of the Espada Ditch Company, the only colonial *acequia* still in operation.

On April 9, 1718, Governor Don Martin de Alarcon, accompanied by Fray Olivares and seven families of settlers crossed the Rio Grande. Because of disagreements between the Governor and the priest, they traveled separately but arrived at the San Antonio River on April 25th. Father Olivares explored the vicinity and independently founded a mission, San Antonio de Valero, "...near the first spring [San Pedro] half a league from a high ground and adjoining a small thicket of live oaks" (Hoffman 1938:43). Shortly thereafter he moved the mission to the east bank of the river, south of its present location. On May 5, 1718, Alarcon established the Villa de Bejar, near San Pedro Springs, named in honor of the brother of the Viceroy. The first *acequias* in the San Antonio valley were begun shortly afterward. While there have been many *acequias*, of varying length and importance, within the rich historic past of the city, the seven major Spanish *acequias* have had the most profound effect and will be addressed in this narrative (Figure 1).

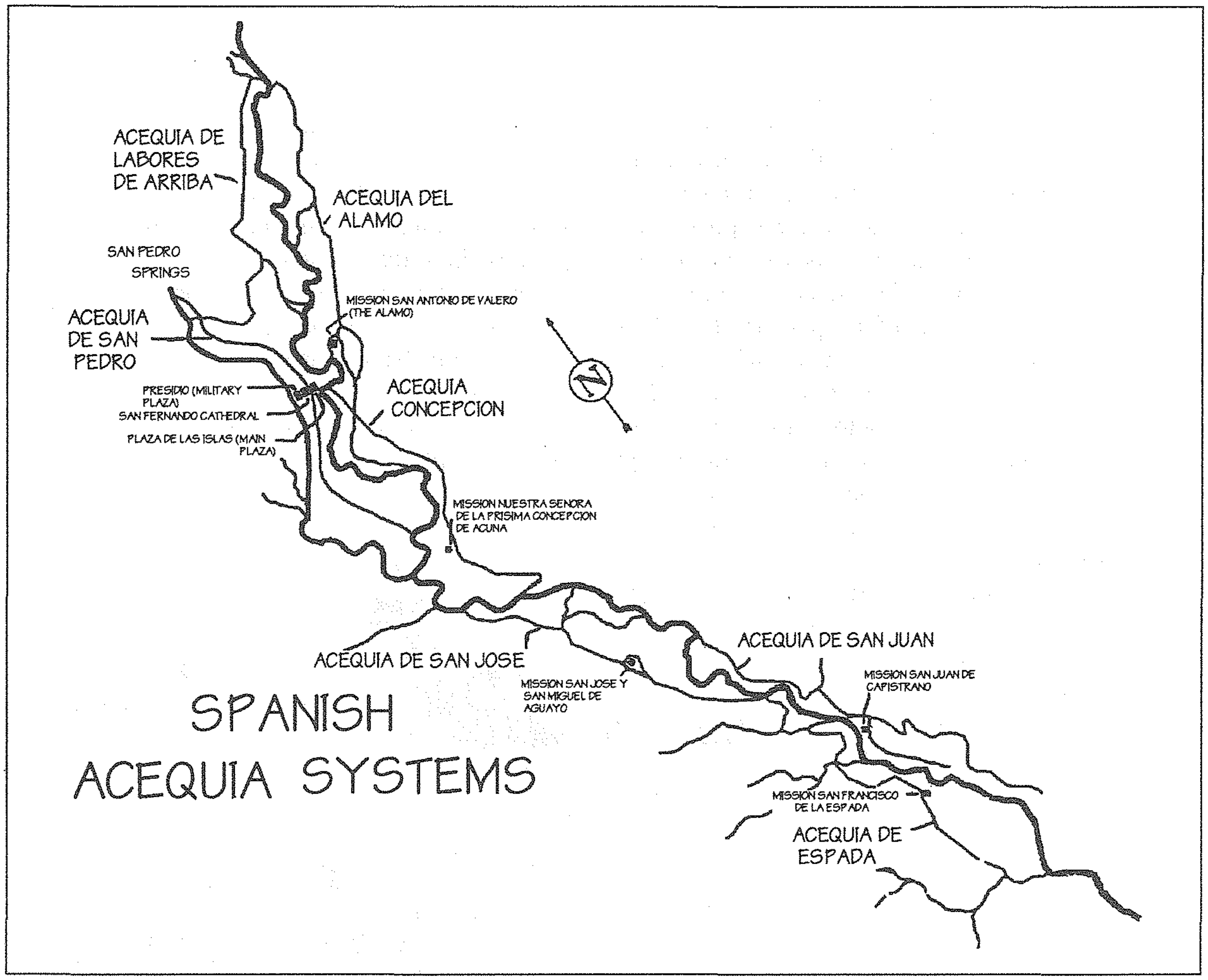


Figure 1. The Seven Major Spanish *Acequias* of the San Antonio River valley.

The *acequia* for the Villa de Bejar would have been established in close proximity to the settlement and would logically have drawn upon the abundant waters of the spring as its source. The land above the springs rose sharply, with the lands to the south offering the only lands to serve as fields for the settlers.

As is usually the case, the archival records fail to indicate the location selected for the presidio's new *acequia*; however, in this case there is the Aguayo map (Figure 2). This map, reputedly produced by the Marques de Aguayo for Viceroy Casafuente in 1729, has been dismissed as "charming" but "inaccurate in scale and geographic features" (Schuetz 1966:4-5, 1968:11). It has further been criticized because it places the loop of the river on the wrong side, the confluence of San Pedro Creek and the river incorrectly, the presidio irrigation system incorrectly, and Mission San Jose on the wrong side of the river (de la Teja 1996:54).

However, if viewed as a representation of the area as it appeared when last viewed by Aguayo upon his departure in 1722, an entirely different interpretation can be made of the map. A comparison of the area from below the springs to the confluence of the creek and river shows a direct correlation of features (Figure 3). Although the river is clearly not depicted in correct detail, San Pedro Creek is represented in a realistic manner, and the loop of the river can be identified as the portion above the horseshoe bend, now identified as the Riverwalk, that does project toward the west. This indicates that the presidio *acequia* emanated from the first major bend of the creek, then curved to the southwest to return to the river near the beginning of the river bend. If we consider the present street configuration, there is a street that originates at the first bend of the creek, curves along a natural contour of the river basin, and returns to the river at what is now the straightened portion now occupied by Auditorium Circle. Originally named *Calle Romana*, it now forms a portion of Romana and Navarro Streets. This street formed the upper limits of the old city, the *barrio del norte*, a portion of tbe *ejidos* or public lands. This same drainage later served as a return channel for a portion of the Upper Labor *acequia* (evidence of this ditch remained as late as 1920; see *San Antonio Express* 1920). Considering all of these factors, this appears to have been Aguayo's *acequia* for the Presidio. The channel would have been some 4000 feet in length and could have provided irrigation to some 100 acres above the site of the presidio.

If this interpretation is accepted, we are confronted with the problem that Mission San Jose is shown as occupying the present location of Mission Concepcion. The mission was moved to a new site on the west bank of the river pnor to 1727, but it would appear that an *acequia* was also constructed for the first location. There is good reason to believe that the first site was later selected as the location for Mission Nuestra Senora de la Purisima Concepcion de Acuna, and that the Pajalache, or Concepcion, *acequia* was initially constructed to serve San Jose at its founding location. The Aguayo map clearly places the mission in this vicinity, and archeological investigations on the site have yielded ceramic evidence of occupation prior to 1730 (Scurlock and Fox 1977:56). The Pajalache *acequia* has traditionally been accepted as one of the oldest of the *acequias*. The first author to attempt to document the history of the *acequias*, William Corner (1890:43), stated that testimony from a 1858 trial established the date of construction as 1729. Although a review of the court case does not contain this date within the trial records, it does state that the privilege to establish the *acequia* was granted "...previous to the foundation of the Alamo Church..." (West Publishing Company 1903). Regardless how this is interpreted, it would seem to establish that the *acequia* was begun before the occupation by Concepcion by at least three years; in fact, Fray Nunez stated that it had been completed by 1724 (Leutenegger and Habig 1977b).

For his mission, San Antonio de Valero (The Alamo), Father Olivares required land and a place

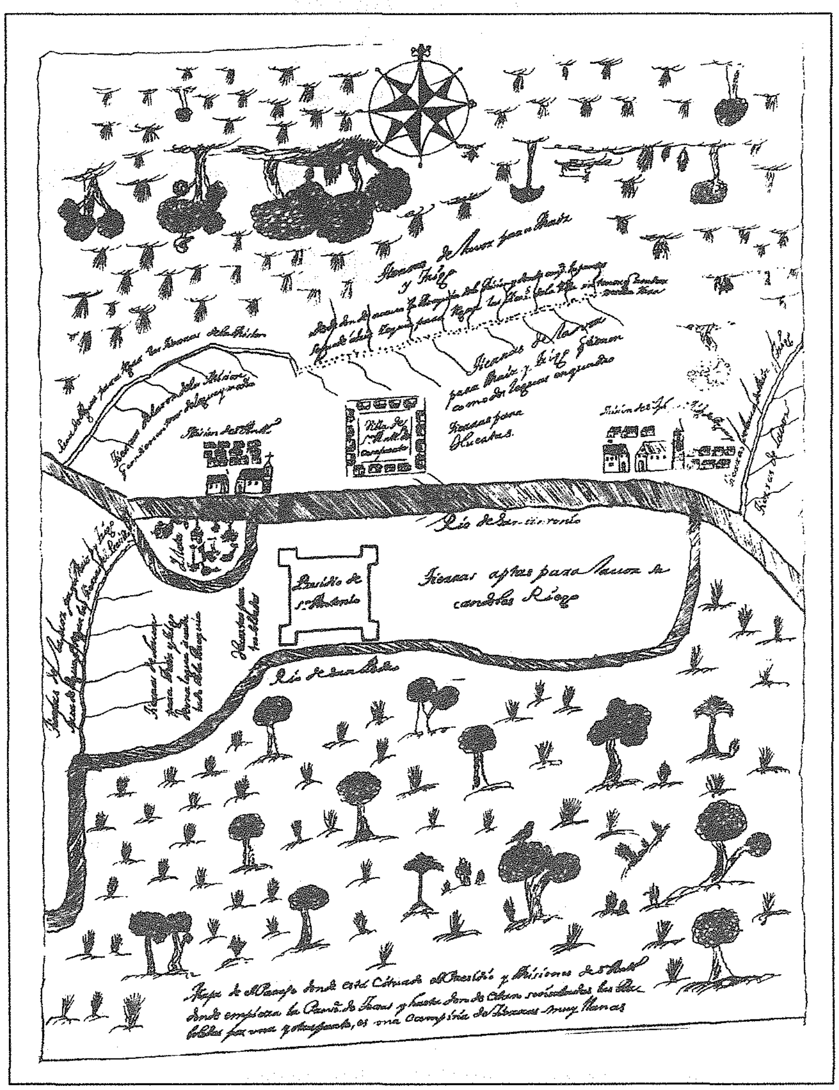

Figure 2. Map of San Antonio by Marquis de Aguayo. Map courtesy of Institute of Texan Cultures, The University of Texas. Original in Archivo General y Publico Mexico, Provincias Internas, Vol. 236.

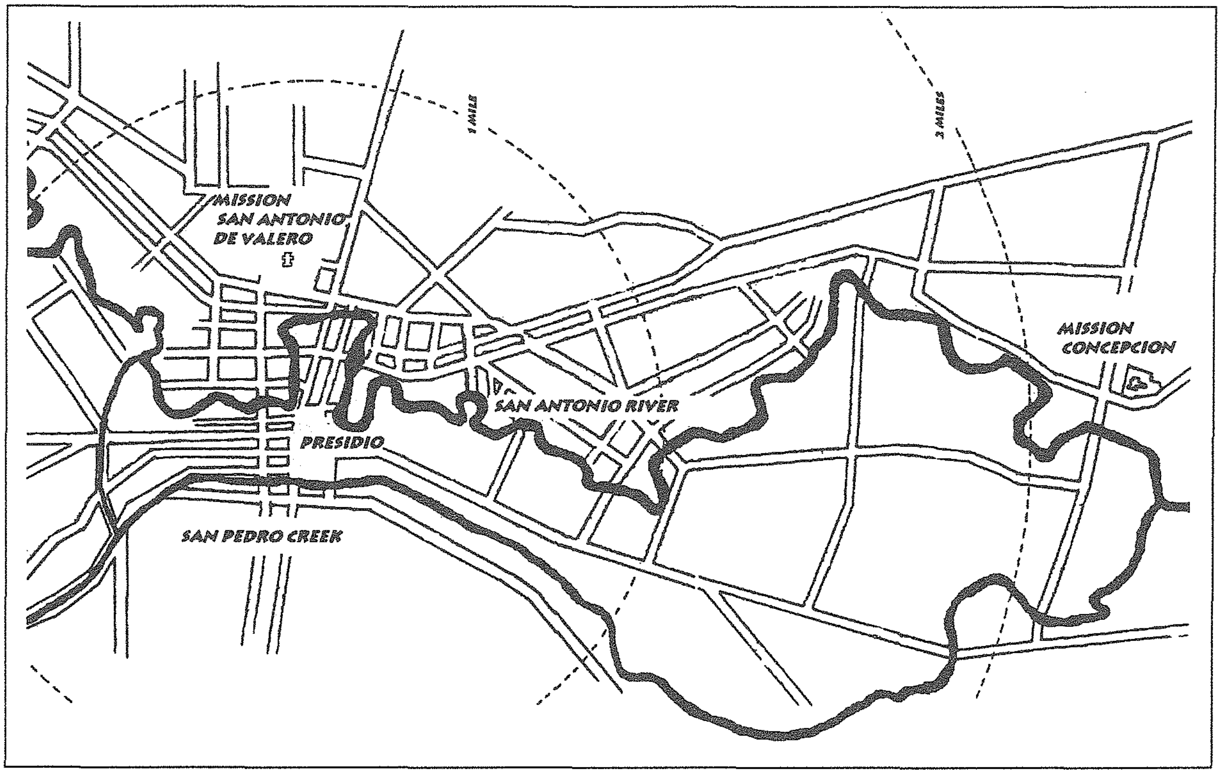


Figure 3. Area represented by the Aguayo Map in respect to modern San Antonio.

where an *acequia* could easily draw water from the abundance of the springs. He had already selected an ideal location. On his first visit, with the Aguirre expedition in 1709, he had noted the numerous springs that formed the headwaters of the river and knew that those waters could be easily tapped near the ford just below their confluence, the Paso de Tejas, on the road to the eastern missions. Fray Mesquia, in his journal, recounted that the first week in May 1719 was devoted to excursions to examine the area, and a site had been located at a "ford of the San Antonio River, about a fourth of a league" that was ideal to draw water for an *acequia*. He cautions that a "good deal" of work would be involved, for the lands selected for the new location "are a league and a half distant [3.9 miles]. The water rises to the top of the ground and the entire work is a matter of using a plow" (Hoffman 1938:317-318). He further describes the future location as extensive and level, enclosed on one side by the river and on the other by low hills.

The *acequia* emanated from a diversion dam that sprang from the west bank of the river and extended into the stream to raise and direct the flow toward the eastern bank where the canal intake was located. The *acequia* then traced a sinuous path, between the river and the low hills to the east, toward the south-southwest, to pass through the mission grounds to return to the river at the largest bend, creating a ditch approximately three and one-half miles in length. Later additions to the channel, branching near the mission and irrigating additional *labores* or farm lands to the east and south, would extend the total length of the *acequia* to approximately 10 miles.

On October 15, 1727, Fray Miguel Sevillano de Paredes visited the mission and reported their progress. He noted that the clerics had established "...a little fortification (*torreonsillo*) two gunshots (*dos tiros*, approximately 300 yards)... from its present location" (Paredes 1727), but everything had been destroyed by a humcane in 1724, at which time it was moved. He reported that the *acequia* was still one league (2.63 miles) from the mission, and "...the entire project was an arduous one, since it was carried out solely by using crowbars" (Paredes 1727). He further commented that the work had been repeatedly delayed by the need to protect the struggling mission from Apache attacks, requiring them to discontinue work on the *acequia* and fortify their quarters. Because of the importance of completing the *acequia*, work on the stone church had not begun, but stone had been selected and they were awaiting the arrival of a master craftsman. It is known that one of the officers accompanying Govemor Alarcon was Captain Barreiro y Alvarez, a member of the Royal Corps of Engineers, and official engineer for the expedition (Fireman 1977:54). It can, therefore, be assumed that the actual planning for the placement of the *acequia* was under his direction.

In 1718, Spain found herself at war against a European alliance, including her arch enemy, France. Military operations between the two countries began in January 1719 and ended in February of the following year. During that period, France made engagement against the East Texas settlement, forcing their withdrawal. Among the refugees were the eight fathers from the evacuated missions. One of the priests, Fray Antonio Margil de Jesus, who founded in 1706 the College of Nuestra Señora de Guadalupe de Zacatecas, viewed this as an opportunity to advance the needs of his college. He had encountered three groups of Indians who desired mission life but could not tolerate the group living at Valero. To accommodate them he resolved to found another mission farther down the river. Fray Margil wrote an impassioned letter to the new viceroy, in December 1719, stating the requirement for a new mission as well as the imperative needs of the Zacatecan friars for their own halfway mission in the San Antonio valley. Father Olivares, of Mission Valero, viewed this a definite infringement upon the lands he had selected for his mission, but his objections were ignored. Perhaps the main reason that Father Margil had so readily been granted his wishes on the matter of the new mission, was that he had tactfully suggested that it would be named after new Govemor Aguayo. At any rate, on February 23, 1720, Lieutenant General Captain Juan Valdez, accompanied by Father Margil and an official party, arrived at a site "where water can be drained from the San Antonio River to irrigate the land" and "went down river following the direction where the irrigation ditch is to be." They selected a site where

> the land offered such rich pastures and plentiful woods for beams, quarry stones, and firewood. There are excellent exits and entrances along the river for the cattle, sheep, goats and horses.

Having satisfied all involved that this was a suitable location, the Mission San Jose y San Miguel de Aguayo was established (Leutenegger and Habig 1977a). This later became known as the "Queen of the Missions," and proved to be one of the most successful of the San Antonio complex. However, the *acequia* described was for the initial site, not its present location.

The *acequia* for the final, and present site, of San Jose issued from the river eight-tenths of a mile south of Concepcion, and just above a ford of the river for the mission road crossing. The dam was constructed approximately 1400 feet below the confluence of San Pedro Creek and the river, jutting upstream, to divert the water to a headgate located on the west bank. From there, the channel followed land contours southward to pass to the west of the mission compound. After passing the mission, it veered slightly to the east to retum to the river just north of the Espada dam. In approximately 1790, the *molina*, or mill, was constructed to the north of the church, and the *acequia* was diverted north of the mission to provide power for the operation. The channel then skirted the east wall of the compound to rejoin the old channel south of the mission to return to the river. The total length of the madre was approximately three miles.

With the appointment of Juan de Acuna, Marques de Casafuente, as viceroy in October 1722, King Philip V charged him to conduct a survey of the frontier to evaluate the defenses and instigate necessary reforms. In 1724, Brigadier General Pedro de Rivera y Villalon, former governor of Tlaxcala, was dispatched by the viceroy to accomplish this formidable task (Weddle 1968:172). The tour lasted until June 1728, and covered more than 8,000 miles. Among his recommendations was the reduction of the East Texas garrisons and the relocation of the three Queretaran missions to new sites on the Colorado River, near present-day Austin. Viceroy Casafuente, acting on the recommendations, reduced the presidios and moved the missions in July 1730. That location was not acceptable to Father Paredas, the guardian of the college, and the missions were again moved to the San Antonio River basin on March 5, 1731. Nuestra Señora de la Purisima Concepcion de los Hainai became Nuestra Señora de la Purisima Concepcion de Acuna, and was located between San Antonio de Valero and the new site of San Jose y San Miguel. San Jose de los Nazonis, now San Juan Capistrano, and San

Francisco de los Neches, now San Francisco de Espada, were assigned lands farther to the south.

The Concepcion, or Pajalache, *acequia*, as previously stated, was probably in existence before the new mission was built. The channel began on the east side of the river at a rather large dam that spanned a point just above the town's major ford at Presa (Spanish for dam) Street. Because the entry point was at *La Villita* (the little village), one of the highest points in the downtown area, it required a massive cut to initiate a downward flow. The Concepcion *acequia* was always noted as the largest of the ditches, so large in fact that it was reported that the fathers kept a boat on it to attend to its cleaning (Corner 1890:44). It was certainly large enough at the inlet point, for the width was reported as 20 feet (*San Antonio Express* 1913). It progressed southward along the west side of the road to the lower missions, to a point 2500 feet from the intake, to where a *canoa*, or hollow log, transported a later extension of the Alamo madre over the canal on its return to the river. This was later replaced, probably during the mid-1800s, by a "substantial arched stone aqueduct" extant in 1890 (Corner 1890:43). It then progressed along the road to the mission compound, where it diverted westward to return to the river south of the confluence of San Pedro Creek. The original *acequia* had a total length of approximately 3.3 miles. In later times a double gate was installed 1.4 miles from the intake. and an eastern branch was constructed to irrigate additional farm lands, adding another two miles to its length. Before the *acequia* was abandoned, it consisted of more than 7.5 miles of ditches.

The *acequia* for Mission San Juan Capistrano was probably begun about the time that the first huts were constructed on May 4, 1731, but progress on the mission, and probably its *acequia*, was slow during the first 10 years due to frequent Apache raids, obstructionist tactics of Govemor Franquis de Lugo, and an epidemic in 1739 (Habig 1968:164). However, the *acequia* was in operation by February 1740, for the fields were reported as newly planted in the spring of that year, and a report by Fray Fernandez de Santa Ana comments on the "five very abundant withdrawals from the river" (Leutenegger 1968). The dam that serviced the *acequia* was constructed along the west bank of the river, almost directly opposite the present site of Mission San Jose, and was approximately 300 feet in length and projected downstream, diverting the flow to the deep intake located on the east bank. Approximately 550 feet down the *acequia*, a stone headgate was constructed to control the flow. The channel continued slightly more than three miles southward on the east side of the river to the mission. An eastern branch to irrigate later fields added an additional 2.6 miles of canals.

The *acequia* for Mission San Francisco de Espada began at a dam spanning the river, midway between missions San Jose and San Juan, diverting water into a channel along the western side of the river. This dam, the last of the functioning Spanish colonial dams, is constructed of limestone and lime mortar, and arches downstream of the river flow. At a point 1.49 miles down the *acequia*, it became necessary to construct an aqueduct to convey the water over Piedras (Six-Mile) Creek; it remains as the only surviving stone aqueduct. It was described in 1772 as a

> ...conduit of lime and stone of thirty-eight varas [105.5 feet] in length; six [16.6 feet] in height; with its diamond point, and two arches, which allow the currents of said creek to pass... (Saenz 1772).

The diamond point referred to is the pointed projection of the central pier that diverted the pressure of the stream away from the support for the two arches. The *acequia* continues south to the mission and below for a total length of approximately 3.25 miles.

Another of the recommendation of Brigadier General Rivera was that the frontier be settled with stable families, believing that "one permanent Spanish family would do more to hold the country than a hundred soldiers" (Chabot 1937:141). King Philip V turned to the Canary Islands to provide the emigrant families for New Spain. On March 9, 1731, 56 Islanders arrived at the presidio to form the nucleus of the Villa of San Femando de Bexar, the first civil settlement of Texas. Viceroy Casafuente had ordered that the newcomers be greeted and housed in the presidio until the villa was established a "...gunshot's distance...to the west of the presidio" (Aviles 1726-1731). The Captain of the Presidio, Juan Antonio Perez de Alamazan, delayed the laying out of the villa until after the planting season, selecting "land subject to irrigation" as temporary fields for the Islanders, and selected a site east of the presidio instead. In order to do this, it was necessary that he usurp the fields presently being farmed by the presidio families. Alamazan had selected the fertile area to the south of the villa between the river and the creek down to the confluence of the streams for the permanent fields for the Islanders.

Each family was consigned a plot sufficient to plant their crops. As previously noted by Celiz, the banks of the two streams were deep enough in this area to make irrigation difficult; therefore, an *acequia* was envisioned to begin from San Pedro Springs proceeding southward between the water courses to return to the river just prior to the confluence. This design presented two distinct advantages; first, it could service the *barrio del norte*, the presidio and the villa, as well as the Islander's fields; secondly, by following the high ground between the two water courses, it could irrigate lands on both sides, in contrast to the other *acequias* that watered only the lands toward the river. The date establishing the beginning and completion is not recorded, but it is logical to assume that construction was initiated soon after assignment of the land. On January 11, 1734, by order of the viceroy, the lands were re-surveyed and official title was granted to the Islanders. Excess land was also granted to eight other citizens of the villa (Leal 1986). In all probability, the *acequia* was in operation by this time. With the completion of the San Pedro *acequia*, the entire basin between the creek and the river could now be irrigated from the area of the springs to the confluence of the two streams. The channel was approximately four miles in length and watered approximately 400 acres below the villa, the new lands of the Islanders and other citizens.

It has been stated that the arrival, in 1773, of the relocated persons from another withdrawal of the citizens from East Texas, the *Adaesanos*, prompted the demand for another *acequia* to make available the irrigable lands to the north of the villa (Buck 1980:244-245). However, the demands for such an *acequia* were of long standing. In fact, the permission for an additional *acequia* had been granted in 1733. In August 1762, a group of 13 citizens petitioned the governor for land and water to be distributed as had been previously ordained. In their request, they claimed that "about the year of forty-five" the viceroy had ordered this of his predecessor, but for reasons unknown, he had failed to comply. The govemor, Angel de Martos y Navarrete, agreed that the request was valid and directed Geronimo Flores, who was "skillful in withdrawing water," to measure the lands proposed for the *acequia*. Flores reported that a channel could be constructed from a point on the river 5853 *varas* (three miles) north of the villa that would pass through five thousand *varas* (4428.4 acres) of irrigable land. The only obstruction that presented itself was a stretch of 150 *varas* (416.6 feet) "across the brow of the hill which is called Loma de la Vieja" (now Tobin Hill). He further noted that it would require a dam of 35 *varas* (97.2 feet), 25 of them (69.4 feet) two and three-quarters *varas* in height (7.6 feet), and the remaining 10 (27.8 feet) of one and one-half *varas* (4.2 feet). He estimated the cost of the dam and canal at 3,000 pesos (BAT 1762). The govemor fully agreed with the proposal and submitted it to the viceroy, but for unrecorded reasons, the plan was not put into effect.

Fourteen years later, the citizens would again petition the govemor, Baron de Ripperda, for the additional land and water. The reason for this renewal of interest may have arisen from the fact that the villa was in the depth of a severe drought that began in 1771 and lasted for six years (Gunn et al. 1982:70). The governor, well aware of the volatile nature of the various factions of the villa, approached the proposal with a full awareness of the need of his diplomatic skills. On January 10, 1776, he addressed the citizens of the villa, stating that "there will be found in the archives of this province, two orders from the Sir Viceroy Marquez de Casafuente, of December 10, 1731 and March 12, 1733, distributing the waters of the two springs of San Pedro and San Antonio and that of the five missions adjoining this presidio and village." He then noted that the governor, Antonio Bustillos, commissioned Lieutenant Governor Matheo Perez to give possession of a *saca de agua* above the *Paso de Tejas* out of the San Antonio river to the residents of the village on October 27, 1733 (BCA, Vol. 3, p. 317). He then requested that "all Canary Island settlers as well as all the rest of the inhabitants... in order to avoid in future all motives of discord," and present any documents that "may prove in their favor" within four days (Corner 1890:46). Upon receiving no valid complaints from this quarter, he then addressed a similar letter to Fray Pedro Ramires, president of the missions, inquiring if this would adversely impact the missions. The padre replied that he did not think that the missions would be injured by the building of the ditch (BCA, Volume 3, p. 318).

Having satisfied himself that neither the villagers nor the clergy had a strong protest against the project, he then ordered that by January 29, all

> resident Islanders and others present themselves before me, and those who wish to contribute to said ditch, therefore after having enlisted themselves, to commence same, each to commence with one *peon* and the necessary tools.

He then specified that distributions of the lands would be made by *suertes* with its corresponding one day of water to each of the participants. The construction of the ditch was to be placed in charge of an "able man of experience" (BCA, Volume 3, pp. 318-319). The shareholders met on July 13, 1776, and elected Angel Galin to supervise the four *peon* and 26 men "who are to work daily on said ditch." Thoribio Fuentes was placed in charge of the actual construction. For this they agreed to pay Galin a peso per day "until the madre and other necessary ditches" were finished, while Fuentes was allotted an additional portion of land (BCA, Volume 3, pp. 322-324).

By April 28, 1777, the *acequia* had reached the midpoint of its construction; therefore, in order to place the ditch in operation for the planting season, the ditch was returned to the river, and a drawing was held to distribute the first 26 *suertes*. The governor then called all officials of the presidio, missions, and villa together for the drawing of the *suertes*. The names of the shareholders were placed in a brass urn and sealed, the numbers of the *suertes* were then placed in a like urn and sealed, and then "two boys of tender age" proceeded to draw one ticket, alternately, from each urn to select the property holders (BCA, Volume 3, pp. 325-332).

By March 1778, the remaining portion of the *acequia* was finished, "draining into the San Pedro Creek by a trough... so that the residents located on the other side may avail themselves of its excess," and the drawing procedure was repeated to distribute the remaining *suertes* of land. One exception was that Francisco Xavier Rodriquez did not take part in the drawing for he had agreed to take a *suerte* and one half to the north of the ditch (BCA, Volume 3, p. 327). Thus, by March 10, 1778, the *acequia* was complete and the remaining irrigated portions of land had been distributed.

The *acequia* was constructed as envisioned by Geronimo Flores in 1762. The dam was erected on the west bank of the river at the "Paso de Tejas," now Hildebrand Avenue, and the water supplied by the group of springs to the west of the main spring feeding the river. The portion first constructed, between July 1776 and April 1777, progressed along land contours toward the southwest to a point at the present intersection of Evergreen Court and North St. Mary's Street, where it returned to the river near the intersection of St. Mary's Street and Ninth Street, a length of almost three miles.

With the completion of the Upper Labor *acequia*, the last major construction period for *acequias* under the Spanish ended. However, the fruit of their efforts continued to serve the growing and changing city. Through the years the same ditches served the population under the flags of Spain, Mexico, the Republic of Texas, the Confederacy, and the United States of America. They served as the sole source of drinking water for the city until the municipal water system was established in the 1870s, and they continued to supply the citizens with garden irrigation until the first decade of the 20th century when they became an expensive luxury for the taxpayers and the downtown *acequias* were closed and filled. The downtown portions of the Alamo and San Pedro *acequias* now functioned only in those portions that had been adapted as storm drains. The San Juan and Espada systems continued to perform their function, but their relationship to the other systems was known to only a few. The rich heritage of the *acequias* had slipped from the public consciousness.

Although the *acequias* no longer flow through the streets of the city or supply the population with its source of water, they are still very much a part of the fabric of the city and a vital element in understanding the history of San Antonio. At present only the Espada *acequia* performs the function for which it was designed 250 years ago. Soon the old San Juan *acequia* will be restored and again water the demonstration farm of the mission, another element of the National Park Service interpretive program.

Is there a requirement, or need, for further work on the old waterways? The answer is most certainly a positive one. There are still unanswered question and buried resources that have not been exposed.

Beneath the surface of one of the city's busiest intersections, St. Mary's and South Alamo, lies buried the remains of a major stone aqueduct that was still visible as late as 1890 (Cox 1995). Another, most probably of stone, reposes buried and forgotten just to the east of the Five-points intersection. One of the major reasons that San Antonio has become such a popular tourist and a convention destination is the rich cultural history it displays. The further addition of the story of the *acequias* can only enhance this experience for the visitors, as well as our own citizens. At present only fragments of the *acequia* are present in the downtown area to tell the story, such as can be seen at the Alamo, HemisFair Park, Brackenridge Park, the Justice Center, and the San Antonio Housing Authority. Recently, during the planning for the Downtown Hampton Inn, the *acequia* was incorporated into the landscape area behind the building (Renner 1997). While these allow small windows into this rich history, there is no single location where the story can be told in its entirety. This rich history should be preserved for future generations in order to allow them a complete picture of their heritage and the little waterways that helped shape their city.

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# Archeological Investigations at Area I, the Cabaseño Ranch (41ZP79), Falcon Reservoir

*Timothy K. Perttula, James B. Boyd, Sergio A. Iruegas, and Bo Nelson*


## ABSTRACT

Area I at the Cabaseño Ranch site (41ZP79) is a ca. 1775-1800 Spanish Colonial settlement along the lower Rio Grande. It is normally inundated by the waters of Falcon Reservoir, but archeological investigations conducted in 1996 and 1998 when the site was exposed during record low water levels have documented a small *rancho* with three structures, two pits filled with animal bones, and a midden with majolica, an assortment of lead-glazed wares, and a wide variety of hand-made and wheel-thrown coarse earthenwares.


## INTRODUCTION

Much of what is known about Spanish Colonial archeology in Texas is based principally on a long history of 20th century investigations at mission and presidio sites in centers of Spanish civil and religious settlement, such as San Antonio and environs, Goliad, Nacogdoches, and San Augustine (see Fox, this volume). We have learned a great deal about the lives of the missionaries, soldiers, and Native American converts in these places, much that was never documented in the historical records and archives of the Spanish bureaucracy. Nevertheless, this emphasis of archeology on the civil and religious sites, important as it is, does not tell the whole story of Spanish Colonial life in Texas and, in fact, overlooks the historical importance of the early ranching sites and communities in the colonization and settlement of the state (cf. Tijerina 1998). At the Cabaseño Ranch site (41ZP79), the subject of this article, we have a rare archeological glimpse of an early ranching settlement along the north bank of the lower Rio Grande, in one of the heartlands of Tejano ranching (see Jackson 1986:443-450).

The Cabaseño Ranch site was one of 40 historic archeological sites dating between the late 18th century and 1950 that were recorded and studied during the 1996 National Park Service-Texas Historical Commission-Texas Archeological Research Laboratory, The University of Texas at Austin site assessment effort at Falcon Reservoir (Perttula et al. 1996). It is situated amidst several other ranching sites in a north-south stretch of the Rio Grande, a few miles above the small community of Lopeno (Figure 1), and a few miles downstream from Zapata Viejo.

Subsequent archeological survey by McCullough and Warren (1998) across Falcon Reservoir have documented more than 110 historic archeological sites, including ranches with stone and wood structural ruins, cemeteries, wells, dipping vats, troughs, quarries, and corrals. However, Area I at the Cabaseño site is one of the earliest Hispanic colonial ranching sites identified to date at Falcon Reservoir; apparently contemporaneous *ranchos* were investigated at the Falcon Reservoir dam in the early 1950s (Krieger and Hughes 1950; Hartle and Stephenson 1951).

The ceramics from this component of the Cabaseño site contain only majolicas, lead-glazed wares, and a variety of coarse earthenwares, and British or European ceramics or bottle glass are notably absent. The Tejano ranching sites along the lower Rio Grande dating after ca. 1820/1830, by contrast, contain abundant British-made whitewares and many lead-glazed ceramics, a trend noted on Hispanic archeological sites elsewhere in Texas, the Southwest, and California (cf. Fox 1992; Cohen-Williams and Williams 1996). Based on the recovery of Puebla Blue on white II majolica, San Elizario Polychrome, Puebla Green on white, Aranama Polychrome, and Huejotzingo Blue on white majolica, the ranching settlement at Area I appears to date between ca. 1775-1800.

The Cabaseño Ranch is situated on the Zapata terrace (Evans 1962), a Holocene-aged alluvial deposit that parallels the now-inundated channel of the Rio Grande. It ranges in elevation from ca. 250-255 feet amsl, and is normally inundated by 46-51 feet of water when the Falcon Reservoir conservation pool is full. The Arroyo Cabaseño enters the Rio Grande a short distance downstream from the site, creating a southward-facing terrace landform between the arroyo and the Rio Grande.

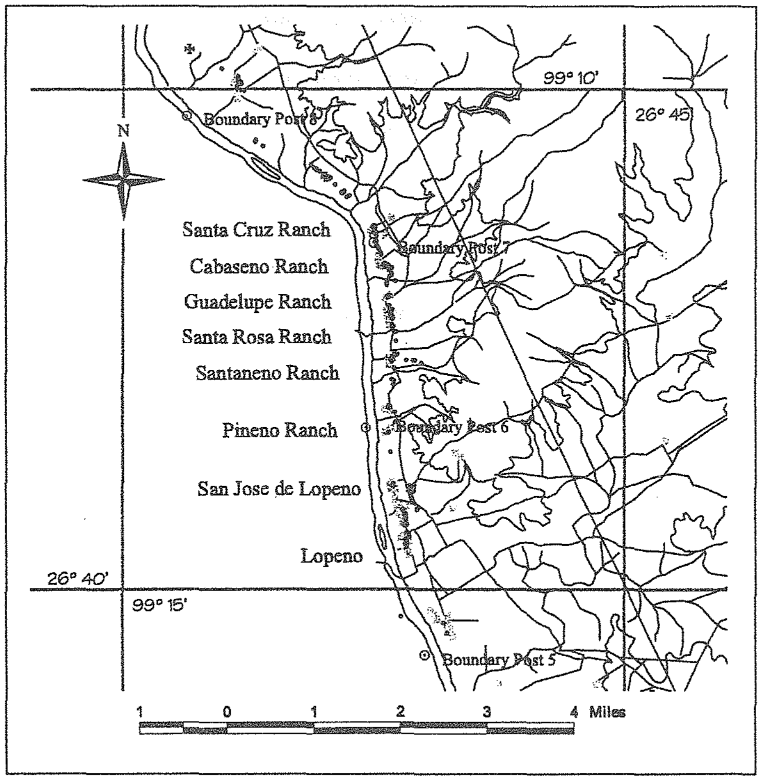


Figure 1. 1996 Map produced by the National Park Service of a Portion of Falcon Reservoir, showing 1929 locations of ranch sites, San Jose de Lopeno, and Lopeno. The 1929 Cabaseño Ranch is near Area I at the Cabaseño site.

## CULTURAL AND ARCHEOLOGICAL SETTING: HISPANIC AND TEJANO ARCHEOLOGY ALONG THE LOWER RIO GRANDE

The historic archeological sites present at Falcon Reservoir represent the remains of 18th to 20th century Hispanic and Tejano ranching communities along the lower Rio Grande (George 1975; Tijerina 1994, 1998; Poyo 1996; Alonzo 1998). These communities on the north side or bank of the Rio Grande were established after 1750, following Jose de Escandón's colonization efforts in the province of Nuevo Santander (Thompson 1997:19-24), which extended from Tampico, Mexico on the south, Matagorda Bay on the north, the Sierra Madre Oriental to the west, and the Gulf of Mexico to the east (Gerhard 1993). The largest river in the province, the Rio Grande, ran through the center of the province (Figure 2). The 1750 ranching community of Nuestra Señora de los Dolores in northern Zapata County was the "first settlement in Nuevo Santander on the north bank of the Rio Grande in what is now South Texas" (Thompson 1997:27).

The Colonial Hispanic ranching and agrarian communities quickly developed along the Rio Grande and took on great importance as a major ranching area, despite its relatively late 18th century occupation compared with inland and coastal mission and civil settlements in Texas that were established in the first quarter of the 18th century (cf. Jones 1996). By 1830, there were 241 Tejano ranches in the Rio Grande region, and this had increased to 356 ranches by 1833 (Tijerina 1994:Table 7).

The Rio Grande area was one of the centers of Hispanic cattle ranching in North America, taking shape from Mexican Gulf coastal (Tamaulipan) culture and ranching/herding practices extending

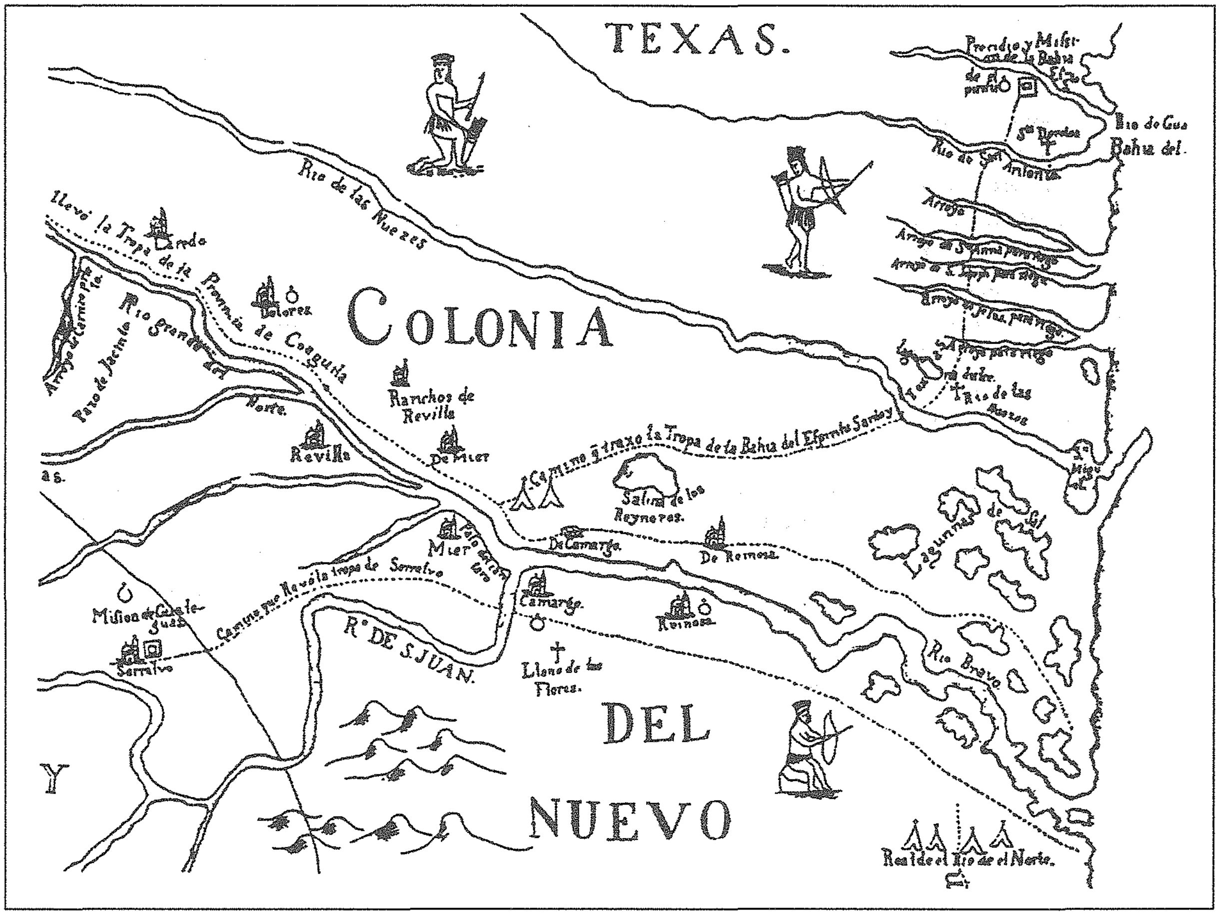


Figure 2. 1755 Mapa de La Sierra Gorda by Tomas Sanchez. Archivo General y Publico, Mexico, Historia, Vol. 29. Area I at the Cabaseño site was located in the general area of the "Ranchos de Revilla."

back to about 1650 (Jordan 1993:147-156 and Figure 27). This area had large herds of feral cattle and horses, which proved to be a boon to the eventual development of the cattle ranching industry. Associated with the spread of cattle ranching/herding to the lower Rio Grande were distinctive systems of private land ownership (large Royal grants or *porciones*), unsupported by either the military or missionaries, use of a *vaquero* (cowboy) work force, and an architectural expression in houses and public buildings that reflected the climate of the region and available materials, including wood, stone, clay, and grass/branches (Robinson 1979; Graham 1994, 1997; Fleming 1998). Jones (1996:78) succinctly captures the essence of the Hispanic and Tejano populations that colonized the lower Rio Grande valley:

> These settlers were not great landowners or members of any aristocratic group. They were mostly small farmers and ranchers, artisans, day laborers, and occasionally merchants. Their society not only held this frontier for Spain, but established a Spanish-speaking nucleus of population for southern Texas and Tamaulipas. Their emphasis upon raising large numbers of livestock near the Río Grande became the basis of the huge Texas cattle industry that developed after the Civil War in the United States.

The historic archeological ranching sites and communities at Falcon Reservoir "were selected with cares, with consideration toward good terrace soil, firewood, shade-trees, and available water" (George 1975:20). The earliest ranches and communities appear to have been situated on alluvial terraces adjacent to low water crossings or fords of the Rio Grande, as at Nuestra Señora de los Dolores (later named Dolores Viejo, but established in 1750 by Jose Vasquez Borrego), Lopeño (established after the 1761 land grant to Ysabel María Sánchez) and Falcón (established ca. 1781 by Don José Ramirez and Rita de la Garza Falcón). Late 18th to mid-19th century archeological sites with stone structure ruins are also common in the vicinity of the Santa Rosa ford of the Rio Grande (near the confluence of Arroyo Cabaseño), including the Cabaseño (41ZP79) and Santa Rosa Ford (41ZP302) sites, and on alluvial terraces where a major arroyo enters the Rio Grande valley.

These ca. 1780-1860 ranching sites were probably in ruins at the time of Emory's 1852-1853 survey of the Rio Grande (Emory 1987:Map No. 1). Emory's map shows a "Deserted Rancho" and a "stone Rancho (in ruins)" between present-day Arroyo Loma Blanca and Arroyo del Tigre, in the vicinity of the Santa Rosa Ford as shown on the 1929 15' USGS maps of the Falcon Reservoir area. These sites contain the sandstone ruins and foundations of ranch structures, *hornos* or outdoor stone baking ovens, trash pits and bone-filled middens, and extensive trash midden deposits containing Mexican majolica types common in northern New Spain between ca. 1780-1850 (Cohen-Williams 1992; Cohen-Williams and Williams 1996; Fox 1992). Also present are Mexican lead-glazed wares, locally-made coarse earthenware jars and ollas (labeled Mier Plain by Alex Krieger from ceramic sherds and partial vessels recovered from 41SR39 and 41SR43 at Falcon Reservoir [Krieger and Hughes 1950; Hartle and Stephenson 1951]), British and European ceramics, liquor and medicine bottles, metal implements and tools, and an assortment of other kinds of material goods obtained from Mexican, American, and European sources.

Some of the earliest identified Hispanic ranching sites and ruins (as at Area I at Cabaseño, see below, and the Santa Rosa Ford site) contain roughly rectangular rock foundations (one or two courses in height) rather than the thick stone-walled and flat-roofed or pitched-roof structures also common along the Rio Grande in the Falcon Reservoir area (see George 1975; Fleming 1998). These rock foundations may have had adobe walls and thatched roofs (John W. Clark, 1998 personal communication). Others of wood probably represent the foundations for wood post *jacales*, the walls having been composed of vertical mesquite posts covered with adobe plaster and with a wood roof framework thatched over with saw grass or tule (George 1975; Graham 1997). In other cases, early 19th century archeological deposits with preserved middens and features have been identified along the Falcon Reservoir shoreline, but no stone structure ruins or other rock features were apparent. It is likely that the structural remains of these particular early ranching communities are either buried in alluvial deposits (and/or buried under recently deposited reservoir silts) or remain inundated.

## SITE INVESTIGATIONS

Investigations at the Cabaseño Ranch site in 1996 and 1998 primarily consisted of mapping and photographing features and artifact concentrations, along with the systematic collection of late 18th and 19th century artifacts (including ceramics, bottle glass, and metal items) on the exposed shoreline (Figure 3). During the surface collection, all plain and decorated majolicas, lead-glazed wares, and coarse earthenware sherds in Area I were collected, while in the other areas of the site, decorated refined earthenwares and bottle glass lips were also collected for analysis (see Perttula et al. 1996; Perttula et al. 1998). Visibility was excellent along the recently exposed beach, which facilitated the surface collections, but a few shallow shovel tests (ca. 40 x 50 cm in size) were excavated at Cabaseño in 1998 to ascertain if buried archeological deposits and features remained there.

The Cabaseño site has been periodically occupied since the late 18th century, and the last occupation (associated with Features 13-17, a corral, two collapsed *jacales*, a two room pier structure, and a midden deposit) dates to the early part of the 20th century. The most substantial settlement at Cabaseño dates to the mid-19th century, based on decorated English whiteware and Guanajuato Polychrome majolica. This settlement included one large two-room stone structure (Feature 1), two smaller stone structures (Features 2 and 7), a possible *horno* or oven (Feature 3), a lime pit (Feature 5), and several areas of trash midden deposits with an abundance of artifacts and animal bone. Area I, the late 18th century component, is situated near the northern part of the terrace, and slightly lower (1-3 feet) in elevation than either the mid-19th or early 20th century *ranchos*. It covers at least 25 x 20 m (see Figure 3), but an unknown

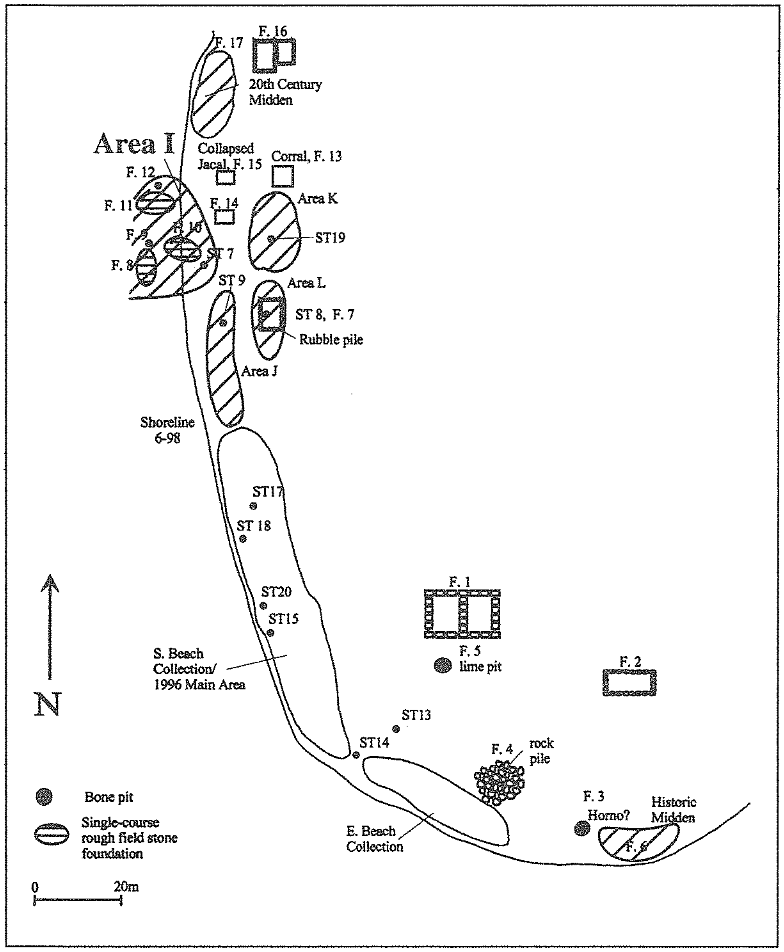


Figure 3. Features, Areas I-L, and Surface Collection areas at the Cabaseño Ranch site.

portion of Area I was underwater during both the 1996 and 1998 archeological investigations.

## FEATURES

Five features have been recognized in Area I at Cabaseño, including three stone structure foundations (Features 8, 10, and 11) and two bone-filled pits (Features 9 and 12), one immediately north of Feature 8 and the other just north of Feature 11. As previously noted, these are distributed over an area of ca. 25 x 20 meters along the Falcon Reservoir shoreline (see Figure 3).

Each of the features was exposed during the latter part of the 1996 investigations (when water levels dipped to about 251 feet amsl), but only a portion of one of the stone structure foundations was seen in 1998 because of slightly higher water levels (252.28 feet amsl) during the June 1998 work. The quantity of animal bones and large sherds visible along the shoreline, and in the water just offshore, indicates that there is also a midden deposit present in Area I.

The three stone structures are roughly rectangular, approximately 6.5 x 4 m in size, and are comprised of uncut sandstone field stones piled in 1-2 courses. No entrances are apparent, and interior features were not detected in our limited investigations. It is suspected that the entrance was to the east or south, facing away from the Rio Grande, and they probably had central hearths or fireplaces, based on excavations at 41SR39 at the Falcon Reservoir dam site (Krieger and Hughes 1950:26). Two of the stone structures have their longest dimensions in a east-west direction (Features 10 and 11), while Feature 8 is oriented north-south (see Figure 3).

The bone-filled pits probably represent trash pits for the disposal of inedible faunal remains from the butchering and consumption of domestic animals at the site, including cow and goat. Other bone-filled pits and middens with substantial animal bone deposits have been reported at a number of the Falcon Reservoir *ranchos* (see Perttula et al. 1996).

## ARTIFACT ASSEMBLAGE

### Majolica

The majolicas found at the Cabaseño site were imported from central Mexico (probably from manufacturing sources such as Puebla, Mexico City, and Guanajuato). Their purchase and use by 18th and 19th century ranchers in the Falcon Reservoir area hint at broad patterns of commerce and existing systems of exchange between the local, probably self-sufficient, Hispanic and Tejano ranching communities on the lower Rio Grande and the Mexican mercantile centers.

In general, the Mexican majolicas at the Falcon Reservoir historic ranching sites appear to be dominated by Guanajuato wares, which include majolicas with green, reddish brown, and rust-colored bands, flower petals, and decorative motifs that became popular in the early 19th century at Hispanic sites in South Texas (cf. Fox 1992; Carlson 1994), and continued in popularity into the early 20th century (Clark 1989; Cohen-Williams 1992). At Cabaseño, for example, over 71 percent of the Mexican majolicas are Guanajuato polychrome wares, but these majolicas are found exclusively outside Area I (Perttula et al. 1998). There are also in general surface collections at the site, small percentages (between 1-5 percent) of Aranama Polychrome (1800-1835), Puebla Green on white (1780-1800), Huejotzingo Blue on white (1700-1850, but rare before 1780), Puebla Blue on white (1700-1850), including a late variant (Puebla Blue on white II [see Carlson 1994] dating between 1775-1800), Esquitlan Yellow (1800-1900), Mexico Green on white (1700-1800), and San Elizario Polychrome (1750-1850); the estimated date ranges for the majolicas follow Carlson (1994).

The same range of Mexican majolicas are represented in University of Texas collections from previously investigated Hispanic or Tejano ranching sites at Falcon Reservoir (Krieger and Hughes 1950; Hartle and Stephenson 1951; see also Goggins 1968), including 41SR39 (two small plates of Guanajuato polychrome ware), 41SR43 (San Elizario Polychrome, Aranama Polychrome, and Puebla Blue on white), and a poorly recorded ranching site between Lopeño and Falcón (with Huejotzingo Blue on white, Puebla Blue on white, Aranama Polychrome, and Guanajuato wares). Recent investigations at Corralitos (41ZP74), a few miles north of San Ygnacio on the Rio Grande, also recovered the same sort of late 18th century majolica and other Mexican wares in a midden deposit apparently associated with the 1780s construction and use of a *Casa Fuerte* (Fleming and Perttula, this volume; see also Fleming 1998).

There are only 26 majolica sherds from Area I at Cabaseño, accounting for 7.3 percent of the ceramics from this component. By comparison, the 308 majolica sherds (principally Guanajuato polychromes) from other parts of the site comprise a much higher 13.9 percent of the ceramic assemblage, which is otherwise dominated by Mexican lead-glazed wares (n=759), coarse earthenwares (n=550), and decorated English-made whitewares and yellowwares (n=572). From the differences between the two assemblages (one late 18th century and the other primarily dating from ca. 1830-1860), and similar ceramic assemblage data from several other early and mid-19th century ranchos at Falcon Reservoir (see Perttula et al. 1998: Table 1), it appears to be the case that the opening of the Mexican port of Matamoros on the lower Rio Grande in 1824 for international trade (Alonzo 1998:67-73) led to the introduction of new ceramic wares from England and a broadening of the ceramic trade within Mexico and border regions and towns. This apparently led to the increased shipment and purchase of more majolica and lead-glazed wares in the Falcon Reservoir area by local ranchers after 1824.

The Cabaseño, Area I majolica was made in at least two source areas in central Mexico, based on differences in the paste and surface color of the tin glaze. The principal majolica (accounting for 50 percent of the majolica) has a grayish-white Puebla paste (cf. Fournier 1997), followed by a majolica with a reddish-brown paste and a creme-yellow surface color (31 percent), and a few majolica sherds with a reddish-brown paste and a creme surface color. The latter majolica may have been manufactured in Puebla or Guanajuato; the one Guanajuato polychrome sherd has a reddish-brown paste with a creme-yellow surface color.

The Puebla paste majolica (n=13) includes two plain body sherds, one unidentified sherd with blue petals, San Elizario Polychrome (n=5) rim, body, and base sherds with dark blue petals and dots (Figure 4a, c-d, g), a possible Monterey Polychrome (1775-1825) rim with dark brown, reddish-yellow brown, and brown rim bands (Figure 5e), three Huejotzingo Blue on White rims, including one with a wavy rim band, and each with blue rim bands on interior and exterior surfaces (Figure 4e, h), and one Aranama tradition rim/body sherd with brown, grayish-green, brown, and blue bands (Figure 5c). Decorated majolica with the reddish-brown paste and creme-yellow surface color (n=8) comprises an Aranama tradition base sherd with circular black and green lines (Figure 5b), one base sherd with light blue and dark blue petals (Figure 4f), a Puebla Blue on White cup with blue lines and three dots (Figure 4j), a small rust-brown decorated piece that may be a Guanajuato ware, two Huejotzingo Blue on White rims (Figure 4i), a Huejotzingo Green on White rim, and one sherd with light green bands (Figure 5d), probably made in Puebla. Finally, the five majolica sherds with a reddish-brown paste and a creme surface color are represented by two Puebla Green on White body and base sherds with dark green petals (Figure 5a), probably part of the same vessel, one Huejotzingo Blue on White rim (n=6), and two San Elizario Polychrome rim sherds (Figure 4b).

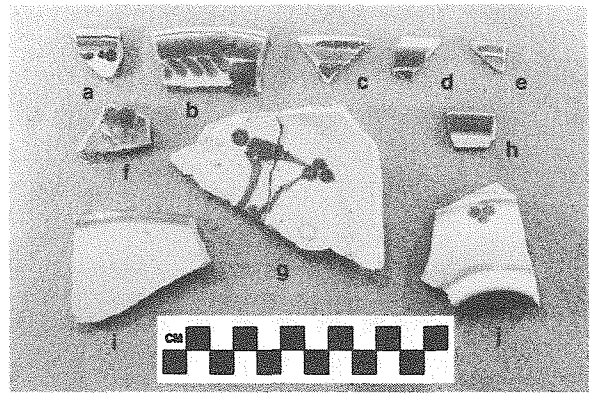


Figure 4. Area I Majolica: a-d, San Elizario Polychrome; e, h, Huejotzingo Blue on White with interior and exterior rim bands; f, unidentified majolica with light and dark blue petals; g, San Elizario Polychrome base; i, Huejotzingo Blue on White; j, Puebla Blue on White II.

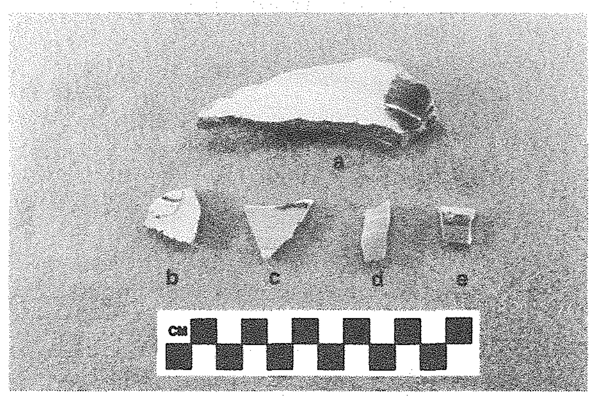


Figure 5. Majolica from Area I at Cabaseño site: a, Puebla Green on White; b-c, Aranama tradition; d, green bands; e, Monterey Polychrome rim.

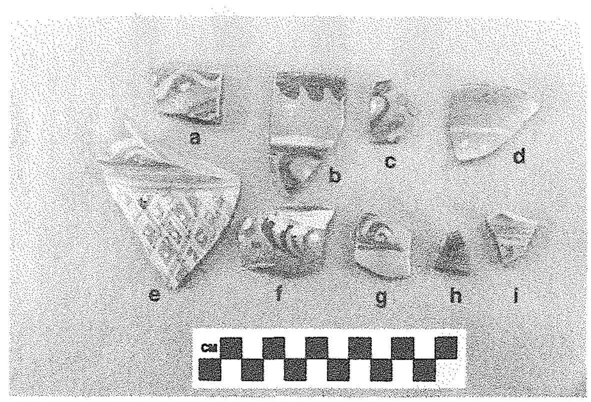


Figure 6. Lead-Glazed Wares with Fine Pastes: a-g, and i, Galera Polychrome; h, lower rim/body sherd from a bean pot.

### Lead-Glazed Wares

The Mexican lead-glazed wares from Area I are wheel-made vessels with a very fine paste, lead glazes on interior and exterior surfaces, and several different kinds of decorations. They have a characteristic orange vessel surface color from having been well-fired in an oxidizing environment.

A number of the lead-glazed wares are from post-1750 Galera Polychrome sherds (n=14) from *chocolateras*. The sherds are thin-walled (averaging 3.5 mm in thickness, with a range of 2.6-4.8 mm) and have creme-colored bands and dots, black lines and swirls, as well as green and creme-colored lines and dots on the vessel exterior (Figure 6a-g, i). Five other lead-glazed sherds are probably from bean pots, and include two handles, two rim sherds (3.6 mm in thickness), and a rim/body sherd (see Figure 6h). The rim sherds have a brown painted rim band on the interior of the vessel. Another 24 sherds are undecorated rim and body sherds from thin ($3.8 \pm 0.7$ mm) lead-glazed vessels of undetermined form and with fine pastes. They have clear, yellow, and brown glazes.

### Burnished Red Wares

There are four rim and body sherds of a burnished red ware from Area I, possibly all from a single bowl with a 22 cm orifice diameter and 7.9 mm thick body walls (Figure 7a-d). The rim is direct and rounded at the lip. The red ware has a fine reddish-brown paste, and the sherds are from a vessel fired in an oxidizing environment. A few other burnished red ware sherds are present in shovel tests and surface collections to the east and south of Area I (see Perttula et al. 1998:Table 1), but they are found in mid-19th century contexts. One black glazed ware sherd, or Black Luster probably made


Figure 7. Burnished Red Ware Sherds from Area I.


Figure 8. Coarse Earthenwares: a, unglazed hand-made earthenware rim; b, unglazed wheel-made earthenware rim.

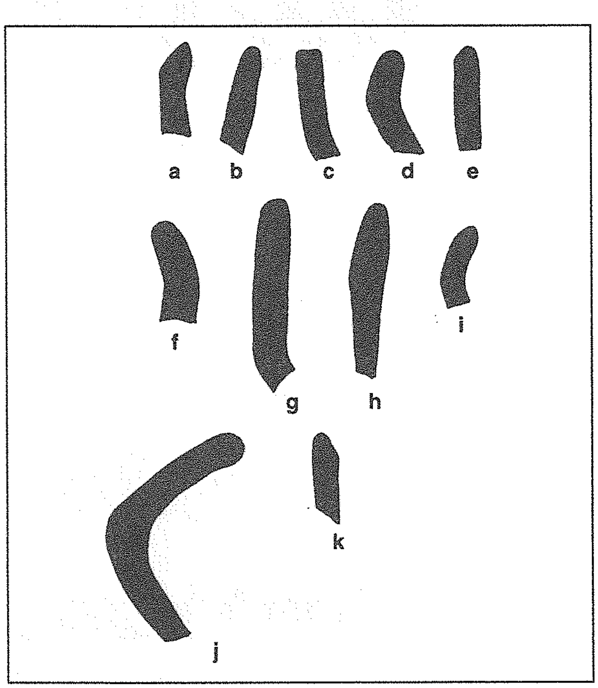


Figure 9. Rim Profiles, Coarse Earthenware: a-e, hand-made coarse earthenware; f-k, wheel-made coarse earthenware.

in Puebla, Mexico, was also found in mid-19th century contexts at Cabaseño.

### Coarse Earthenwares

There are three kinds of coarse earthenwares at Area I in the Cabaseño site: (1) large wheel-made jars, bowls, and ollas with sandy paste and crushed rock temper; (2) medium-sized to large jars and bowls of a hand-made earthenware, tempered with shell, bone, or crushed rock; and (3) olive jars. These earthenwares comprise approximately 80 percent of the ceramics from Area I, but only 24.8 percent of the ceramic sherds from the mid-19th century or later components at Cabaseño (Perttula et al. 1998:Table 1).

### Wheel-made Coarse Earthenwares

There are 91 rim, body, and base sherds of wheel-made coarse earthenwares in Area I. The vessels are large jars, bowls (Figure 8b), and ollas, with rounded lips and everted to strongly everted rims (Figure 9f-k). Measurements of orifice diameter on the larger rim sherds range from 22 cm to greater than 32 cm. The wheel-made earthenwares have thick body walls (ranging from 6-9 mm) and bases (11-14 mm in thickness), while rim thickness varies by vessel form and profile, but range from 4-10 mm; in a few cases, the vessel rim is deliberately thickened below the lip (see Figure 9h).

The majority of the sherds (75 percent) have a lead glaze, usually on the interior and/or exterior vessel surfaces, with a smaller number (about 11 percent) having a glaze only on the exterior. A green glaze was preferred (Figure 10b, g), and was usually applied in globs and splotches, and several sherds have streaks and lines of glaze. Brown or clear glazes were 3-4 times less common in the wheel-made earthenwares (Figure 10f, h).

Analysis of the paste in the sherd cross-sections (cf. Teltser 1993) indicate that the majority (more than 55 percent) of the wheel-made coarse earthenwares were fired in an oxidizing environment, probably a kiln, although the number of sherds fired in a reducing (or low oxygen) environment and/or not completely oxidized during firing suggests that some of the wheel-made earthenwares may also have been fired in an open air environment. Proportionally, however, the amount of wheel-made earthenwares that were not completely oxidized during firing was much lower than among the hand-made coarse earthenwares (see below).

### Hand-made Coarse Earthenwares (Mier Plain)

The hand-made coarse earthenware from Area I at Cabaseño is a distinctive part of the Spanish Colonial and Tejano material culture along the lower Rio Grande. This kind of earthenware (dubbed Mier Plain), frequently tempered with bone, shell, or crushed rock, has been found in numerous historic archeological sites at Falcon Reservoir, and at other sites along the lower Rio Grande (Perttula et al. 1997), and comparable hand-made earthenwares have been reported from San José de Corralitos (Fleming and Perttula, this volume) and the 1830s-1840s Fort Lipantitlan on the Nueces River (Ing 1976; Warren 1988). The relatively thick unglazed sandy paste ware reported from Tonkawa Bluff (see Hindes et al., this volume) also appears to be similar to the hand-made coarse earthenwares on the lower Rio Grande.

Although petrographic and neutron activation analyses of the sherd pastes have not been completed, we suspect that the hand-made coarse earthenwares were made locally by Hispanic and Tejano potters for local domestic consumption. The fact that the hand-made earthenwares are so common in a late 18th century context at the Cabaseño site suggests that there was a limited supply of affordable and good quality ceramics (i.e., such as the majolica, *chocolateras*, and bean pots) available through long-distance traffic with central Mexico, and that the early settlers along the lower Rio Grande needed to also manufacture ceramics for themselves.

There are 183 rim, body, and base sherds of hand-made coarse earthenwares in Area I. The vessels are medium-sized to large jars, bowls (see Figures 8a and 10a), and ollas, with rounded or flat lips and direct to strongly everted rims (see Figure 9a-e). Measurements of orifice diameter on the larger rim sherds range from 16 cm to greater than 32 cm, and average 23.2 ± 4.7 cm. The coarse hand-made earthenwares have thick body walls (ranging from 6-10 mm) and bases (12-18 mm in thickness). Rim thickness varies by vessel form and profile, ranging from 4-18 mm; in one case, the vessel lip is deliberately beveled on the vessel interior (see Figure 9a).

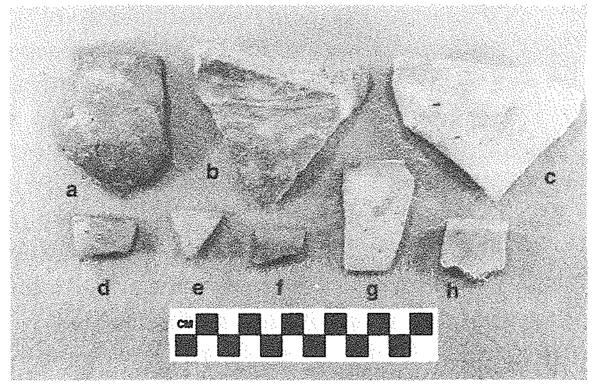


Figure 10. Coarse Earthenware and Olive Jar sherds: a, unglazed hand-made coarse earthenware rim; b, g, wheel-made coarse earthenware, interior/exterior green glaze; c, Olive Jar; d, hand-made coarse earthenware rim, interior/exterior green glaze; e, hand-made coarse earthenware rim, interior green glaze; f, wheel-made coarse earthenware rim, interior/exterior brown glaze; h, wheel-made coarse earthenware, interior/exterior clear glaze.

Even though these coarse earthenware vessels are hand-made, many of the sherds (56 percent) have a lead glaze, usually on the vessel interior (48 percent), with a smaller number (about 9 percent) having a glaze on the exterior and interior vessel surfaces. Both green and brown glazes were used (see Figure 10d-e), in roughly equal proportions, and the glaze also applied in globs and splotches, while several sherds have streaks and lines of glaze. A few of the sherds have exterior brushing, wiping, and fingernail marks, along with smudged and soot marks, indicating their use over a fire during cooking activities.

Analysis of the sherd cross-sections indicate that the majority (more than 60 percent) of the hand-made coarse earthenwares were fired in an oxidizing environment, but particularly common are sherds from vessels that had not been completely oxidized during firing, leaving black carbon streaks in the paste; only about 15 percent of these sherds were from well-oxidized vessels. The remainder were from vessels fired in a reducing environment, including a number that were then cooled in a high oxygen environment, leaving a thin oxidized band at the surface of the vessel core. The combination of firing conditions suggests that the hand-made coarse earthenwares were fired in an open air environment.

Comparing the firing environments of the hand-made and wheel-made coarse earthenwares, as well as the olive jars, by whether the sherds are from vessels with (a) oxidized exteriors, (b) reduced exteriors, or with (c) surface oxidized exteriors indicates that there is a statistically significant difference (chi-square=12.33, df=4, p=.015) in how these vessels were fired and cooled. Sherds from hand-made earthenware vessels had higher than expected proportions of surface oxidized exteriors (i.e., fired in a reducing environment, but cooled in a high oxygen environment), while sherds from wheel-made earthenware vessels had lower than expected proportions of this kind of firing environment. Olive jar sherds had significantly higher proportions of reduced exteriors, and much lower proportions than expected of sherds with oxidized exteriors.

If we consider differences among the earthenware sherds in firing environments by more specific categories—namely oxidized, reduced, incompletely oxidized, or reduced but cooled in a high oxygen environment—the hand-made and wheel-made coarse earthenwares and olive jar vessels are again from demonstrable and statistically different populations (chi-square=15.9, df=8, p=.05). Hand-made coarse earthenware vessels are proportionally more likely than the wheel-made earthenware or olive jars to have been fired in a reducing environment but cooled in a high oxygen environment, while wheel-made earthenware is much more likely to have been fired under oxidizing conditions than were the hand-made coarse earthenwares. Incompletely oxidized and reduced vessels occur in comparable frequencies in both the hand-made and wheel-made earthenwares.

### Olive Jars

Olive Jars are one of the mainstays of the ceramic assemblage in Spanish Colonial sites in Texas, where they were utilized for the storage of liquids and the transportation of goods. The seven Olive Jar body sherds from Cabaseño, Area I (see Figure 10c), appear to be late style jars, dating from 1780-1800 (Deagan 1987:34-35), as they have compact fine pastes, lack the exterior white slip seen more frequently in earlier jars, and have thick vessel walls (mean thickness of 10.3 $\pm$ 1.8 mm). They were also fired under both oxidizing and reducing environments, but most of the sherds are from vessels that were incompletely oxidized.

### Faunal Remains

A small amount of vertebrate faunal remains (n=66) have been recovered in shovel testing in Area I (Schniebs 1998), and faunal remains are abundant along the shoreline in this area of the Cabaseño Ranch. The fauna includes large mammals (probably cow, but not identifiable to species), cottontail rabbit, deer-sized artiodactyl, cow, and sheep or goat (Schniebs 1998:Table 7). More than 90 percent of the fauna has been burned or charred, indicating its trash midden context.

## CONCLUDING REMARKS

The Spanish Colonial and Tejano cultural heritage of the lower Rio Grande valley is embedded in the many ranching communities established along the north bank of the Rio Grande by Jose de Escandón in the mid-18th century: "The ranch communities along the Lower Rio Grande developed a distinctive identity, noticeably different from the people of interior Mexico" (Tijerina 1998:xx).

Despite the many excellent historical studies of the Spanish Colonial, Mexican, and early Texan (post-1836) periods along the Texas-Mexican border, and the recent concern with the lifeways of Tejano ranchers (see Alonzo 1998; Tijerina 1998), our understanding of these early Tejano ranching communities and the lives they led can be enhanced by intensive archeological studies of 18th-20th century *ranchos* along the lower Rio Grande. There, well-preserved Spanish Colonial and Tejano archeological sites are known, such as Area I at the Cabaseño Ranch, that warrant further and careful investigations. These sites contain direct evidence in the archeological record of house construction; the spatial layout, use, evolution, and abandonment of ranches and small communities by the ranching patriarch, his extended family, and laborers; the furnishings, material culture, and tools of the ranching families, including goods obtained from Mexican markets as well as other goods made locally for local consumption; the building and use of outdoor cooking ovens and lime kilns, corrals, dipping vats, and other facilities; the raising, consumption, and marketing of cattle, sheep, and goats; and the participation of local ranchers in local and long-distance markets to obtain necessary goods. We look forward to further archeological research on the Spanish Colonial and Tejano cultural heritage on the lower Rio Grande.

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Nancy Reese prepared several of the figures in this article and helped edit the paper, and Bo Nelson assisted with the artifact photographs. LeeAnna Schniebs completed the faunal analyses. We are also grateful to Galan Galbraith for his assistance in arranging the use of boats during the project, and to his drivers for their boating skills.

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# Majolica and Faience from the Presidio Loreto Site (41VT8)

*Cecil A. Calhoun*


## ABSTRACT

Site 41VT8 is located on the east bank of the Guadalupe River about 8 miles upstream from the present-day city of Victoria, Texas. It was the second location (1726-1749) of the Spanish Presidio Nuestra Señora Santa María de Loreto de la Bahia del Espiritu Santo. The presidio site was discovered and recorded in 1966, and was the focus of the 1968 Texas Archeological Society Field School.

This article, written in 1969, was originally intended to be part of the complete report of the limited excavations conducted at the site. It deals strictly with one class of artifacts recovered there, the tin-enameled Spanish majolica and French faience ceramics. I present descriptions of the sherds, the suite of represented types, and comparisons with tin-enameled earthenwares documented previously at other Spanish Colonial sites (primarily in Texas).


## INTRODUCTION

The technique of coating ceramic surfaces with an opaque white enamel, which was obtained by adding an increment of tin to the glaze, is believed to have evolved in the Middle East before the beginning of the Christian era. Gradually diffusing along the eastern and southern Mediterranean regions, it was introduced to the native peoples of the Iberian peninsula by Moorish invaders sometime before A.D. 1000 (Goggin 1968:5). The practice was accepted there, was modified and improved upon, and eventually became a traditional feature for the vessels and tiles of Spain and Portugal. Potters from Spain carried the technology to Italy and thence to France. By the 15th century, Holland was producing a variation of the soft paste, low-fired pottery with its hard, opaque, vitreous coating; somewhat later, potteries in Germany, England, and other smaller European countries were manufacturing it in quantity (Barber 1907:20, 31).

Today, three broad categories of the ware are generally recognized: majolica (or maiolica), faience, and delft. Each term is usually reflective of its country of origin, although certain minor distinctions can be made between them. Thus, majolica connotes such tin-enameled pottery produced in Spain, Portugal, Italy, and Mexico, while faience is ordinarily limited to that made in France and Germany; delft is made in Holland and England. Sherds identifiable as majolica and faience were recovered from site 41VT8, and in this article only these two subdivisions of the ceramic tradition will be discussed.

## ANALYSIS METHODS

In referring to the vitreous coating of the soft-bodied wares, the term enamel is used rather than glaze. Whereas the latter is clear, the former contains an additive that renders it opaque; in this case it is a tin oxide (or tin ash) that is suspended in a matrix of lead oxide and silica (Jelks 1958:202).

A graphic explanation is provided in Figure 1 of the nomenclature used for different areas and salient features of the brimmed plates, or *platos*, the most common vessel form found at 41VT8. Hardnesses were determined by scratch tests using a set of standard mineral specimens (Mohave Instrument Company, Long Beach, California), and are expressed in Moh's scale. Colors are expressed in common descriptive terms as no suitable standard color classification guide was available when these analyses were conducted in 1968-1969.

## MAJOLICA

Majolica, in the form of utilitarian plates, cups, and bowls, was probably aboard the first Spanish ships to reach the New World. But it was only following the establishment of outposts and settlements on various of the larger islands, and on the American mainland, that the pottery, along with any other European artifacts, might be expected to have appeared in any significant amounts. Tunnell and Ambler (1967:26) state that: "In Texas, tin-enameled potsherds are of special interest because they are found in large numbers on Spanish Colonial sites and are completely absent in the later Anglo-American occupations." By the mid-1500s, some majolica was being manufactured in New Spain, particularly in the vicinity of Puebla, Mexico (Barber 1911:4), and perhaps exclusively in that locale at this early date. The industry grew quickly, and consequently the need diminished for majolica supplied from Spain.

As was the case with the earlier Spanish ware, Mexican majolica underwent numerous temporal changes in form and decorative mode. Only since the 1960s, however, have useful archeological studies been made along these lines, starting with Goggin's (1968) work.

There are 824 majolica sherds from 41VT8. Their classification follows Goggin (1968), where possible. Exceptions to this classification are noted,

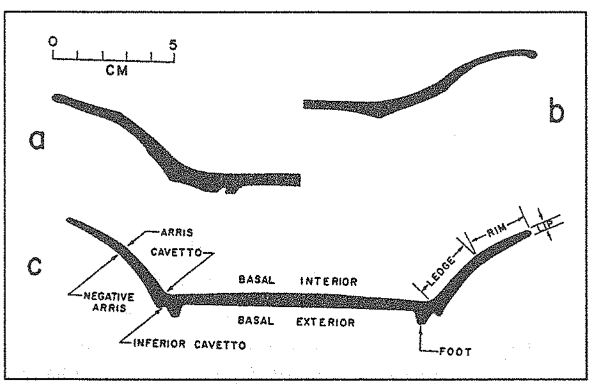


Figure 1. Plate Profiles and Vessel Nomenclature: a, San Luis Polychrome majolica; b, undecorated faience; c, Puebla Blue on White majolica.

but no new types are proposed in this paper. Sherds grouped into *Unclassified* lots include those with attributes so consistently similar as to likely constitute distinct types, but for which no precedents have been noted in the archeological literature. The several *Miscellaneous* lots contain sherds that may belong to any two or more separate types or to no recognizable type. Primary reliance was upon decorative features (including motifs and pigments) in placing the majolica sherds in defined groups and types; rim sherds were particularly important in this respect.

Most of the majolica from 41VT8 is from two vessel forms. By far the most common is a deep, flat-rimmed (or brimmed) plate or *plato*. The other is a deep cup or bowl, with nearly vertical sides and usually without handles, termed an *escudilla*. A few sherds were found that appear to represent a drug jar, or *albarello*, a tall, cylindrical vessel with somewhat constricted sides, while some may be from small drinking cups or *tazzas*. All forms are wheel-thrown, with a low, circular foot-ring.

The inside edges of many of the vessel foot-rings appear to have been formed around the edge of a disc, while the basal exterior shows evidence of having rested on a smooth, flat surface during vessel manufacture. This consists of rough depressions in the base that may be the result of small patches of clay being pulled from it when the raw ware was removed from the surface of the disc. Thus, rather than the vessel base being hollowed out as a separate step in shaping the piece, these basal marks suggest that it and the foot ring were molded over a pedestal (which was probably oiled or dusted) centered on the potter's wheel during the initial manufacture. The exterior of the ring, along with the exterior of the rim, was shaped with a template or jig, then the foot cut away from the wheel with a thin wire (Goggin 1968:4).

The vessels were each kiln-fired twice, and after the first firing they were coated with enamel and then (in most cases) decorated. The second firing (at a lower temperature than the first) simultaneously fixed both the enamel and the decorative element.

Crazing of the enamel is a feature common to the 41VT8 majolica. It ranges from light, hair-line cracks to prominent and extensive cracking. Exfoliation, however, is quite rare. The enameled surfaces are scratched and scored on all sherds, particularly on the interior plate surfaces. These striae may not be from use, per se, but rather from how the vessels were cleaned. Wet sand, for example, was probably used to scour the vessels. On some flat basal sherds that lack other distinguishing characteristics, this differential abrasion is useful in defining the interior and exterior surfaces.

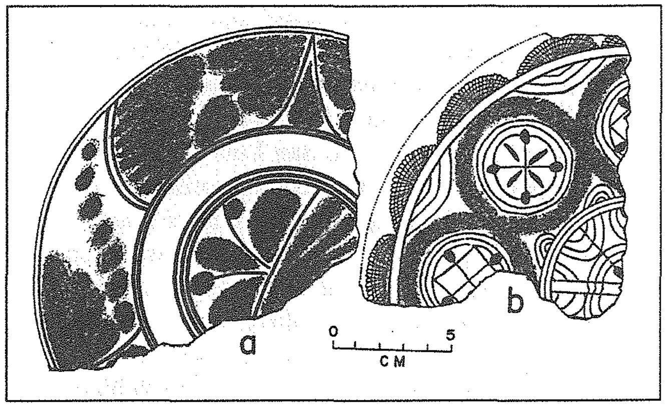


Figure 2. Majolica Decorations: a, San Luís Polychrome plate interior; b, Puebla Polychrome plate interior. Composite drawings based on large sherds.

### San Luís Polychrome

**Frequency:** 31 sherds (Figures 1b and 2a)

**Paste:** Fine, compact. A few small air cavities are present that are parallel to surfaces. The paste is mainly light buff, but a few are cream-colored. Grains of fine, angular sand appear consistently, but rather sparsely. The grains are transparent, and separated from each other by several grain diameters. Also present, but widely separated, are small (>0.25 mm in diameter) particles of a soft, white mineral that effervesces in a drop of cold, dilute hydrochloric acid. The paste hardness is about 3, but slightly softer for those sherds with a lighter-colored paste.

**Form:** Small, deep plates that were ca. 21 cm in diameter. The surfaces are covered with a thin cream enamel (hardness of 6) that is profusely speckled with tiny black dots. Rough, ovate firing scars are present on the interiors of four sherds. All scars are in the *cavetto*, suggesting that the legs of the firing stilts were relatively large and spanned a comparable diameter. The arris is prominent, and the rim curves slightly downward near the lip. The lip is rounded, and one sherd has a thickened lip. Wall thickness varies considerably on individual vessels, but basal sherds average 5.5 mm, rim sherds are 5.0 mm thick, and the thickness near the lowermost part of the ledge is an average of 10.0 mm. Two contiguous chamfers are prominent on the ledge exterior, similar to the flat bands exhibited by earlier majolica produced in Spain (Goggin 1968:117). Static stability was provided by a circular basal ring (5.0 mm wide and 6.5 cm in outside diameter) that is delimited by an incised groove in the exterior wall.

**Decoration:** Confined to the interior of the plates, the decoration is a stylized floral motif painted in thick, dark, emerald green, and developed within geometric panels outlined by narrow black (or dark brown) lines. One basal sherd also has a large smudge of ochreous orange paint over the translucent green. The thick green paint stands away from the enamel background in low relief, and is softer (5.5) than the enamel. The decorative paint was applied over, or into, the raw unfired enamel.

With the vessel upright, and apparently rotating (probably on a small revolving work table or wheel), one black line was painted on the rim just below the lip; two parallel black lines along the arris, and three closely-spaced ones around the *cavetto*. The rim was then separated into six large units by three series of two short, parallel, strokes arcing from rim to arris, alternating with three other sets of black lines forming chevrons. The basal interior was divided into four segments by one line curving across its diameter, and two short radii from its center to the innermost of the three rings forming the circumference. Large dabs and broad strokes of viscid green were then painted within the divisions of the rim panel and the basal interior. The entire design was clearly done rapidly, but with a quite skillful dexterity. The ledge was left undecorated (except for one 41VT8 sherd). Examples have been noted elsewhere with the ledge decorated with letters or inscriptions (Goggin 1968:167 and Plate 11h-i).

**Chronological Position:** Goggin (1968:169) attributes this type to the last half of the 17th century and the early 18th century, and he considered it a very good time marker.

**Comments:** This may be the first recorded occurrence of this majolica type in a Texas site. Goggin (1968:168) noted that the type "usually occurs with Puebla Polychrome and ranges late enough to appear with Puebla Blue on White" in other areas. It may have been manufactured in Puebla, Mexico (Goggin 1968:168)

One trait shared by the San Luís Polychrome sherds from 41VT8 is the speckled surface of the enamel; that is, the cream-colored surface appears to be copiously peppered with tiny black dots. When examined under a binocular microscope, the dots are actually fenestrations resulting from ruptured gas bubbles in the thin enamel, as well as dark unbroken bubbles below the surface. The bubbles often contain tiny, dark, angular inclusions (either burnt-out impurities or deliberate additives to the enamel) that are firmly embedded in the vitrified walls of the voids. Although the speckled appearance of the enamel is not unique to San Luís Polychrome, however, it is characteristic of a high frequency of the type sherds.

### Puebla Polychrome

**Frequency:** 14 sherds (Figure 2b)

**Paste:** Very fine and compact, but comparatively soft. In some sherds the color is white and almost chalk-like with a hardness of 2. Other sherds have a buff color, are coarser or more granular, and have an average hardness of 3. Both kinds contain small amounts of fine, transparent to white sand grains, and a small amount of finely crushed red inclusions.

**Form:** Both plates and cups are represented in the sherds. No rims were recovered, and the overall dimensions of either form are undetermined. The plate sherds average 5 mm in thickness at the base, 6 mm at the *cavetto*, and gradually taper to 4.5 mm on the rim. The *escudilla* sherds range from 3-4 mm in thickness.

The two plate foot rings are 11 cm in diameter. Both foot ring bases have been abraded, either as the result of attrition during normal use, or more likely they were deliberately abraded to even and level the bottom of the foot ring.

Both the plates and cups were coated with white enamel and then decorated with dark blue and black paints. The opacity and purity of the enamel is more notable on the Puebla Polychrome sherds than on any other majolica type from the site. Crazing is relatively light, particularly on the sherds with a white paste, and surface bubbling is uncommon except in the blue painted decoration. The hardness of the enamel is 6, while that of the blue paint is 5.5.

**Decoration:** This type is probably one of the most readily identifiable of the blue and white Puebla wares because of its distinctive decorative style. Two palettes were used over the white enamel, a clear cobalt blue and an opaque black or very dark brown. The blue is dark and brilliant where the paint is thick, and a paler, grayish-blue where it is thin. Where the blue paint overlaps the black framing lines, diffusing into them, a clear green color is evident.

Although the decorations are basically the same from vessel to vessel, there is some variation. The so-called *dibujo de encaje* pattern (Snow 1965:27) is present on all the specimens. This is a complex, well-balanced design where the black is applied in very fine, narrow lines to create a cobweb effect, one imitating lace (Goggin 1968:174). The blue paint appears as broad, symmetrically arranged, and curvilinear ribbons bordered by the detailed black elements.

**Chronological Position:** This majolica appears to have been made no earlier than the last half of the 17th century and no longer manufactured by ca. 1725 (Goggin 1968:180; Snow 1965:32). Puebla Polychrome is also present at the site of Fort Saint Louis (41VT4), where it is attributable to the 1722-1726 Spanish occupation of Presidio Nuestra Señora de Loreto. The type seems to have its closest associations with San Luís Polychrome, San Luís Blue on White, and Abó Polychrome (Goggin 1968:179; Snow 1965:33).

**Comments:** It is possible that two separate types of majolica are included within the Puebla Polychrome from 41VT8. One, the sherds with soft light pastes, appear more like the "classic" Puebla Polychrome in that the design elements are done with black paint and with a uniform skill and care in the repetitive detail work. The second group includes the sherds with dark reddish-brown paint instead of the black paint. On these sherds, the lines forming the lacy fans or cobweb-like framework are broader and mottled, and more crudely applied. Also, crazing of the enamel is more pronounced on these sherds, and the paste is darker, coarser, and harder.

### Puebla Blue on White

**Frequency:** 136 sherds (Figures 1c, 3a-b, 5d)

**Paste:** Variable, but generally porous and somewhat coarse. Its color is usually cream, but it ranges from buff to light pink. The average hardness is 2, but possibly 2.5 for the pink pastes. Small elongated voids are present in most sherds, and all sherds have fine angular sand in amounts large enough to suggest an intentional addition rather than a natural occurrence in the clay. Grains of black and clear sand are approximately equal in proportion, with smaller amounts of a translucent white particle. Also common to the sherds are numerous well-dispersed inclusions of dull red clay, usually quite small in diameter (0.05 mm) but ranging to 0.2 mm in diameter.

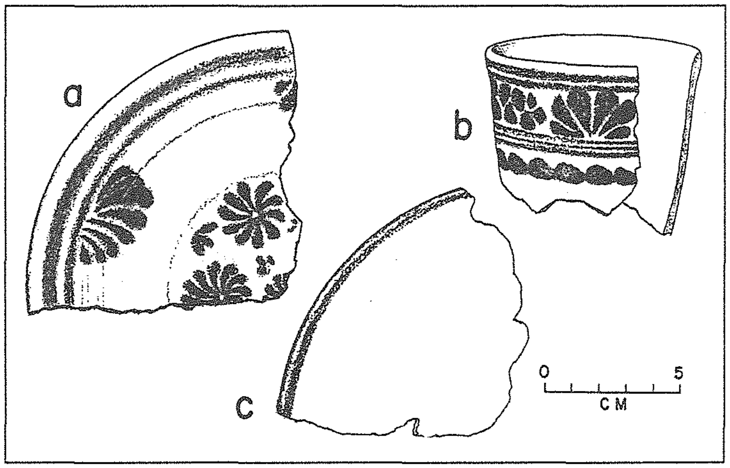

Figure 3. Decorated Majolica: a, Puebla Blue on White plate interior; b, Puebla Blue on White cup; c Huejotzingo Blue on White plate interior. Composite drawings made from large sherds

There is little doubt that the paste is a poorly mixed fraction of the *prieto* or dark clay, which was reportedly mixed with the white clay (or *blanco*) in the Puebla potteries (Van de Velde and Van de Velde 1927:465). On sherds where the enamel has cracked directly over the large red clay particles at the paste-enamel interface, the crazing line and the adjacent surfaces of the enamel are stained orange-brown by oxidation. Under low magnification of the sherds, many other smaller rust-colored stains are visible in the white enamel. The red clay appears to contain a high percentage of iron, from which it receives its color, and it is different in composition and origin from the white clay in the paste. In the raw unaltered state, this was probably ferric oxide, a common impurity of some clays.

Ferric oxide as a fluxing agent lowers the vitrification temperature of a clay. Its incremental addition (or its addition as part of a second type of clay) must be controlled, however, otherwise the vitrification is too rapid and the ware is subject to deformation (Shepard 1965:23). Since the clays were reputedly combined in equal proportions, and neither used alone (Barber 1911:15-16), it is likely that these factors were known and avoided by the Puebla potters.

**Form:** Deep rimmed plates and small cups. The plate diameters averaged 20 cm, and they have rounded lips with the same thickness as the rim, although some sherds are thinned along the interior edge. The flat basal interior of the plates is ca. 12.5 cm in diameter, and it curves upward to form the ledge. The flat surface of the ledge is inclined at a $40^0$ angle. The shallow angle between the surface of the basal interior and the ledge is the *cavetto* or *superior cavetto*, and the ledge terminates at its juncture with the rim. This forms a pronounced carination or arris as the rim flares outward about $10^0$ to the lip. The annular rim is 2.5 cm wide. The 1653 laws for the Potters Trade Guild of Puebla stated that "Ordinary plates for the table should have a fourth of border, in fine ware as well as in the common" (Van de Velde and Van de Velde 1927:462).

Wall thickness of the plates is greatest at the lower margin of the ledge adjacent to the *cavetto* (averaging 7.0 mm), and tapers to 5.0 mm at the arris and along the rim. Plate basal sherds average 5.0 mm in thickness, although the central part of the base is thicker, occasionally reaching 7.5 mm in thickness. The average height of the plates was about 4.25 cm.

The cups have a projected orifice diameter of about 8.0 cm. The walls are nearly vertical and the sherds are relatively thin. Vessel heights ranged from ca. 7.5-8.0 cm.

Both the plates and cups of Puebla Blue on White have a ring foot. On the plates, it averages 5.0 mm in width, 5.0 mm in height, and about 10 cm in diameter on its inside circle. The ring foot on cups averages 4.0 mm in width, 5.0 mm in height, and 3.8 cm in diameter. A shallow groove or *inferior cavetto* encircles the outer edge of the foot ring on both vessel forms, but is most prominent on the plates.

The vessel surfaces are completely covered with white enamel, but the coating was not uniform and pinhole perforations are frequent; these are caused by bubble pits and small impurities on the body surface that repelled the slip or liquid enamel. The slip covering the bisque is thinnest along the lip, the foot, and the arris, and it has been reduced further during the final firing of the piece through the loss of free water and the absorption of the enamel into the surface of the paste. During regular use, the wear on the enamel was greatest at these same points, and the enamel has been lost through attrition and abrasion. On the ring foot, the enamel has been removed by deliberate grinding to minimize projections from enamel drippings, or to permit the finished vessel to sit upright and stable.

A few cup sherds were poorly fired and slipped. They have light throwing marks on the sherd interiors, and the enamel has a rough eggshell-textured surface. The enamel is occasionally absent from the thin lips of these cups.

Where the enamel is thin, it has a light cream or soft pink tint; even where it is thicker and opaque, the enamel has a grayish-white cast. The enamel surface has a hardness of 6, a high gloss, and a tactile smoothness. It contains myriad tiny spherical gas bubbles apparent under magnification. Crazing is common, particularly on the basal interiors of plates.

The use of firing stilts or spurs is evident from the scars displayed on four basal plate sherds; three scars on the exterior surface are rough and the interior surface scar has been lightly smoothed. Multiple firing of pieces, and the use of clay supports to separate then, was usually restricted to the common class of majolica in the Puebla potteries (Van de Velde and Van de Velde 1927:468; Goggin 1968:7).

**Decoration:** It is confined exclusively to the interior of the plates and the exterior of cups, and the designs are painted with blue glaze paint in a motif of flowers, leaves, and complementary bands. The blue paint is softer than the white enamel (5.5 hardness), and ranges in chroma from a brilliant dark cobalt to a thin gray cerulean.

On the plates, two light blue bands always encircle the rim. The outside one, placed about 5.0 mm from the unpainted lip, is usually the broader (6.0 mm) of the two bands, with the second band below it averaging about 3.0 mm in width. Pendant from this narrower band, and spaced equidistant along it, are eight (?) inflorescent elements, each consisting of a group of slender, rounded petals radiating from a center between the two bordering bands. The flowers extend down the rim to slightly below the arris, and are separated from one another by undecorated arcs about as long as they are wide. A central medallion fills the round, flat field of the base, and includes several daisy-like flowers and numerous paired and single dark blue dots and ovals (probably leaves).

A different Puebla Blue on White decoration includes two narrow light blue parallel lines that form a 7 mm diameter circle centrally located on the interior base. The circle encloses a single large blue blossom and several random blue dots, and the circular feature is framed by a close-set series of large blue ovoids.

The lip on cups is also unpainted. Two closely spaced light blue lines (about 3 mm wide) encircle the rim exterior, about 3 mm below the lip, and three other narrow blue horizontal lines gird the cup at mid-height. Usually there is a single light blue band painted around the lower part of the cup, while the upper half of the cup has several large dark blue flowers separated by clusters of dark blue compound leaves. A fairly broad line of overlapping dark blue leaves (?) forms a sinuous band around the lower half of the cups.

Regardless of how light-colored or thin the blue paint is that forms the floral element, the horizontal bands and circles are always lighter and thinner. The differences are probably the result of different methods of application: the bands painted while the ceramic piece was being rotated (dispersing and thinning the paint) and the primary design elements (flowers and leaves) painted individually with a loaded brush. The viscous glaze paint retained a darker hue because of its greater thickness, often standing in low-relief on the enameled surface.

A fragmentary potter's mark in dark opaque brown paint is present on the exterior of two plate base sherds. It may represent the initials of the potter or the pottery, but it is incomplete (see Figure 5d).

**Chronological Position:** Puebla Blue on White majolica has a broad temporal range, as it groups together several blue-on-white styles of Mexican majolica. Goggin (1968:194) states that it was made from ca. 1700-1850, with similar derived forms being made at the present time. The types of plates at 41VT8 also occur in Texas at the 1746-1755 San Xavier missions in Milam County (Gilmore 1969:91-92 and Figure 12f-g, i, p), at the 1762-1771 Mission San Lorenzo de la Santa Cruz in Real County (Tunnell and Newcomb 1969:Figures 45a-c, f and 46b), and by a few sherds from Mission Nuestra Señora del Rosario in Goliad County (1754-ca. 1821).

Among the Puebla Blue on White cups, a large cup sherd from the San Xavier missions closely resembles those from 41VT8 except that the floral design is pendant from the rim bands (Gilmore 1969:Figure 8g). Another decorative variation from the 1731-1793 Mission San Juan Capistrano—but on a bowl—has a painted lip and blue bands painted on the interior (Schuetz 1968:13, 66, 1969:Plate 26d-f).

**Comments:** The closely-related blue on white majolica types need a careful and critical analysis to sort out temporal differences in form and decorative elements. Gerald (1968:44-52) defined the San Elizario Polychrome type from the melange of blue-on-white majolicas, and more such work is warranted.

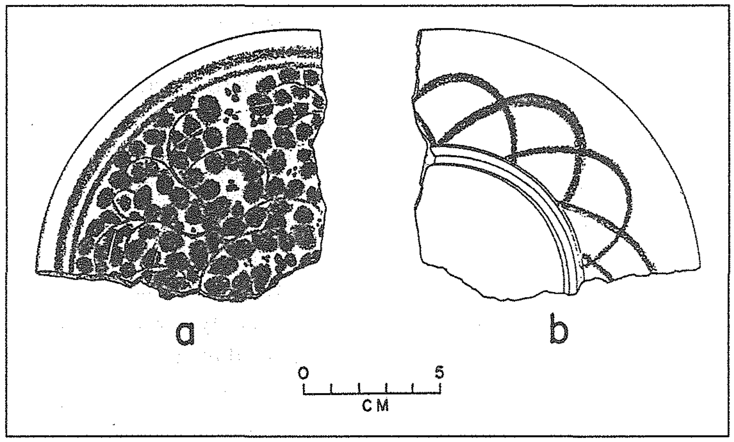


Figure 4. San Agustín Blue on White Majolica Plate Decorations: a, interior; b, exterior. Composite drawings based on large sherds.

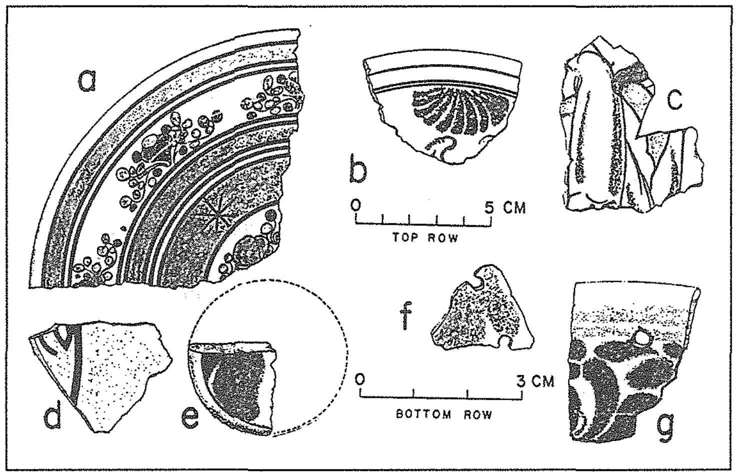


Figure 5. Decorated Majolica and Altered Majolica Sherds: a, Abó Polychrome plate interior; b, Unclassified Polychrome plate rim interior; c, Unclassified Polychrome plate basal interior; d, fragmentary potter's mark on basal exterior surface of Puebla Blue on White plate sherd; e, fragmentary disc ground from blue on white plate sherd; f, perforated blue on white sherd; g, perforated San Agustín Blue on White rim sherd. Specimens a-b are composite drawings based on large sherds.

### San Agustín Blue on White

**Frequency:** 24 sherds (Figures 4a-b and 5g)

**Paste:** Similar to Puebla Blue on White

**Form:** Similar to Puebla Blue on White. Only the deep rimmed plate is present in the 41VT8 sample.

**Decoration:** San Agustín Blue on White is distinguished from Puebla Blue on White by its decoration. The interior of the plates have closely-spaced floral elements (in two distinct shades of blue) painted into the white enamel background (Figure 4a). A series of light blue overlapping loops or arches are present on the plate exterior along the underside of the rim and ledge (Figure 4b).

The plate interiors also have two light blue bands encircling the rim, just below the lip, like Puebla Blue on White. Below the bands are a series of dark blue painted oval compound leaves and daisy or carnation-like flowers. Light blue lines depict viny stems, tendrils, and peticles, and connect with the dark blue elements. Random dots of dark blue fill in otherwise undecorated areas of white enamel

The decoration appears from an examination of large sherds to have been executed while the white enamel was still wet; the custom was usually to allow the enamel to dry. The margins of the design elements are blurred and feathered, diffusing into the white enamel. The San Agustín Blue on White vessels from 41VT8 are distinguished from later majolicas of similar character by their unpainted lips and decorative elements that have only dark blue and light blue painted colors.

**Chronological Position:** Goggin (1968:27, 189) dates this type from about 1700 to 1730. In Texas, decorative variations of San Agustín Blue on White have been reported from the 1718-1793 Mission Valero in Bexar County (Tunnell 1966:7, 13-14 and Figure 2f), the 1762-1771 Mission San Lorenzo in Real County (Tunnell and Newcomb 1969:Figures 45g-h and 46a), and the 1766-1771 Presidio Ahumada in Chambers County (Tunnell and Ambler 1967:30-31 and Figure 4f-g). At the latter site, however, the plate lip is covered by a blue painted band. Similar majolica, with the light blue arches decorating the rim exteriors, is known from sites in Texas that postdate the mid-18th century (Anne A. Fox, 1969 personal communication), but these also have painted lips along with dark brown lines as part of the interior decorative element.

**Comments:** One sherd has a single small (3.5 mm in diameter) perforation through the rim, 1 cm below the lip (Figure 5g). A similar perforated sherd was recovered at Mission San Lorenzo (Tunnell and Newcomb 1969:Figure 47c). Di Peso (1953:222) noted this feature on majolica sherds from Quiburi, Arizona, and suggested that (instead of being a crack lacing hole) a cord may have been passed through the drilled perforation for suspending the vessel.

### Huejotzingo Blue on White

**Frequency:** 37 sherds (Figure 3c)

**Form:** Similar to Puebla Blue on White, except proportionally more sherds have either a buff or pink paste. Sherds with a white paste have a body hardness of 2, while the buff and pink paste sherds are harder (2.5).

**Form:** Plates similar to those of Puebla Blue on White.

**Decoration:** The plate decoration consists of a single blue band along the lip. On approximately 50 percent of the sherds, the lip is completely covered with paint, and on a few, it extends down the underside of the rim a short distance. On the remainder, the paint extends only to the mid-line of the lip. The paint uniformly overlaps the interior rim surface about 5 mm.

The blue ranges from a pale grayish-blue to a dark ultra-marine. The darker color appears to be related to the thickness of the paint.

**Chronological Position:** It appears to be contemporary with Puebla Blue on White, and Goggin (1968:195) dates it to the 18th and 19th centuries. Gerald (1968:43) places its manufacture from 1700 to the present time. In Texas, Huejotzingo Blue on White is present at the first location (1722-1726) of Presidio La Bahía (Tunnell 1966:Figure 7), and at all later Spanish Colonial sites in the state that have large samples of majolica sherds.

**Comments:** Snow (1965:29) uses the term "Huejotzingo Banded" for plates and bowls that are decorated with a narrow band of "blue, green, or yellow just below the rim." This description probably includes the wares from 41VT8, but his conclusion that it dates from 1780-1850 is obviously anachronistic (Snow 1965:Table I).

### Abó Polychrome

**Frequency:** 22 sherds (Figure 5a)

**Paste:** Similar to Puebla Blue on White

**Form:** Deep rimmed plates similar to Puebla Blue on White. Small cups and bowls of Abó Polychrome are known from other sites.

**Decoration:** The design is found only on the interior of the plates, and consists of stylized floral or arboreal elements bordered by alternating black (or very dark brown), orange, and white bands. These floral or arboreal elements are dominated by ovoid leaves and varying sizes of circular and pear-shaped fruits, and are executed in at least five separate palette colors, with various shades of each. The colors in descending order of use are: opaque, ochreous orange; dull, citron yellow; a light pea green to dark jade green; black or dark brown; and dark indigo blue. The floral elements are outlined by narrow black lines, and cursive black lines (representing branches and stems) connect the primary elements. Random dots of thick dark blue paint are scattered casually over the design and/or interior surface. They frequently stand higher than the background enamel, but none are outlined.

The heavily colored decorations are enclosed by a single broad (5-8 mm) band of orange or yellow that encircles the rim (one sherd has two orange bands outlined in black); the band is 3 mm from the lip. The band is itself bordered by a narrow black line along its outer edge, and two closely-spaced parallel lines along its inner margin. The black lines along the rim border, as well as those outlining the floral elements, are usually sharply defined and opaque, but may be thinned, blurred, and mottled, as the manganese flowed into the lighter colors, indicating that the "black" is actually a very dark brown.

**Chronological Position:** Goggin (1968:171-172) dates the type to the last half of the 17th century, ending around 1700. He notes its close relationship with Puebla Polychrome, and that it is commonly found in association with San Luís Polychrome. Snow (1965:26 and Table 1) calls this type "Abó Polychrome I," and includes it among the majolica present on Southwestern sites until 1725.

### Unclassified Blue on White I

**Frequency:** 6 sherds

**Paste:** Similar to Puebla Blue on White.

**Form:** Cups (n=4 sherds) and bowls (n=2). Rim diameters on the cups average 8.0 cm, and bowl diameters average 11.0 cm. The rims are slightly thickened and the lips are rounded.

**Decoration:** Limited to the vessel exteriors, with two exceptions: first, the lip on the sherds is painted, and the paint extends a short distance down the interior rim; and second, one bowl rim sherd has two narrow light blue lines around the vessel interior, adjacent to the lip band. The decoration below the lip band is uncertain, but resembles a bowl found at the 1746-1755 San Xavier missions (Gilmore 1969:Figure 8k).

### Unclassified Blue on White II

**Frequency:** 4 sherds

**Paste:** Similar to Puebla Blue on White.

**Form:** Vessels with nearly vertical and relatively thick (4.5 mm) walls, such as cups or drug jars.

**Decoration:** Exterior floral motifs that are executed in a camaieu style, resembling the interior designs on San Agustín Blue on White plates. The cups and/or drug jars appear to have been decorated while the enamel was still wet, also like San Agustín Blue on White.

**Comments:** These sherds may be from San Agustín Blue on White majolica, but are kept separate because only wide-rimmed plates are included in that type.

### Unclassified Blue on White III

**Frequency:** 1 sherd

**Paste:** Similar to Puebla Blue on White.

**Form:** A small cup with broad and vertical corrugations (see also Gilmore 1969:90 and Figure 8d). It has a wall thickness of 3.0 mm, and a projected oral diameter of 8.0 cm.

**Decoration:** The sherd has only a blue painted lip, with the paint extending 5.0 mm down the interior rim and 2.0 mm on the exterior rim. The 1746-1755 San Xavier specimen also has no decoration other than along the lip. A large section from a cup of the same type has been reported from the first site of Presidio La Bahía on Garcitas Creek (V. C. Branch, 1969 personal communication).

**Chronological Position:** The occurrence of the simply decorated and fluted/corrugated cups at the three sites noted above indicates a use range between ca. 1722-1755.

**Comments:** Gilmore (1969:91) associates this type of majolica with Huejotzingo Blue on White, based primarily on the occurrence of both types at the San Xavier missions.

### Unclassified Polychrome

**Frequency:** 7 sherds (Figure 5b-c)

**Paste:** Similar to Puebla Blue on White.

**Form:** Plates similar to Puebla Blue on White.

**Decoration:** The decoration is limited to the interior surface, and embodies distinctive styles of two other majolica types. The rim design consists of a broad yellow to yellowish-orange band bordered with narrow black lines (one above it and two below) that is identical to Abó Polychrome. Pendant from the band are dark blue floral elements exactly like those on plates of Puebla Blue on White. The decoration below the rim is less certain because of the small number of sherds. It contains yellow, orange, green, and blue elements in a floral or arboreal pattern, closely related to Abó Polychrome. Fine black or dark brown lines frame each of the colors, except for the blue. Narrow black lines also depict branched (or thorny?) stems and tassels.

Where this unclassified polychrome majolica can be readily distinguished from Abó Polychrome is in the decoration of the base. Blue paint is present not as capricious dots and spots, but as curving, lanceolate slashes (see Figure 5c). Also, along the rim, blue is used for the flowers. However, the blue is the only color not framed by black lines, which is characteristic of Abó Polychrome (this attribute is useful in differentiating sherds of Aranama Polychrome, in which the green designs were never outlined with black).

**Comments:** The unclassified polychrome majolica represents an intermediate form of both Abó Polychrome and Puebla Blue on White, more akin to the latter than the former. It was probably produced ca. 1725 or later. One rim sherd of this particular polychrome majolica was found at the 1746-1755 San Xavier missions (Gilmore 1969:92-93 and Figure 12n).

### Miscellaneous Blue on White

**Frequency:** 347 sherds (Figure 5e-f)

**Paste:** Similar to Puebla Blue on White.

**Form:** The majority of the sherds (n=220) are from rimmed plates, and the rest are from cups or small bowls. One basal sherd from a plate has a small triangular firing scar on its interior surface and another scar on the exterior, both of which were smoothed by intentional abrasion or vessel use. A second base from another plate is exceptionally thin (3.5 mm at the base, and 3.0 mm at the *cavetto*), although otherwise it has the same general dimensions as the other plates. One *escudillo* or *albarello* base sherd has a foot ring. There is little enamel visible along the bottom of the foot ring, which is chipped and rough, suggesting that the vessel had no secondary support from the kiln floor or saggar during the final firing.

One sherd from a cup or small jar (3.0 mm thick) bears a noded finial, and the attachment scar from one end of a loop (?) handle. The vertical handle is round in cross-section and 6.0 mm in diameter, and is the only appendage represented among the tin-enameled sherds from the site.

**Decoration:** All sherds have simple, fragmentary blue on white designs. The plate rim sherds have portions of an interior band below the lip, and all sufficiently large rim sherds have two such bands.

The cup sherds have partial designs comparable to the Unclassified Blue on White styles. Three base sherds from small bowls have two closely spaced light blue bands on the exterior, next to the outside angle formed by the juncture of the ring foot with the body. Another base sherd bears part of a blue flower or leaves. Fourteen very small rim sherds from cups and/or small bowls have only painted lips.

**Comments:** There are two modified sherds in this group. One, from along the arris of a plate, has two perforations (10 mm apart and each 2 mm in diameter) that may represent an attempt to mend a cracked vessel by lacing the fracture (see Figure 5f). The other sherd may be about 25 percent of a disc, with a smoothly ground and rounded margin, possibly 3 cm in diameter. The sherd is 6.5 mm thick, and from a plate base. Pottery discs made of majolica and other glazed as well as unglazed sherds have been found at several Spanish Colonial sites in Texas, including Mission Nuestra Señora del Rosario, Presidio San Luís de las Amarillas (Gilmore 1967:21 and Figure 6k), and Mission San Lorenzo (Tunnell and Newcomb 1969:103 and Figure 40a-b). Schuetz (1969:94, 99) equates the ceramic discs with stone ones found at Mission San Juan Capistrano and Mission San Antonio de Valero. Schuetz (1969:74) suggests that they are examples of gaming pieces called *quatros*, used in a game of skill (of the same name) that involved tossing them at a certain mark or small hole, and that the pastime was probably accompanied by betting.

### Miscellaneous Polychrome

**Frequency:** 29 sherds

**Paste:** Generally comparable to Puebla Blue on White.

**Form:** Deep rimmed plates and one thick-walled cup or bowl.

**Decoration:** The plate sherds are decorated only on the interior surface, while the *escudilla* or *albarello* sherds are decorated only on the exterior. The six plate rim sherds have a broad band of ochreous yellow bordered by dark brown lines, and may belong to Abó Polychrome or the Unclassified Polychrome group. Nine other plate sherds are much like these, except that the lip is missing.

Five very small sherds have only yellow paint on one surface. They are included here because this earth color appears only on polychrome wares on the larger sherds from 41VT8.

A dark ochreous yellow paint covers the exterior surface of one hollowware body sherd, and a narrow dark brown line extends across it under the thin yellow paint. The other two cup or bowl sherds are also painted yellow, but the color is bordered by narrow brown lines.

One atypical plate rim has two dark brown parallel lines that circumscribe the superior rim surface just below the lip, rather than a single bordering line at the outer edge of the rim band. The sherd is included here on the same basis as the yellow painted sherds discussed above.

The last sherd in this group is a base with a fragmentary and unidentified subject carefully executed with fine black lines; a small spot of blue paint is near one edge. The design may be part of a furred animal, a conventionalized bird, or a human head. Such zoomorphic and anthropomorphic elements have been noted on Abó Polychrome.

### Miscellaneous Undecorated Majolica

**Frequency:** 166 sherds

**Paste:** Similar to Puebla Blue on White.

**Form:** Plates (n=161 sherds) and cups (n=5 sherds). The cup sherds include three foot rings (about 4 cm in diameter) that lack enamel on their bottom edges. One cup sherd, thicker (4.5 mm) than the others, has a relatively hard (3) cream paste and a hard (7) grayish-white enamel.

**Decoration:** None. Four rim sherds are large enough to be reasonably sure that they are from vessels without painted rim bands. The remaining sherds could have come from vessels with decorations.

**Comments:** Plain white sherds comprise a large percentage of the majolica sample from most 18th century Spanish Colonial sites. However, plain white vessels do not.

## FAIENCE

Faience is the term generally used for the tin-enameled ceramics produced in France. The technology for its manufacture reached France by ca. 1500 in the form of Italian majolica, and the early examples produced there were imitative of the Italian style. By 1550, native French expressions had a strong outlet in the ware, and between 1709 and ca. 1780, faience reached its highest development in France (Lane 1946:16). It was used for tiles, statuary, and ornamental and utilitarian vessels.

The decorative style to about the mid-18th century was inglaze. By 1750, however, most French potteries were producing faience that was an imitation of, and a cheap substitute for, Oriental porcelain. This innovation was characterized, among other traits, by overglaze painting of the decorations. By 1800, the faience industry had sharply declined in the face of competition from the hard-paste, clear glaze ceramics that continue to be made today.

The bulk of the faience produced by French potteries in the 17th and 18th centuries, and certainly the vast proportion of the faience that eventually reached the New World, was the low-fired, inexpensive, simply decorated domestic and utilitarian tablewares. Termed *faience blanche*, "these plain or simply ornamented articles for mass-consumption furnished the economic basis on which some faience makers, by spreading their costs, could afford to produce wares more elaborately decorated" (Lane 1946:9). Throughout its history, the faience industry in France depended on the customs of the poorer bourgeoisie:

> Both the large factories and the obscure little country ones made great quantities of faience with slight ornament in no particular style, from the seventeenth till well into the nineteenth century. So cheap were these simple wares that almost any-

> one could afford them and the style spread. Montaigne, in his travel-journal (1581), after visiting Siena, remarks how well suited these white dishes were for table use in comparison with the filthy pewter found in French inns (Lane 1946:8-9).

In Texas, faience is less useful to the archeologist than majolica because French sites are comparatively few, and the faience reported to date has been from sites that are attributable to Spanish occupations. The presence of faience at Spanish sites in Texas is most often considered indicative of contact (whether direct or through intermediaries) between the Spanish and their French contemporaries at outposts nearest them in colonial Louisiana. Fehrenbach (1968:42) described the situation: "All trade between Spanish colonies and foreigners was strictly forbidden, of course, but on the frontier such regulations were not only ridiculous, they could not be enforced."

The Louisiana French were active traders. Unburdened with the problems of colonization and subjugation, they offered hardware, dry goods, and alcohol in exchange for livestock and furs, for information and alliances, and as bribes to encourage new partners for their lucrative trading ventures. Faience itself cannot have been an important item in this commerce, and while no sufficient reasons have been presented to conclude that most of it reached Texas by way of Louisiana, there is no doubt that the great majority of it did. Therefore, it can serve as an index of inter-cultural contact along a common frontier, and provides clues about the amount of trade and the depth of the trade's penetration into Spanish territory. The more eastern the location of a Spanish military garrison, mission, or civil settlement in Texas, the more likely that French faience will be found there. At Presidio Ahumada in Chambers County, for example, 46 percent of the tin-enameled sherds (n=559) were French faience (Tunnell and Ambler 1967:26-27), while less than 0.7 percent of the 617 tin-enameled sherds were faience at Mission San Lorenzo in Real County (Tunnell and Newcomb 1969:87-97). About 4 percent of the tin-enameled sherds at 41VT8 are faience.

Other than the decoration, the most readily distinguishable characteristic of the faience from 41VT8 is the tendency of the enamel to flake away from the body of the sherd. This exfoliation rarely occurs on the majolica, while on the faience it is not unusual for the sherds to have completely lost the enamel from one or both surfaces. This appears to be the result of the dissimilarity of the enamel and the paste, in that the glaze on well-made and well-fired ceramics (of which porcelain is probably the premier example) must have the same temperature coefficient of expansion as the paste itself (Esbach 1963:74). Neither majolica or faience meet this criterion, but majolica has a coarser and more porous body than faience. The enamel covering the surface of the majolica has penetrated deeper into the paste and thereby has a mechanical advantage over faience, the enamel of which has only a surface fusion.

Temperature changes cause differential expansion between the paste and the enamel in both wares, and set up stresses. Crazing of the enamel is the primary form of stress relief in majolica. In faience, however, with its inferior bond between enamel and paste, crazing of the enamel is secondary to exfoliation. This deficiency in faience was noted nearly 300 years ago on tile facades and decorative vessels destroyed by frost action (Lane 1946:16).

Another difference between the two wares at 41VT8 is the tendency of faience, with a finer paste, to fracture sharp and straight, while majolica breaks with rough and uneven edges. The paste of faience has fewer black and red inclusions, and they are smaller than the "tempering" particles in the majolica. Also, the sand is more widely dispersed in the faience paste, the grains are larger in size, and are commonly a pink color. The tin oxide content of the faience is higher than the majolica, and it has a dull matte finish. The surface, although very smooth, looks dry and feels chalky. Majolica, on the other hand, has a glossy enamel that feels waxen.

### Rouen Faience

**Frequency:** 4 sherds (Figure 6a-b)

The paste of these body sherds is light buff, with a hardness of 2. The sherds (from two different vessels) average 4.5 mm in thickness and come from large bowls. The enamel on both surfaces is a flat white, quite thick, and has a hardness of about 6.5.

The decoration is confined to the vessel exterior and is executed in dark blue paint with narrow blue-black accent lines. Although the complete

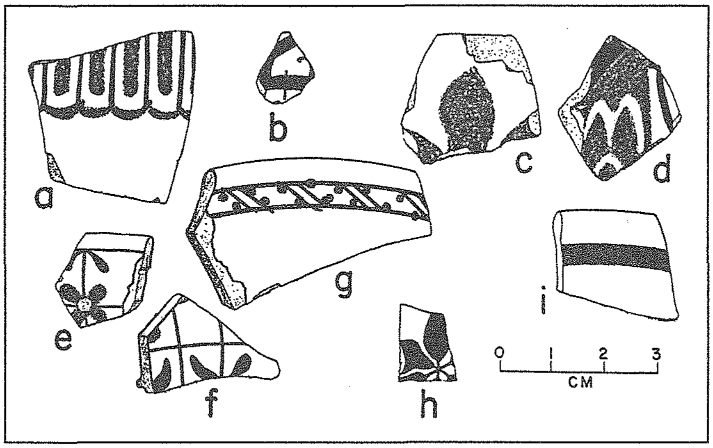


Figure 6. Decorated Faience Sherds: a-b, Rouen; c-d, Unclassified Polychrome I; e-f, Unclassified Polychrome II; g-h, Unclassified Blue on White I; i, Unclassified Blue on White II.

design is not identifiable, elements present include the repetitive use of elongated petal-like elements with black edges, blue tips, and a blue line down the center of each (Figure 6a). This decorative mode, associated with the *style rayonnant*, is diagnostic of the faience produced at Rouen, on the Normandy coast, after 1647 (Lane 1946:20). Lane (1946:Plates 18-22) illustrates several vessel forms with this particular design element, all of which he attributes to the early 18th century. Barber (1907:26) states that the ornamentation, which he calls *broderie*, was suggested by the embroidered hangings or drapery of the period, and illustrates a blue "monochrome" plate and a large polychrome platter, both typical of the "School of Rouen, France" (Barber 1907:Figures 36 and 39).

The remaining small sherd has a fragmentary design that may be part of the numeral "7," the numeral "2," or part of the Roman capital letter "Z." It is in dark blue with two narrow black supplementary lines (Figure 6b).

### Unclassified Polychrome I Faience

**Frequency:** 6 sherds (Figure 6c-d)

The Polychrome I faience body sherds are thick (5.5 mm) and have a fine, soft (a hardness of 2), and light yellow paste. They were found in three widely separated parts of the site, and may represent sherds from six individual vessels, all fairly large examples of hollow ware. Throwing marks are common on exterior surfaces, and both sherd surfaces are covered with a thick white enamel; crazing is light, but exfoliation is extensive. The enamel has a hardness of 6.5, is matte and completely opaque, and has a very light blue-gray tint (especially on the interior).

The decoration is inglaze and found only on the exterior surfaces. It is a conventionalized floral design executed in dark green (leaves), dark blue (petals), and dark red (stems). A similar dark ochreous red paint is mentioned by Lane (1946:24) as typical of the Rouen potteries, along with a few smaller contemporary potteries that imitated this style prior to 1737.

### Unclassified Polychrome II Faience

**Frequency:** 7 sherds (Figure 6e-f)

These faience sherds have a cream-colored paste with a 2.5 hardness, and an average thickness of 3.5 mm. The enamel on both surfaces is hard (6.5), thin, and dirty-white in color.

Six sherds, including one rim and a basal sherd with part of a low, narrow foot ring, may belong to one vessel: a small, shallow plate decorated on the interior surface (see Figure 6e-f). The other sherd is decorated only on the exterior surface, and appears to be from a small cup with nearly vertical walls.

The decoration on both vessels includes a profusion of small flowers painted in pink, yellow, and dark red, and leaves painted in light green. Other indeterminate elements are rendered in thick dark red paint. Narrow lines and isolated dark blue leaves or petals form a set of grids beneath the floral elements. Patterns of cross-hatching combined with polychrome floral accents were common at potteries near Rouen ca. 1720-1740 (see Lane 1946:21 and Plate 25a).

### Unclassified Blue on White I Faience

**Frequency:** 5 sherds (Figure 6g-h)

The sherds are probably *faience blanche*, or *bianchi de* Faenza, intended for common use and produced in great quantity in France between the 16th and 18th centuries (Lane 1946:8-9). They have a fine cream-colored paste with a hardness of 2, a grayish-white enamel with a hardness of 6, and a fragmentary blue decoration painted on one surface. The two largest sherds are from plates with rounded and thickened lips. The decoration on these sherds consists of a 6.0 mm wide interior decorative band with two dark blue parallel lines that enclose a series of blue dots and narrow diagonal lines; the band is 5.0 mm below the lip (see Figure 6g). The design is similar to several of the simply decorated plate sherds of French faience from Presidio Ahumada (Tunnell and Ambler 1967:35-42 and Figure 7). Another sherd, also from a plate, has a fragmentary dark blue flower with six petals painted on the interior surface. Of the last two sherds, one has two dark blue parallel lines curving across its exterior surface, and the other (a very small sherd) has two narrow light blue parallel lines on one surface.

### Unclassified Blue on White II Faience

**Frequency:** 1 sherd (Figure 6i)

This sherd is a rim from a large, thin (4.0 mm) plate. It has a light yellow paste with a fine texture and a hardness of 2. The vessel diameter is ca. 32 cm, and the lip is rounded and slightly thickened. Both surfaces of the sherd are covered with a relatively hard (6.5) white enamel with a bluish tint. The enamel has no crazing or exfoliation.

A single band of blue paint, 5.0 mm wide, borders the interior rim, about 6.0 mm below the lip. The surface of the paint is thinly clouded by an iridescence not unlike the patina that commonly forms on bottle glass sherds.

This blue on white faience probably belongs to a type within the *faience blanche* series of wares (Lane 1946:8-9). Similar faience is reported by Tunnell and Ambler (1967:37 and Figure 7e) from Presidio Ahumada in Southeast Texas. They note other examples in the 18th century French faience from the Fortress of Louisburg in Nova Scotia (Tunnell and Ambler 1967:33, 37-38).

### Miscellaneous Undecorated Faience

**Frequency:** 14 sherds (see Figure 1b).

These sherds have fine pastes and clean, sharp, fractures. The pastes range from cream-colored to yellow and buff, and have an average hardness of 2.5. Both surfaces of the sherds are coated with a white enamel that has exfoliated to such an extent that only traces of it can be observed under magnification. The enamel is milk white to grayish-white in color, and one sherd has a pinkish tint; it is much harder (6.0).

The undecorated faience sherds range from 2.5-8.5 mm in thickness. One large plate sherd has a slightly concave exterior that is 6.5 cm in diameter and 5.5 mm in thickness (see Figure 1b). One large fluted sherd may be a "pouring lip" from a large pitcher.

## SUMMARY

The best available dates on the majolica and faience from 41VT8 (Figure 7), and the overlap in date ranges, all strongly support the premise that the site was the intermediate location of Presidio Loreto de la Bahía (Figure 8). The presidio was relocated from its first site (41VT4) on Garcitas Creek at the head of Lavaca Bay to the Guadalupe River in 1726. It remained on the Guadalupe until 1749, when it was moved a final time to a location on the San Antonio River (41GD7) near present-day Goliad (Oberste 1949:3-5). Since 41VT8 is a single component Spanish Colonial occupation, these ceramics help expand the inventory of majolica types, and perhaps some of the faience,

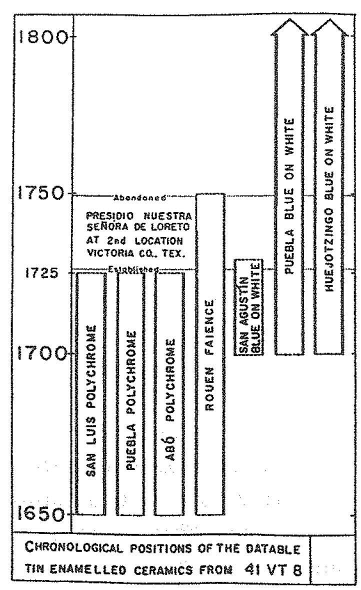


Figure 7. Chronological Positions of the Datable Tin-Enameled Ceramics from 41VT8.

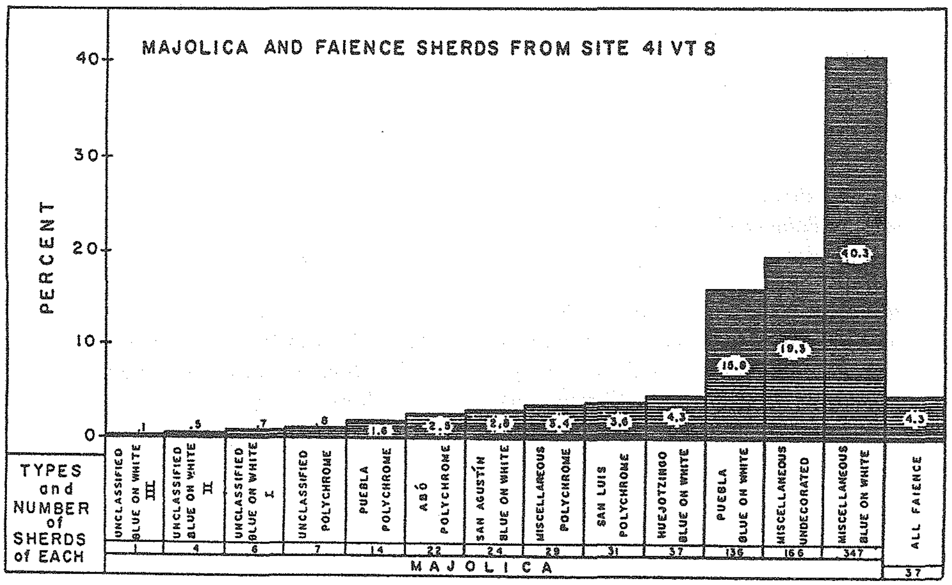


Figure 8. Frequency of Majolica and Faience Types at 41VT8.

supplied to the presidios in this area (and probably the missions as well) during the second quarter of the 18th century.

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# Lead-Glazed Ceramics from Four Texas Missions

*Shawn B. Carlson and Ariel Malicse*

## ABSTRACT

Petrographic analyses were conducted on lead-glazed earthenwares from four 18th century Texas mission sites. The primary goal was to identify manufacturing locales and, especially, to distinguish between Texas-made wares and Mexican-made wares. The results showed, partly through comparisons with wares of known origin, that the Texas missions were reliant upon locally-made Indian wares and Mexican-made wares.

## INTRODUCTION

Most lead-glazed earthenwares found on colonial sites throughout the Spanish borderlands are poorly known despite the fact that they occur in great abundance (Deagan 1987:47-53). One explanation for this is the difficulty in disseminating information about ceramics that have relatively few distinguishing characteristics. Comparison of these wares from site to site is nearly impossible if the ceramics are not physically examined. Even then, difficulties arise. To overcome these problems in identification, different techniques are available that provide quantitative data that are easily compared. One of these techniques is petrographic analysis.

A grant from the Texas Archeological Society Donors Fund was used to conduct a petrographic analysis of ceramics from four 18th century Texas mission sites. The four sites were Missions Dolores de los Ais (41SA25), San Lorenzo de la Santa Cruz (41RE1), San Juan Capistrano (41BX5), and Rosario (41GD2). The purpose of the study was to identify the matrix and temper of the paste used in the manufacture of lead-glazed wares found at these sites. The underlying assumption was that the ceramics should reflect the local geology of their place of manufacture. If this assumption is true, then it should be possible to distinguish which ceramics were made on-site and which were not. Typically, a sample of clay from each site is necessary to verify that the ceramics were made on-site. However, in this study that was not possible to do. Rather, the goal was to identify relative manufacturing locales, especially those of Texas-made wares versus Mexican-made wares.

## METHODS

### Instrumental Neutron Activation Analysis

The selection of samples was based on a previous study of the lead-glazed wares from the same ceramic collections (Carlson 1994:140-149; Carlson and James 1995). That study was an Instrumental Neutron Activation Analysis (INAA). In the INAA study, the ceramic samples were ground into a powder, thus combining the matrix and temper. In the petrographic analysis, they were thin-sectioned and mounted on a slide so that both the matrix and temper could be observed.

In the initial INAA study, 100 sherds were ground and then sent to the nuclear reactor at Texas A&M University, where the samples were bombarded with neutrons. This caused the various elements in the clays to be transformed into unstable radioactive isotopes that emit gamma rays. The gamma rays were then measured to determine the quantities of each element present in the sample. This method provides a signature for the various pastes used in the manufacture of the ceramics, and the signatures can be compared with each other to determine a place of manufacture. Without a sample

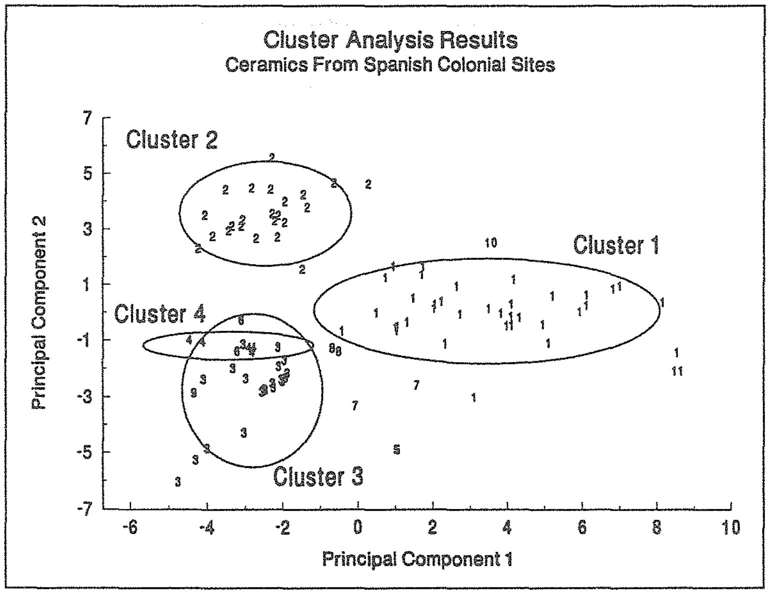


Figure 1. Clusters Identified from Instrumental Neutron Activation Analysis.

occur on red sandy paste wares and are believed to have been made in Texas, while the majority occur on red or gray fine-textured paste wares that probably originated in Mexico. The red-slipped wares in this cluster, and the yellow and green lead-glazed wares, are all believed to have been made in Texas.

The origins of these particular wares have greater significance when compared with the various ceramic assemblages as a whole. Figure 2 shows the breakdown of Indian wares, Mexican wares, European wares, and Chinese wares recovered from the four mission sites. For instance, at Mission Dolores, which is located halfway between two major colonial settlements (Nacogdoches, Texas and Natchitoches, Louisiana), 96 percent of the ceramic assemblage is local Indian ware. At Mission San Lorenzo on the other side of the state, the figures are almost reversed. Indian wares make up less than 1 percent of that ceramic assemblage and are imported rather than local.

At Mission San Juan Capistrano in San Antonio, a third pattern is noted. Local Indian wares make up 42 percent of the ceramic assemblage as compared with 46 percent Mexican lead-glazed wares and 11 percent Mexican majolica.

of the local clays, only a relative place of manufacture can be determined from the ground pastes.

The results of the INAA were encouraging. Four clusters were identified in the analysis, two that included Texas-made wares and two that included Mexican-made wares (Figure 1).

The first cluster was characterized by a decorated lead-glazed Mexican ware called "Galera Polychrome." All of the sherds came from Missions Rosario or San Juan Capistrano except one that was a modern vessel purchased in San Antonio. The second cluster was a distinctly different group of red-slipped Mexican earthenwares and, again, came from Missions Rosario and San Juan Capistrano. The third cluster was especially interesting because it included Indian wares from each of the four missions plus undecorated green and yellow lead-glazed wares, suggesting that these lead-glazed wares may have been made by the local Indians. The fourth cluster included three sherds of olive-green lead-glazed ware from Missions San Lorenzo and Dolores and two sherds of red-slipped Mexican wares. The significance of this cluster is that the red slip occurs on different bodies; that is, some slips

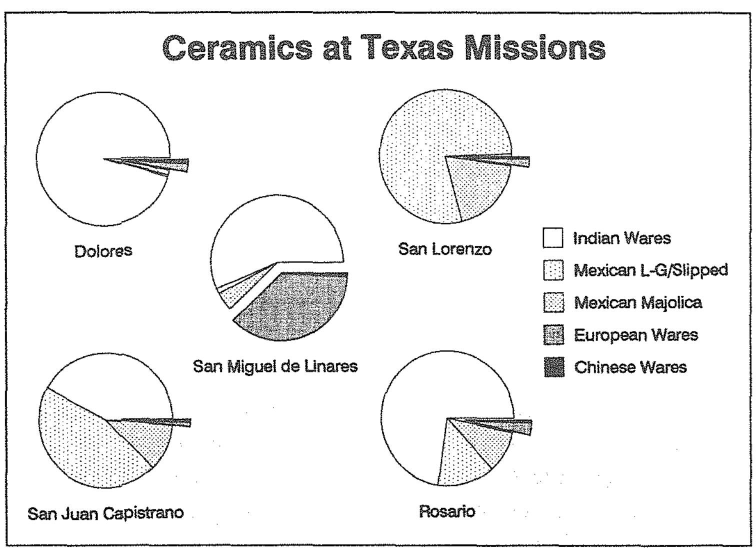


Figure 2. Distribution of Various Wares at Texas Missions.

Lastly, at Mission Rosario, another pattern is found. Here, Indian wares comprise 73 percent of the assemblage, Mexican lead-glazed wares 14 percent, and Mexican majolica 10 percent.

These figures are considerably different for missions that overlap in time and space. However, the consistently low number of European and Chinese wares show that there was a greater reliance by these mission inhabitants on locally-made and Mexican-made products.

### Petrographic Analysis

The petrographic analysis was designed to complement the INAA study by providing information about both the temper and matrix of the sherds from the four missions (Figure 3). Nineteen sherds were selected for the thin-sectioning, with an emphasis placed on testing samples of as many different lead-glazed wares as possible (Carlson 1994:149-155; Malicse 1994:248-269). The Chayes Method (1956) was used for point counting of grain inclusions in the thin sections.

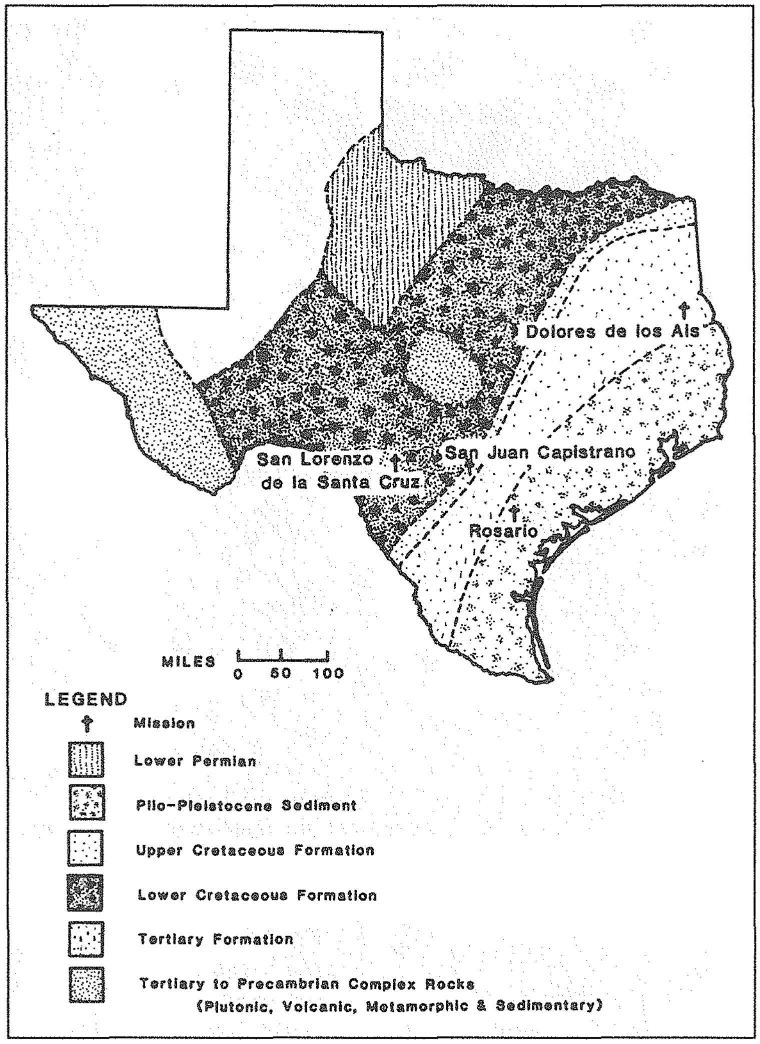


Figure 3. Geology of the Missions.

The major assumption for this study was that the earth materials used in the manufacture of the ceramics should reflect the local geology and soils of the manufacturing sites. For example, a sample manufactured at Mission Rosario near the Gulf Coast should reflect the Tertiary sediments found in that region. However, if the ceramic was manufactured near the Sierra Madre region of Mexico and later transported to Mission Rosario, its composition would not be compatible with the local Gulf Coast geology. A second assumption was that the two basic pastes observed—one a sandy red paste and the other a fine-textured paste with volcanic ash present—reflected Texas versus Mexican wares (Fox 1974:56-57).

The four mission sites are in regions that are generally underlain by Tertiary and Cretaceous sedimentary formations (see Figure 3). Mission Rosario is underlain by sediments that were products of multiple reworking of an original crystalline source such as plutonic and metamorphic rocks. Because of this reworking, several labile, or unstable, grains—especially volcanic and plutonic rock fragments and some ferromagnesian silicates—were lost. Thus, sediments were produced with relatively high percentages of quartz and feldspars, a lack of labile grains, and sub-rounded to rounded shapes. Of the four specimens examined, only one, a local Indian ware, reflects this type of sediment, suggesting that the other ceramics at Rosario were manufactured somewhere else. White quartz fragments and dark brown fragments of burned bone are clearly visible (Figure 4a). The three other samples from Mission Rosario included red-slipped Mexican wares, Guadalajara Polychrome, and an olive lead-glazed ware. In the INAA study, the red-slipped Mexican wares and olive lead-glazed wares

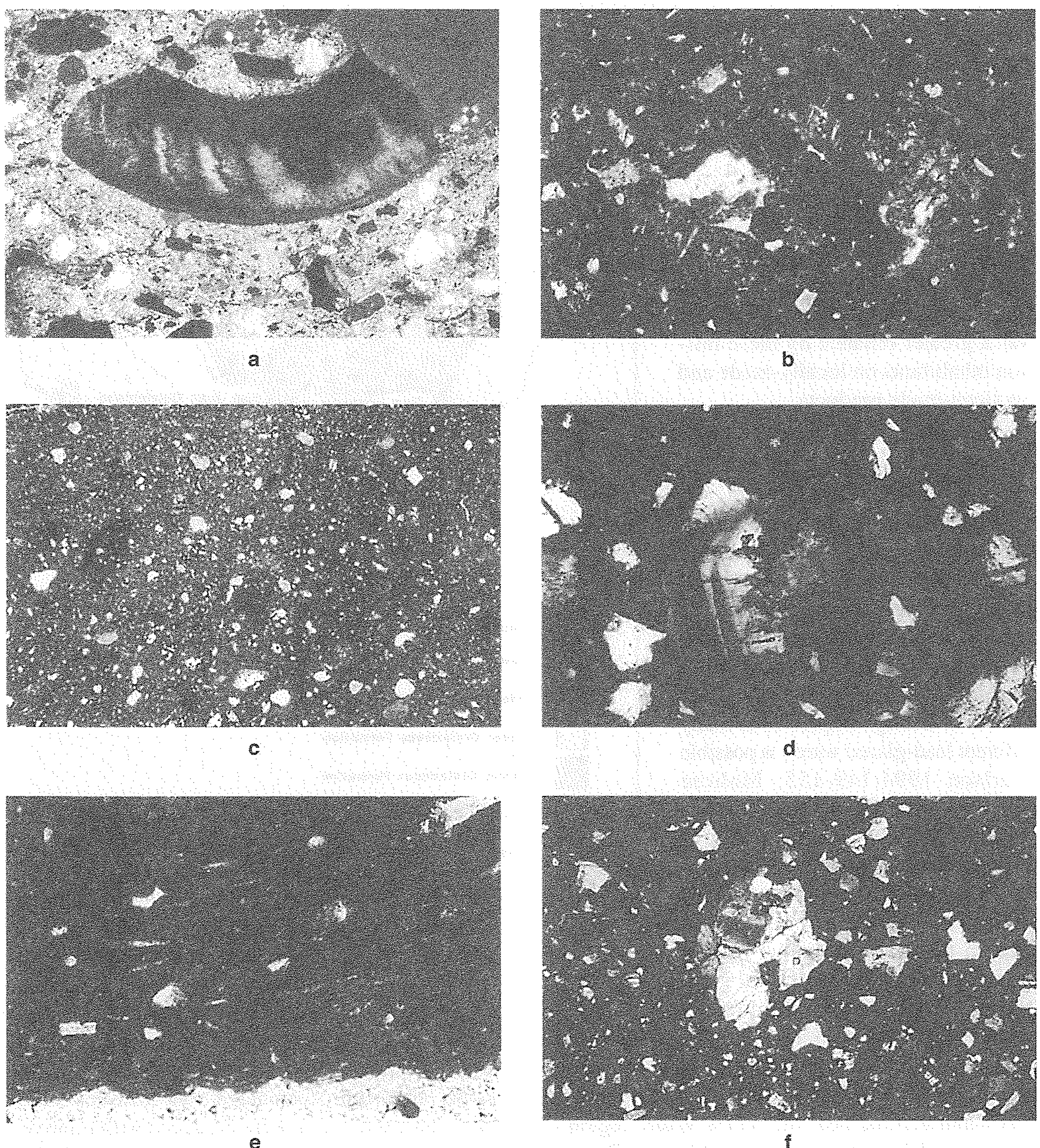

Figure 4. Ceramic Thin Sections: a, burned bone fragments clearly visible along with white quartz fragments; b, volcanic and metamorphic rock fragments; c, white orthoclase, gold biotite, and reddish-brown hematite; d, zoned plagioclase; e, plagioclase laths; f, plutonic rock fragments and zoned plagioclase.

clustered separately although both were characterized by a fine-textured body containing volcanic ash typical of the known Mexican-made wares.

Mission Dolores is underlain largely by fine-grained lithic arkose to feldspathic litharenite. This means that sediments found in this region would be rich in feldspars, quartz, and rock fragments—especially volcanic and metamorphic rock fragments (Loucks et al. 1984) (see Figure 4b). Among the four mission sites, this is the only logical site to expect volcanic rock fragments similar to those found in Mexico. However, the plagioclase laths, volcanic rock fragments, and minerals found in three specimens examined from the site have well-defined crystal shapes or have larger fragments than the texture of the formations found in this area. Therefore, these three specimens were probably manufactured outside this region. One of these wares was identified by another researcher as Tlaxcalan Redware. White orthoclase fragments, gold biotite, and dark reddish-brown hematite are apparent in this redware specimen (see Figure 4c).

Mission San Juan Capistrano is underlain by Tertiary siliciclastics, Quaternary fluviatile terraces, and Cretaceous limestone-rich formations. Ceramics manufactured using local sediments at this site will largely contain limestone, quartz, feldspars, and chert. The Tertiary sediments (e.g., the Wilcox Formation) are quartz and orthoclase-rich and fine-grained at this location. Therefore, the presence of large volcanic fragments, plagioclase laths, large spherulites, and euhedral minerals in the ceramics are clear indications that they were imported. Using these criteria, it would appear that only two of the five specimens examined could possibly be manufactured at San Juan Capistrano.

Green lead-glazed earthenware and yellow lead-glazed earthenware—both with red sandy pastes that clustered together in the INAA study—were examined from Mission San Juan Capistrano. The local Indian ware did not match the local geology, suggesting that the clays were transported from elsewhere. This may be attributed to the sharp change in geological deposits along the Edwards Plateau, suggesting that clays could have been transported a short distance and still have been manufactured locally. The remaining two samples were Galera Polychrome—a known Mexican-made ware—and a reddish-brown lead-glazed ware.

Mission San Lorenzo de la Santa Cruz is largely underlain by Cretaceous limestone/dolomite-rich formations. Ceramics manufactured using materials from this site should reflect high limestone or dolomite fragments. The components of the ceramics found at Mission San Lorenzo were mainly comprised of quartz, feldspars, plutonic and rock fragments, biotite, and altered grains. A zoned plagioclase, a clear indication of volcanic origin, is present in a green lead-glazed earthenware (see Figure 4d). These components indicate a non-carbonate source and, therefore, evidence that most of the ceramics found at the site were imported. The seven samples examined included red-slipped Mexican wares, brown lead-glazed wares, olive lead-glazed wares, a yellow lead-glazed ware, and an imported Indian ware.

In summary, 16 of the 19 petrographic samples from the four mission sites are believed to have been imported (Table 1). The only locally made wares included the Indian ware present at Mission Rosario and the yellow and green lead-glazed wares at Mission San Juan Capistrano. In addition to the basic assumption that the ceramics would reflect the local geology, it was also assumed that the two basic pastes observed—the sandy paste and the fine-textured paste with volcanic ash—reflected Texas versus Mexican wares. This appears to hold true except at Mission San Lorenzo, where none of the wares, including the sandy paste wares, reflect the local geology.

In addition to the generalizations just stated, detritals suspected to have come from Mexico or other regions with complex geology were present in the samples and showed the following characteristics. Specimen 2 (red-slipped Mexican ware) had plagioclase laths in the matrix that appeared as narrow needle-like objects (see Figure 4e). Also, this specimen had volcanic rock fragments. In Specimen 11 (olive lead-glazed earthenware), plutonic rock fragments and zoned plagioclase appeared in the paste (see Figure 4d, f). In Specimen 7 ("Tlaxcalan redware"), there is an apparent association of yellow biotite with samples from volcanic terrain (see Figure 4c). Lastly, spherulites were present in Specimen 5 (Galera Polychrome).

These conclusions are true only if the original assumptions are correct. If, however, the materials used in the ceramics were taken from somewhere else in Texas (e.g., near the Llano uplift or in West Texas where the geology is also complex), then there is no way of identifying where the ceramics came from. Only sampling of the local materials would verify the manufacturing locales.

## RESULTS

The most significant result of the data analysis was the consistently high frequency of Mexican wares present at each site. The extreme difficulty in acquiring imported European and Chinese wares along with the declining economy of Spain may explain the presence or absence of various ceramics at the missions. The Chinese porcelains, occurring

**Table 1. Summary of Petrographic Data**

| Texas Mission Sites | Geology at Site | Ceramic Types | Distinguishing Features of Ceramics |
|---|---|---|---|
| Mission Rosario (41GD2) | Sub-rounded to rounded grains; sediments are high in quartz and feldspar; few rock fragments | (1 Mexican Red-Slipped Earthenware | (1) High content of volcanic fragments, zoned plagioclase |
| | | (2) Tonala Polychrome fragments | (2) Matrix-rich (dark reddish-brown |
| | | (3) Plain Indian Ware | (3) High content of bone and wood fragments with detrital quartz and feldspar |
| | | (4) Guadalajara Polychrome | (4) Matrix-rich, volcanic ash matrix |
| Mission Dolores (41SA25) | Sub-angular to sub-rounded grains; fine-grained lithic arkose to feldspathic litharenite | (1) "Tlaxcalan" Redware | (1) Matrix-rich in feldspar laths and biotite |
| | | (2) Rey Ware | (2) Matrix-rich; few quartz and feldspar |
| | | (3) "Guanajuato" Ware | (3) Matrix-rich; few volcanics, quartz, and plagioclase |
| Mission San Juan Capistrano (41BX5) | Cretaceous limestone-rich formations; limestone, feldspar, and chert | (1) Galera Polychrome | (1) Matrix-rich; common biotite; trace amount of spherulites |
| | | (2) Yellow Lead-Glazed Earthenware | (2) Detrital-rich; quartz. plagioclase, and orthoclase |
| | | (3) Plain Indian Ware | (3) Detrital-rich; bone/wood fragments, sedimentary fragments |
| | | (4) Green Lead-Glazed Earthenware | (4) Detrital-rich; quartz (mono-crystalline and polycrystalline), chert |
| | | (5) Cinnamon brown-slipped earthenware | (5) Matrix-rich; few biotite; altered Fe-Mg |
| Mission San Lorenzo (41RE1) | Cretaceous limestone/ dolomite | (1) Mexican Red-Slipped Earthenware | (1) Detrital-rich; quartz, plagioclase, and minor amounts of sediment-ary rock fragments |
| | | (2) Brown Lead-Glazed Earthenware | (2) Undifferentiated clay-rich matrix with feldspar laths in the matrix |
| | | (3) Green Lead-Glazed Earthenware | (3) Detrital-rich; zoned plagioclase, large plutonic fragments |
| | | (4) Yellow Lead-Glazed Earthenware | (4) Detrital-rich; quartz; plagioclase, orthoclase, polycrystalline quartz |
| | | (5) Light Brown Lead-Glazed Earthenware | (5) Matrix-rich; trace of feldspar laths |

in frequencies of less than 1 percent, were probably the most difficult to obtain. Arriving only once a year on the Manila galleon from the Philippines, these wares had to be transported overland more than 1,000 miles (Schurz 1939:15; Mudge 1986:39). Starting at the port at Acapulco, the pack trains traveled to Mexico City and then northward through central Mexico to Saltillo and San Antonio. The condition of the roads prohibited transport by wagon so pack mules were used instead. The road from Acapulco to Mexico City, known as the "China" or "Asiatic" road and the road from Vera Cruz to Mexico City, known as the "European" road, were described in detail by Alexander Von Humboldt, who visited New Spain in 1803. The road from Vera Cruz he described as "nothing but a narrow and crooked path, and the most difficult, perhaps in all America" (Humboldt 1966, Vol. 4:3). In contrast, the road from Acapulco ascended gradually toward Mexico City, was wide, and in generally good condition. Even as late as 1803, Humboldt described the roads as impassable by wagons. A more typical description of roads during the 18th century is that of the road from Natchitoches to Los Adaes. A 1767 document calls it "a little-marked path over uneven terrain, obscured by the woods" (Steele 1985:3).

The European wares, such as stonewares and refined earthenwares that were present at the missions in quantities of 1-3 percent, would have arrived in New Spain through the Vera Cruz port. The fact that intercolonial trade during the 18th century had been strictly limited to prevent competition with Spain's home industries may partially explain their absence (Schurz 1939:398-410; Deagan 1987:19-24). New World exports were limited to the port of Cadiz, and Spanish foodstuffs and manufactured imports were received only through the port of Vera Cruz. So, during the 18th century any European imports—not made in Spain—were already highly desirable and prohibitive in cost before the overland journey through central Mexico and Texas even began. By the turn of the 19th century, however, these wares were much more available. Humboldt claims that in 1803 there were nearly 150 ships arriving yearly from Spain at the port of Vera Cruz whereas 50 years earlier there was only one a year (Humboldt 1966, Vol. 4:33-50). European wares were so popular by 1803 that their quantities were three times that of Mexican pottery despite a 70 percent greater cost. Of the 46 pottery manufacturers existing in Mexico in 1793, only 16 were remaining by 1803 (Humboldt 1966, Vol. 3:469).

The large quantity of locally-made Indian wares and Mexican-made wares at the Texas missions suggests that there was a greater reliance upon these wares than on European or Chinese wares during the 18th century. Furthermore, the complete absence of Spanish-made wares, with the exception of olive jars, suggests that support from Spain was minimal. Access to any manufactured wares was difficult, if not impossible. The condition of roads throughout New Spain during the 18th century, the distance between settlements, and the continued threats by hostile Indians all contributed to higher costs, making it nearly as difficult to obtain products of New Spain as those of Europe or the Orient. Consequently, locally-made Indian wares or inexpensive Mexican wares were both the easiest and the least expensive to obtain. By distinguishing between Texas-made wares and Mexican-made wares in this study, it was possible to show the degree to which the isolated missions relied upon imported wares from Mexico rather than those from Europe or the Orient.

## ACKNOWLEDGMENTS

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# The Lithic Artifacts of the Native Americans at the Spanish Colonial Missions at Guerrero, Coahuila, Mexico

*Betty J. Inman*

ABSTRACT

This article presents the results of a lithic analysis to examine the retention of traditional lifeways and aspects of acculturation at two mission sites in Mexico. Beginning in January 1700, three missions (San Juan Bautista, San Bernardo, and San Francisco de Solano) were established near the Rio Grande, opening the gateway to Spanish Texas. In 1717, the missionary line was extended northward to the San Antonio River and San Francisco de Solano was re-located there, becoming Mission Valero and beginning the mission system in southern Texas.

Stone tool manufacture and use continued in the mission setting, suggesting that traditional lifeways were not wholly abandoned. Further evidence of traditional lifeways is provided by the abundance and variety of wild game faunal materials, bone marrow extraction seen in some faunal materials, and continued plant food processing. The adoption and use of one arrow point style, the Guerrero, at San Juan Bautista and San Bernardo, and its spread throughout the missions of southern Texas, attests to the movement of Native peoples between missions and the widespread trade network documented in historical records. Use-wear analysis of stone tools from the sites indicates the processing of animal products (hide/meat), wood, and plant materials.

## INTRODUCTION

Beginning in January 1700, the Native peoples entering the missions at Guerrero continued their ancient tradition of stone tool manufacture. This article presents an analysis of the lithic artifacts from excavations at missions San Juan Bautista and San Bernardo to examine the retention of traditional lifeways and cultural change through time as it is expressed in the archeological record (see also Inman 1997).

Under the direction of R. E. W. Adams, the University of Texas at San Antonio, excavations were conducted in 1975-1976 at the two missions (Adams 1977). This research, named the "Gateway Project," focused on archeological, ethnohistorical, and historical aspects of the Rio Grande missions. Contributors to the project included Thomas R. Hester, T. N. Campbell, Felix D. Almaraz, Jr., Parker Nunley, Anne A. Fox, Fred Valdez Jr., and Billy Davidson.

After completion of the excavations in 1976, it was not possible to export the artifacts to the United States. Therefore, a complete lithic analysis was not conducted. In 1996, however, an agreement between Mexican government officials and Dr. Thomas R. Hester, Director of the Texas Archeological Research Laboratory (TARL), allowed for the transport of artifacts for analysis. The research was funded, in part, by a Tinker Field Research Grant to the author from the Institute of Latin American Studies at The University of Texas at Austin (Inman 1997).

## CULTURAL, ARCHEOLOGICAL, AND HISTORICAL BACKGROUND

In the late 17th century, the Spanish, arriving in the area of the Rio Grande where today lies the small village of Guerrero, Coahuila (Figure 1), entered a region that had been occupied by small,

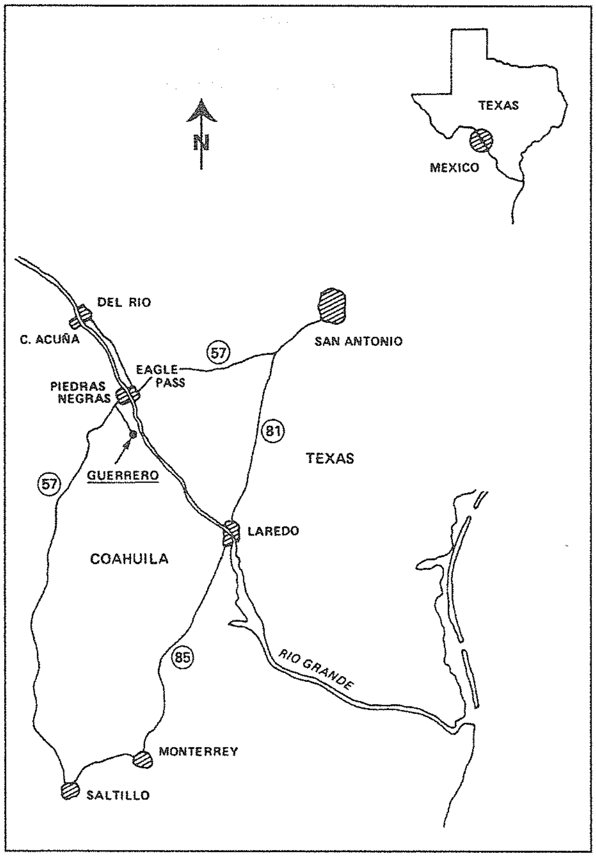


Figure 1. Map of Northeastern Mexico and Southern Texas (after Eaton 1981).

mobile groups of hunters and gatherers for at least 11,000 years (Hester 1995). This region of northeastern Mexico is watered by the Rio Grande, and in the past, freshwater springs were located nearby, creating an oasis in the generally arid north Coahuilan desert. The springs carried a high charge of travertine in solution and these deposits formed a natural dam in the remote past, creating a large lake and a smaller lake behind it. While the springs are still present, the large lake no longer exists due to the dynamiting of the dam in the early 20th century. Several fords of the river were also nearby and these, undoubtedly known about and used by Native peoples in ancient times (Adams 1977), were an important factor drawing the Spanish to the area. Early research labeled the Native groups of northeastern Mexico (and adjacent southern Texas) as "Coahuiltecans" because it was believed they all spoke a similar language. Later work has defined the linguistic and cultural diversity of the Native peoples. At least six different languages were found among the "Coahuiltecans" who came to the Rio Grande missions (Weddle 1968; Goddard 1979; Campbell 1988). Seven major linguistic groups—Coahuilteco, Karankawa, Comecrudo, Cotoname, Solano, Tonkawa, and Aranama—were identified by Campbell (1992) and Goddard (1979).

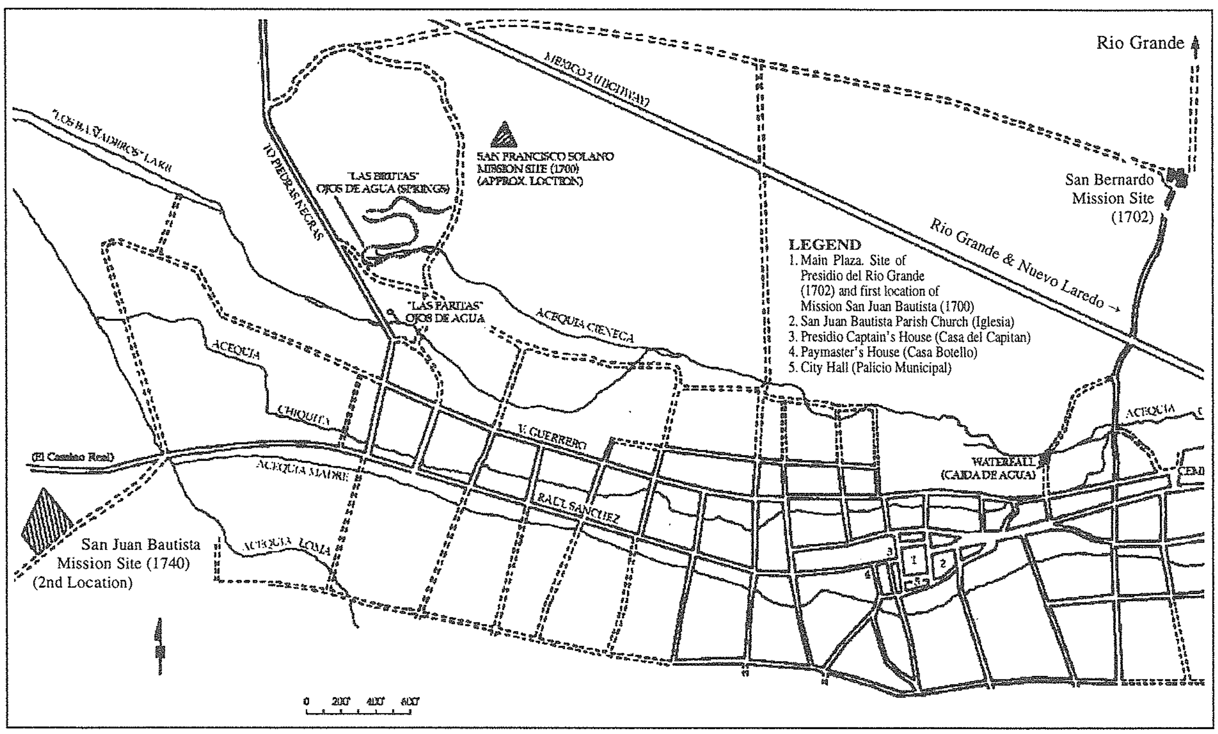


Figure 2. Map of Villa de Guerrero, Coahuila, showing locations of missions (after Eaton 1981).

In more recent work, Johnson and Campbell (1992) named "Sanan" as another of the aboriginal languages spoken in the region.

## SPANISH COLONIZATION

Spanish expansion of the northern frontier toward the Rio Grande proceeded for a variety of reasons: (a) interest in finding new sources of mineral wealth; (b) the desire to convert the Native peoples to Christianity; and (c) French intrusion to the east. It is likely that curiosity and adventure also played a part (Weddle 1968).

Between 1700 and 1703, Franciscan friars of the Apostolic College of Santa Cruz de Queretaro founded three missions—San Juan Bautista (January 1700), San Francisco Solano (March 1700), and San Bernardo (1702)—within close proximity to each other on the west bank of the Rio Grande (Figure 2). These three missions were situated in a triangular pattern around the important springs and lakes (Eaton 1981). Initially, a mobile cavalry unit was assigned to protect the missions, and later a permanent garrison, the Presidio San Juan Bautista, was erected. In 1717, the friars proposed to extend the missionary line northward to the San Antonio River. Mission San Francisco de Solano was closed and its personnel was re-assigned to a new mission at San Antonio (later to be named Valero). The remaining missions, San Juan Bautista and San Bernardo, began to achieve material and spiritual success by 1750 and were able to send supplies north to the new missions in Texas (Almaraz 1979). The two missions at Guerrero continued until they were secularized in 1794 (Eaton 1981).

## MISSION SAN JUAN BAUTISTA

Mission San Juan Bautista was established in 1699 on the Rio Sabinas. It was unsuccessful there and was moved farther north and situated near the Rio Grande on January 1, 1700. The location selected for its re-establishment was in the Valle de Circumcision, about 7 km from the Rio Grande where there were three important river crossings. Here the soil of the drainage plain was very fertile and could be irrigated with water from upland springs (Almaraz 1979). More than 500 natives were gathered at the mission settlement which opened the "gateway to Spanish Texas" (cf. Weddle 1968). This second location is presumed to be in the main plaza area of the present-day village of Guerrero where the church now stands (Eaton 1981). In 1740, Mission San Juan Bautista was moved for a third time to a hillside west of the presidio and a short distance from the Spanish settlement. At this final location it developed into a large and impressive complex (Weddle 1968). The mission was secularized in 1794 and abandoned sometime after 1810 (Eaton 1981).

Archeological investigations were begun at Mission San Juan Bautista during the summer of 1976 (Adams 1977). Testing at the mission's third and final location revealed structural remains and cultural materials (Figure 3). Due to destruction and stone robbing, the only visible remains at the site were low ridges and larger mounds. In 1976, the most prominent area of the site was excavated and architectural features of the church were found in the work. A large amount of fallen masonry and accumulated dirt was removed in order to locate the floor and wall remains.

A human burial was discovered in the main altar of the church, extending into the east part of the main altar. There were no grave goods and it was determined that the burial had been placed there after the church was abandoned.

The monastery quadrangle was located adjacent to the south side of the church. Within the enclosure, and near the south wall, was the circular opening of a well or cistern that had been artificially cut through the limestone bedrock.

A few meters south of the monastery quadrangle, the remains of a large structure, probably the granary, were uncovered. On the south side of the probable granary, excavations identified the remains of walls and packed dirt floors (possibly the textile mill, blacksmith shop, carpenter shop, and other workshops). The Native housing area was located just south of the group of industrial structures and extended farther to the west. The total length of the rectangular structure that was uncovered measured 108 m with a width of 5.4 m.

This long building was probably divided into numerous small apartments. The archeological data corresponds with Weddle's (1968) note that housing units for Native families sometimes contained as many as 20 small apartments. Midden deposits, from both sides of the eastern half of the structure, produced abundant cultural materials, while a very

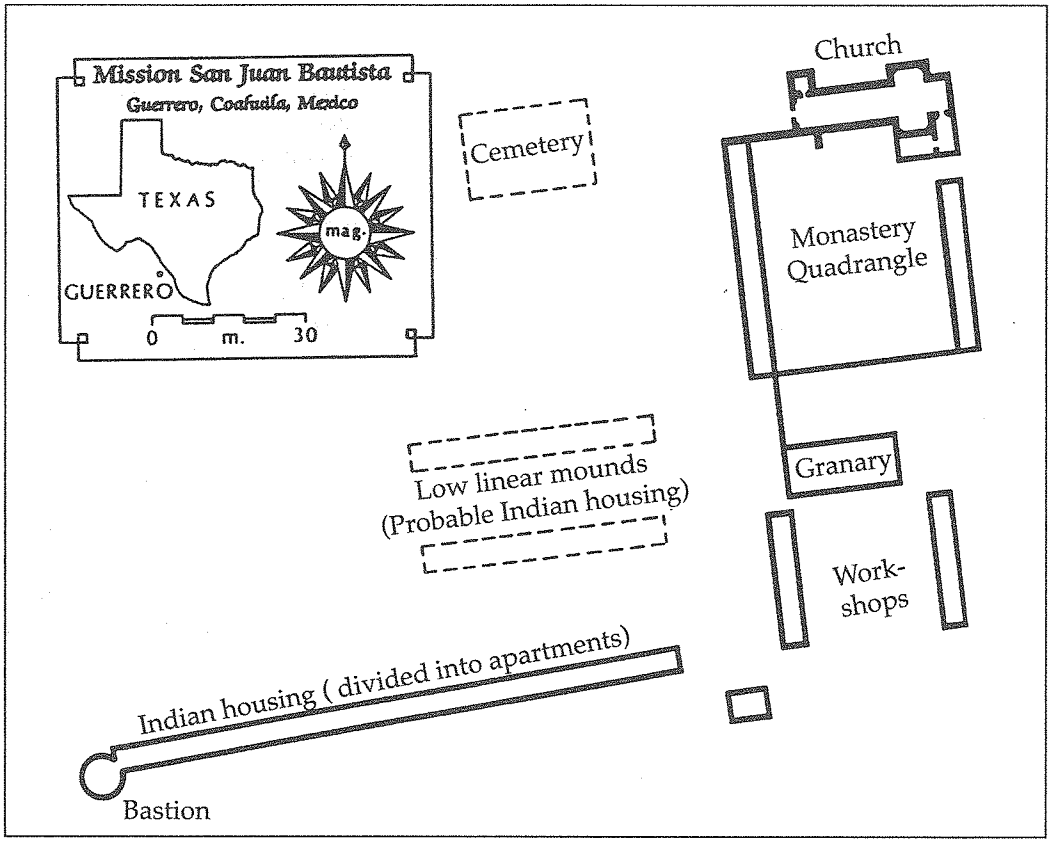


Figure 3. Plan Map of San Juan Bautista (after Eaton 1989).

small amount was recovered from the structure's western half. No architectural remains above the wall footings were found in the western part of the structure, and it appears that no walls had been constructed in that area. It is likely that the eastern section of the Native housing structure was occupied but that construction of the western portion had not been completed when the building was abandoned.

A wall footing, in circular plan and about 8 m in diameter, was also uncovered. This unusual feature, suggestive of a defensive bastion, while not routinely integral to mission structures, is also found at missions San José and Espada in San Antonio.

## Spatial and Temporal Context of the Lithic Artifacts

The cultural materials from San Juan Bautista represent an occupation from 1740 to 1794. The bulk of the lithics (and other cultural materials) is from midden contexts. Excavations—53 trenches of various sizes (totaling 39 m$^2$)—were located along the outside foundations, inside the structures, and adjacent to the Native housing area (but within the mission compound). From these excavations it was apparent that cultural debris had accumulated along the outer walls of the Native habitation quarters, particularly where windows and doors appear to have been located. Based on field notes and maps, the average depth of the midden concentration was 20-30 cm. The deepest exca-vations, generally along foundation walls, were to 60 cm. A dense midden, specifically containing bone fragments (predominantly cow and horse), was on the south side of the bastion.

In the eastern part of the mission compound, at ground surface and to the west of the structural remains thought to be the workshop, were remnants of at least two hearth features. They were on the remains of a packed dirt floor with gravel underneath. Associated with these features was charcoal, ash, large amounts of burned bone, mussel shells, and sherds. At 40-60 cm bs, large stones (thought to be part of a foundation) were located. A test unit, placed several meters north of the Native housing foundation, yielded scattered rubble but few cultural materials.

A small mound, located 6 m southeast of the east end of the Native housing foundation, was also excavated. The upper 5 cm of the 2 x 2 m test unit (Operation 101; Sub-operation GG-Level 1-5 and HH-Level 1-4) was a brown topsoil. Underneath, to a depth of 25 cm, was a dense midden deposit. From 25 to 30 cm was a very hard packed zone of soil and gravel with some cultural debris. A packed gravel with small amounts of cultural material was encountered from 30-42 cm bs. From 42-60 cm was a loose soil with some gravel and small amounts of bone and charcoal. At 60 cm, a very hard packed surface was reached, possibly the floor of a Native *jacal* structure. In the southeast quadrant of the unit, the hard packed surface was reached at a depth of 40 cm. Cultural materials recovered included bone fragments, sherds, land snails (*Rabdotus*), and mussel shells. A dense concentration of lithics (two unifaces; a soot-stained distal tip of a large biface; a medial preform fragment; two Guerrero arrow points; one core; one modified blade fragment; and three modified flakes) was recovered from this test unit.

It is difficult to interpret these cultural materials because in mixed midden contexts vertical and horizontal associations are obscured. The living floors that were excavated within the Native habitation structures yielded few cultural remains. It is likely that the earthen floors were capped with tiles that were collected for re-use after the building was abandoned. Smaller concentrations of artifacts and faunal materials were found in test units in the mission compound, but they do not appear to be associated with activity areas. Perhaps following aboriginal tradition, tasks such as stone tool manufacture took place outside the living areas, and perhaps even outside the mission compound (Hester 1977). There were no clear patterns in the spatial concentration of debitage from San Juan Bautista, although larger concentrations were found to the east of the Native housing area; next to foundation stones (of the probable workshop); adjacent to foundations of the Native housing structures; and outside the north side of the bastion foundation.

**Table 1. Categories and Quantities of Lithic Artifacts from Mission San Juan Bautista**

| Artifact | Quantity |
|---|---|
| Guerrero points | 9 |
| Miscellaneous arrow point | 1 |
| Dart points | 7 |
| Bifaces (& preforms) | 10 |
| Unifaces | 13 |
| Modified flakes | 24 |
| Blades | 1 |
| Cobbles (choppers) | 2 |
| Cores | 8 |
| Ground stone | 8 |
| Debitage | 516 |
| Totals | 599 |

## LITHIC ARTIFACTS (CHIPPED AND GROUND STONE)

Lithic artifacts from San Juan Bautista include chipped stone arrow points, dart points, unifaces, bifaces, cores, modified flakes, debitage, and ground stone tools (Table 1). Typological and chronological data follow Turner and Hester (1993). Measurements are in millimeters (mm) and weights in grams (g); a dash indicates a fragmentary specimen.

### Arrow Points

The 10 arrow points (nine Guerrero and one miscellaneous form) from Mission San Juan Bautista are bifacially chipped, stemless, triangular specimens (Table 2 and Figure 4). One is crudely chipped and may be an arrow point preform (Figure 4a), and another is made from green bottle glass (Figure 4c); the remainder are made from chert. One Guerrero is triangular in form with a straight base and a broken distal tip (Figure 4b), a second is ovate in form with a straight base (Figure 4d), while several others have concave bases (Figure 4f-j).

### Dart Points

The seven dart points recovered from San Juan Bautista are fragmentary (see Inman 1997:Figure

**Table 2. Metric Data for Arrow Points from San Juan Bautista**

| Type | Length | Width | Thickness | Weight | Specimen No. | Figure No. |
|---|---|---|---|---|---|---|
| Miscellaneous | 33 | 20.0 | 6.8 | 4.1 | 184 | 4a |
| Guerrero | – | 17.0 | 5.0 | – | 76 | 4b |
| Guerrero | – | 17.0 | 4.0 | – | 77 | 4c |
| Guerrero | 25 | 15.0 | 4.5 | 2.0 | 73 | 4d |
| Guerrero | 40 | 16.0 | 4.0 | 2.8 | 75 | 4e |
| Guerrero | 34 | 16.5 | 5.0 | 2.4 | 70 | 4f |
| Guerrero | 30 | 14.0 | 5.0 | 2.3 | 72 | 4g |
| Guerrero | 30 | 14.0 | 4.0 | 1.5 | 74 | 4h |
| Guerrero | 28 | 14.5 | 3.0 | 1.3 | 71 | 4i |
| Guerrero | – | 13.0 | 3.0 | 1.1 | 69 | 4j |

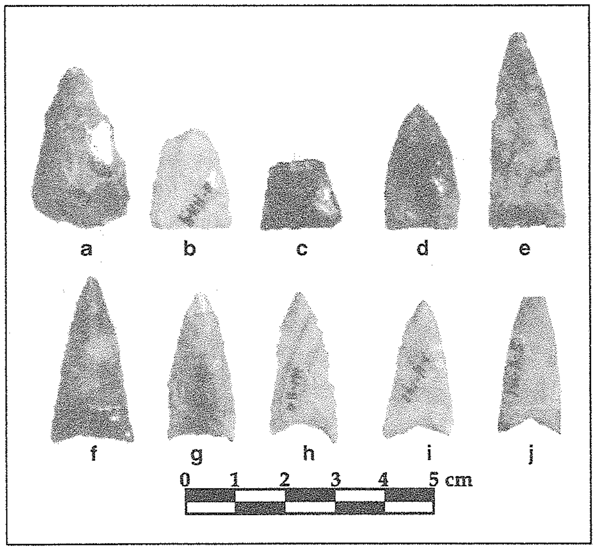


Figure 4. Arrow points from San Juan Bautista.

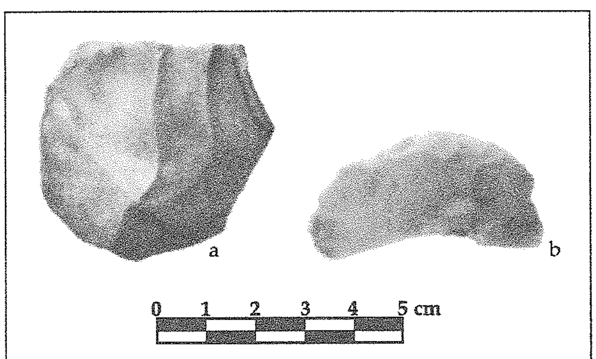


Figure 5. Core and Unifacial Tool.

6a-e). They include a Bulverde-like specimen with a missing distal tip and broken barbs, a rectangular basal fragment that may have been a knife, a dart point basal fragment (of translucent brown chert) similar to a Langtry, and a Pedernales-like form with a broken distal tip; it is made from a purple heat-treated chert. Another possible dart point is highly patinated and mostly unifacial (Abasolo-like), and there is also an un-notched basal fragment and a crudely chipped dart point (with a broken distal tip) of indeterminate type.

## Bifaces and Preforms

Ten biface fragments were recovered from the excavations at San Juan Bautista. Three of the specimens are distal fragments of large bifaces; two are extremely finely chipped, one is made from a translucent medium gray chert; a second specimen is soot-stained (see Inman 1997:Figure 6f); the third distal fragment is crude and unfinished. Of the remaining biface fragments, one is a medial fragment of a large biface (possible knife); three are classified as preforms; and four are small specimens with rudimentary bifacial chipping.

## Unifaces

Eight unifacial tools are small, ovate to elongate specimens that are thick and plano-convex. They range from 21-31 cm in length; widths are variable, and the majority are fragments. These small, informally-made tools can probably be classified as end scrapers or end and side scrapers (although two specimens may be gunflint fragments). A larger specimen, a side and end scraper, has edge damage on the bit end. Although this tool is more similar in form to large scrapers commonly found at Archaic and Late Prehistoric sites in South and Central Texas, it is less formal and crudely flaked. Another unifacial tool (Figure 5b) has a 60° edge angle and resembles a Nueces scraper (Turner and Hester 1993:267-268).

### Cobble Tools

Two large cobble tools are "choppers," cobbles with a few flakes removed from one end (Turner and Hester 1993). They range from 80-113 mm in length, 79-82 mm in width, and 42-45 mm in thickness, but weigh 288-608 g. One cobble tool (Figure 6a) is made of a coarse tan/gray chert with cortex. Battering is evident on the bit end. The other is a light gray chert cobble tool with cortex remaining on approximately one-third of the specimen (Figure 6b). It is likely that both tools were crudely fashioned expedient tools as no evidence (micro-flaking, crushing, or polish) of extended use on the bit end of either tool was detected using low-power microscopy (10-40X).

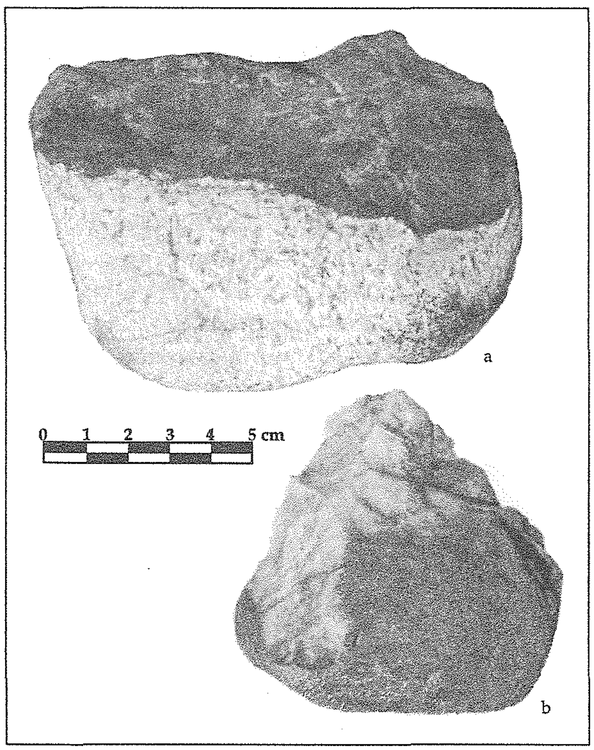


Figure 6. Cobble tools (choppers).

### Cores

Three cores and five split or halved cobbles were recovered at San Juan Bautista. The majority of split cobbles appeared to have been tested and had a few flakes removed. One specimen has a small amount of battering on one end and may have been used as a hammerstone. Of the three cores, two are expended polyhedral blade cores from which a series of blades or flakes have been removed (see Figure 5a). The third core is a tan fine-grained chert, with a flake removed at one end to create a platform from which flakes (or blades) were then struck. Metric data for the cores indicate they ranged from 43-64 mm in length, 29-53 mm in width, and were 29-45 mm in thickness. They weighed between 52.8-86.3 g.

### Modified Flakes and Blades

A total of 28 modified flakes (11 with two chipped or trimmed edges and 17 with one modified edge) are in the assemblage. Additionally, one blade (trimmed bifacially on both lateral edges) was found at the mission.

### Ground Stone

There are a total of 15 ground or polished stone artifacts from San Juan Bautista. This includes a large highly polished gray sandstone piece with very fine striations on both dorsal and ventral surfaces (Figure 7a). It is likely that this tool was a rubbing stone used for hide softening and processing. Obvious use-wear in the form of battering on one end and damaged and broken areas on the opposite end of a large quartzite stone indicates its probable use as a hammerstone (Figure 7b). Two dark brown hematite pebbles (Figure 8a-b) have most surfaces polished, and may have been used as burnishing stones for the final stages of pottery production. Eight metate fragments, including a basal fragment (Figure 9b) made from a porous, vesicular dark gray basalt, four mano fragments,

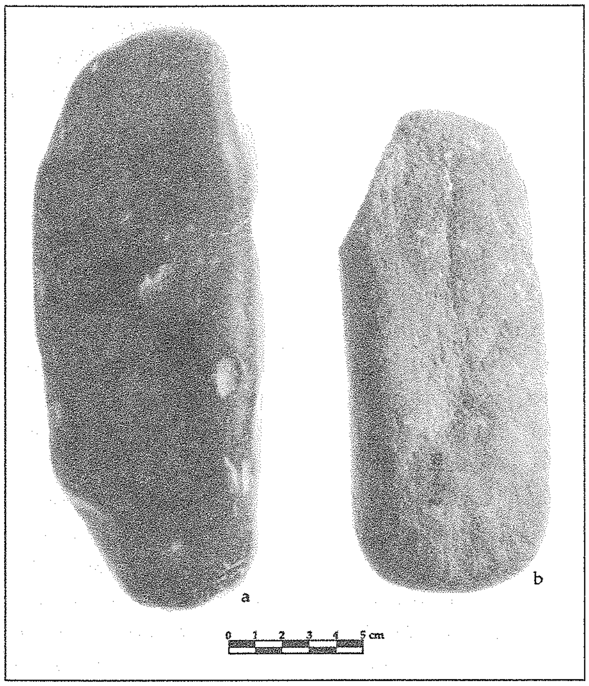


Figure 7. Ground Stone Tools: a, polished stone; b, hammerstone.

and a two-handed mano fragment (Figure 9a) were also recovered during the excavations.

### Debitage

Primary cortex flakes are the first flakes removed from a nodule and have dorsal surfaces that are cortex-covered (Shafer 1969). Further chipping produces secondary flakes that show both earlier flake removals and traces of remaining cortex on the striking platform or on the outer flake face (Turner and Hester 1993). Interior flakes are struck from a core after all cortex has been removed (Shafer 1969). Thinning flakes have been removed from a flake, preform (biface), or uniface by percussion or pressure flaking (Crabtree 1972).

The number of flakes from San Juan Bautista is 516; however, the analyzed sample transported to TARL numbered only 328. From the analysis of the debris, it appears that small pebbles were frequently reduced with fairly unsophisticated techniques. The debitage includes few cores; the core fragments present are primarily pieces of split cobbles. The majority of the debitage are cortex flakes and pieces of split cobbles (Table 3); interior flakes (and biface thinning flakes) are relatively infrequent. Eight percent of the debitage was heat damaged (i.e., crenation fractures [potlids] and heat-treating with pink coloration, or an over-all glassy sheen).

### Summary of Lithic Artifacts from San Juan Bautista

The relatively small amount of lithic artifacts found at San Juan Bautista (third location) may reflect the relatively short time span during which it was occupied (1740-1794). Stone tools were being made from local cherts (small to medium-sized river cobbles) and one of the techniques being used was the bi-polar method (Crabtree 1972). This technique works well with small cobbles and produces distinctive wedge-shaped flakes similar to segments of an orange. A blade/core technology was also being used.

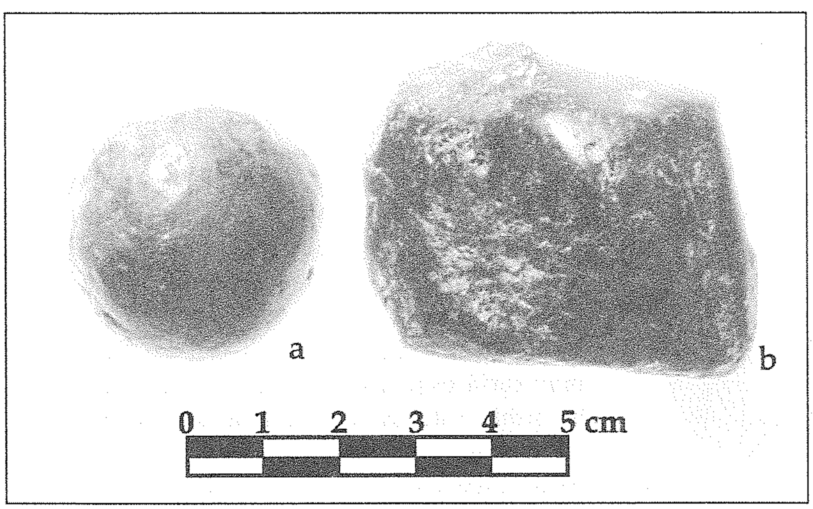


Figure 8. Hematite pebbles.

Arrow points were made for hunting and defense. Dart points were present; however, it is likely that they were scavenged from nearby Archaic sites. The remainder of the tools are preforms, bifaces, unifaces, modified flakes, and modified cobbles. One blade and one expended blade core was recovered. The more formal, large unifaces (scrapers) were not part of the tool inventory; flake tools, however, were

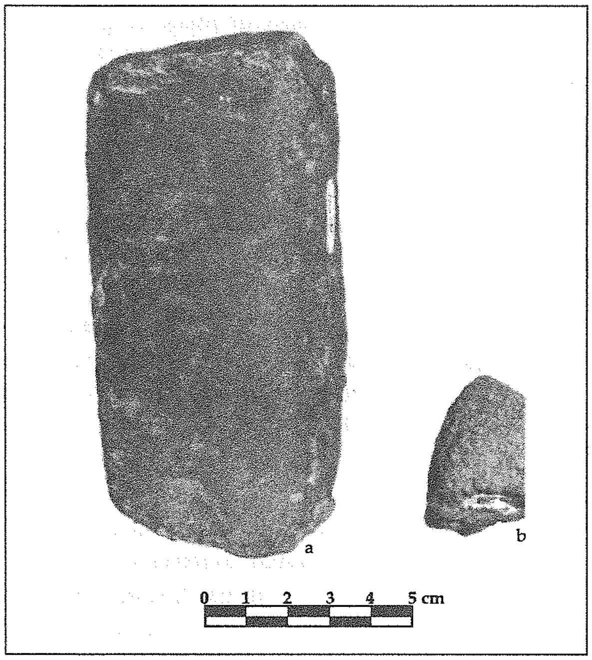


Figure 9. Ground Stone Tools: a, mano fragment; b, metate fragment.

numerous. It is likely that these expedient tools were supplemented by metal knives provided by the Spanish. Few metal tools, however, were recovered from the excavations and documents indicate they were scarce. No perforators were found and only two specimens can be considered possible gunflints. The presence of ground stone indicates plant food processing continued during the mission occupation. Vesicular basalt metates and manos were brought to San Juan Bautista as trade items from Saltillo (Almaraz 1979). Locally available sandstone was also used for manos. A large, dense basalt stone was probably used for softening hides, while a small hematite stone may have been used in pottery manufacture.

## MISSION SAN BERNARDO

San Bernardo, established in 1702 and located approximately 5 km northeast of San Juan Bautista, is the only mission of the three founded at Guerrero with a standing structure. The original church was in the eastern section of the site, and a second church was erected in 1760 but was never completed (Figure 10). The structure was stabilized in the mid-1970s under the direction of the Instituto Nacional de Antro–pologia e Historia de Mexico (Eaton 1989).

At that time, an area around the church was being developed as a park and picnic area, and to the north of the church, a section of land had been cleared using heavy equipment. Excavations in 1975-1976 in this section uncovered the original surface of the mission quadrangle area 18 cm below the disturbed ground surface. Abundant cultural materials were recovered from this surface and excavations also revealed the foundation stones of the Native housing. This linear structure measured approximately 33 m in length and 5 m in width (Eaton 1989).

As work continued, five additional building foundations of approximately the same dimensions were uncovered (see Figure 10). Diagnostic cultural materials and descriptive archival information confirmed that these structures housed the Native peoples. It is likely that each structure was divided into small apartments for family groups, although no interior walls were evident. An inventory from 1772 indicates that 40 houses were already built at San Bernardo. Perhaps each stone structure was divided into 7 family apartments. In plan, the structures were aligned north-south and formed the sides of a street that extended north from the front entrance of the existing church (Eaton 1981).

**Table 3. Categories and Quantities of Lithic Debitage from Mission San Juan Bautista**

| Category | Quantity |
|---|---|
| Primary cortex flake | 34 |
| Secondary flake | 90 |
| Interior flake | 151 |
| Core fragment | 1 |
| Chert chunks | 23 |
| Thinning flake | 3 |
| Quartzite fragments | 8 |
| Chalcedony fragments | 17 |
| Stream pebble | 1 |
| Total | 328 |

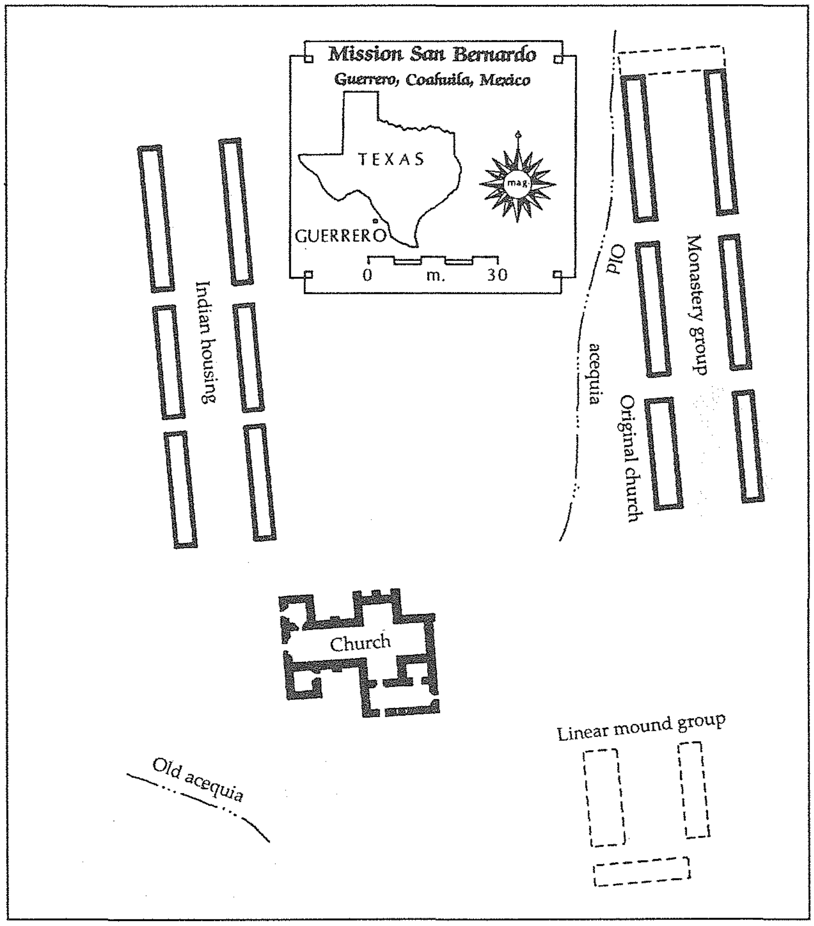


Figure 10. Plan Map of San Bernardo (after Eaton 1989).

In Spring 1976, excavations were also carried out in the area northeast of the church (the east side of the quadrangle). This area produced small amounts of cultural materials attributable to the Native peoples. The artifacts from the area of the six Native habitation structures (north and slightly west of the existing church) are designated as San Bernardo North. Those stone tools recovered from testing in the eastern part of the quadrangle (northeast of the present church) where the original church was located, are identified as San Bernardo East.

## Spatial Context of Lithic Artifacts

Excavations conducted at San Bernardo North consisted of 1 x 1 m and 2 x 2 m test units (totaling 99 m$^2$) and 52 trenches. In general, excavations revealed midden deposits composed of bone fragments, lithic artifacts, snails, sherds, and small amounts of metal fragments at 0-20 cm above packed dirt floors.

At San Bernardo East, 14 trenches were dug along the structural foundations in the eastern part of the site (the probable location of the original church). In addition, 12 test units (totaling 32 m$^2$) were excavated in areas adjacent to the structural remains. These units, located in the "plaza" area of the mission compound, located a packed earth surface at 15-20 cm. The plaza fill contained an abundance of faunal materials (primarily large mammals), some ceramics (bone-tempered Native pottery, majolica, and green lead-glazed sherds), stone tools, and debitage. Other lithics present were Guerrero arrow points (both lanceolate and triangular forms), several miscellaneous arrow points, and small dart points. The fill from the units appears to be refuse that probably originated in the series of rooms to the west (the Native habitation area) that was then dumped in the plaza.

Excavations at San Bernardo North consisted of test units located along the building foundations, inside the Native habitation quarters, inside the plaza, and eight units located west of the structures (just outside the mission compound). One of the units, a 2 x 2 unit (Operation 100, Sub-operation 9C1) located 9 m west of Native housing Structure IV, yielded a cluster of soot-stained/burned lithics: four Archaic dart points, a Guerrero arrow point basal fragment, an ovate unstemmed biface, the basal fragment of a large thin biface, a small ovate uniface, end and side scrapers (made on large cortex flakes), numerous trimmed flakes, and four modified blade segments. Other cultural materials recovered from Level 1 (0-15 cm) included bone fragments, land snails, sherds, mussel shell fragments, a metal object, and 39 small glass beads. This was the only unit excavated at San Bernardo North with an artifact assemblage suggesting it may have been a workshop area.

## LITHIC ARTIFACTS FROM SAN BERNARDO NORTH

Artifacts re1covered from excavations at San Bernardo North (Table 4) include a variety of chipped and ground stone tools, as well as 2155 pieces of debitage and seven blades.

**Table 4. Categories and Quantities of Lithic Artifacts from Mission San Bernardo North**

| Artifact | Quantity |
|---|---|
| Guerrero points | 65 |
| Miscellaneous arrow points | 7 |
| Arrow point fragments | 17 |
| Dart points | 43 |
| Bifaces & Preforms | 33 |
| Gunflints | 4 |
| Scrapers | 7 |
| Perforators | 4 |
| Unifaces | 45 |
| Modified flakes | 120 |
| Blades | 7 |
| Ground stone | 11 |
| Debitage | 2155 |
| Totals | 2518 |

### Arrow Points

A total of 65 Guerrero points (Figures 11 and 12), seven unclassified points (see Inman 1997:Figure ), and 17 fragments were recovered from the Native housing structures and plaza adjacent to the structures. Forty-one Guerrero points are almost completely intact; the remaining 24 specimens are classifiable bases. Metric data on the points is provided in Inman (1997:Table 7), but the mean dimensions of the points are: 28.3 mm in length (n=42), 15.6 mm in width (n=65), and 3.98 mm in thickness (n=65); mean weights of the specimens are 1.73 g (n=43). A variety of base shapes is present in the Guerrero points: straight, slightly concave, and those having a distinct basal concavity. Several specimens show evidence of thermal alteration (potlids and pink coloration). The Guerrero points include specimens that are unifacially (made on flakes) as well as bifacially flaked to shape.

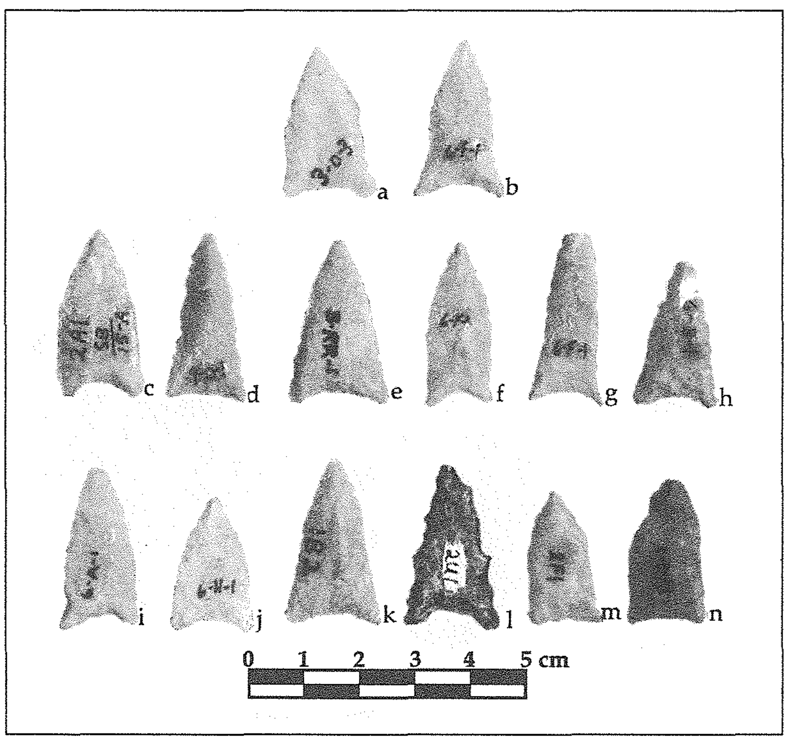


Figure 11. Guerrero arrow points from San Bernardo North.

One Guerrero is chipped from a light green glass (see Figure 12a). Chert materials for the other Guerrero arrow points range in color from light tan to medium gray.

Of the 17 total arrow point fragments (see Table 4), 14 are distal tips. The remaining three are medial fragments that appear to be the size and shape of Guerrero points, but the bases are missing or broken. The miscellaneous arrow points from San Bernardo North include a possible Perdiz; another that is unifacial with serrated edges; and a notched basal fragment made from petrified palmwood (see Inman 1997:Figure 17a-b, d).

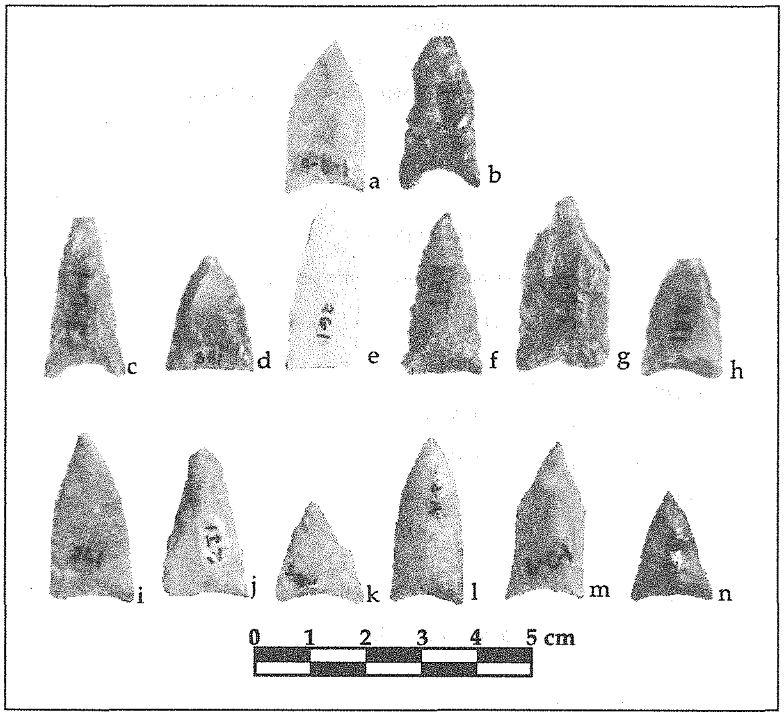


Figure 12. Guerrero arrow points from San Bernardo North.

### Unifaces (End and Side Scrapers)

The unifacial tools from San Bernardo North include 43 large (56-69 mm in length) end and side scrapers and three small (21-26 mm in length) end and side scrapers (Figures 15 and 16). The small unifaces are similar to the "thumbnail" scrapers (Figure 15d) associated with the Late Prehistoric Toyah horizon (Black 1986) of Central and South Texas. One scraper, made on an interior flake, has modified edges on the bit end and one lateral surface (see Figure 16a). Evidence of ventral bit resharpening is seen on this tool. Two other unifaces (see Figure 16b-c), made on cortex flakes, were examined for traces of microwear.

### Dart Points

Of the 43 dart points from San Bernardo North, three resemble Desmuke points and three are similar to Abasolo. Other forms resemble Martindale, Tortugas, Shumla, Marshall, and Langtry (see Inman 1997:Figures 18-20). Evidence of heat treating (Hester and Collins 1974) is present on one of the Shumla-like specimens. Other untyped dart points from the site include specimens that are side-notched, corner-notched, and one that has basal notching, along with eight distal fragments.

### Miscellaneous Unifaces

Thirty-eight miscellaneous unifaces con-sisted of small flakes (<43 mm in length) of various shapes, some with steep bit ends and others with converging, pointed edges (similar to gravers).

### Bifaces and Preforms

Seventeen bifaces (including fragments) were recovered, several that appear to have been refurbished. These include a large, crudely chipped biface (Figure 13b); a large biface distal fragment (Figure 13c) that has been chipped on one lateral surface and may have been used as a knife; and a smaller biface/preform (Figure 13a). The three specimens are made from light gray chert. Another is a large lanceolate biface with a diagonal fracture resulting in the loss of one lateral surface; the distal tip is also missing. Five preforms, four intact (Figure 14a-c, e), are ovate in form and have rounded bases.

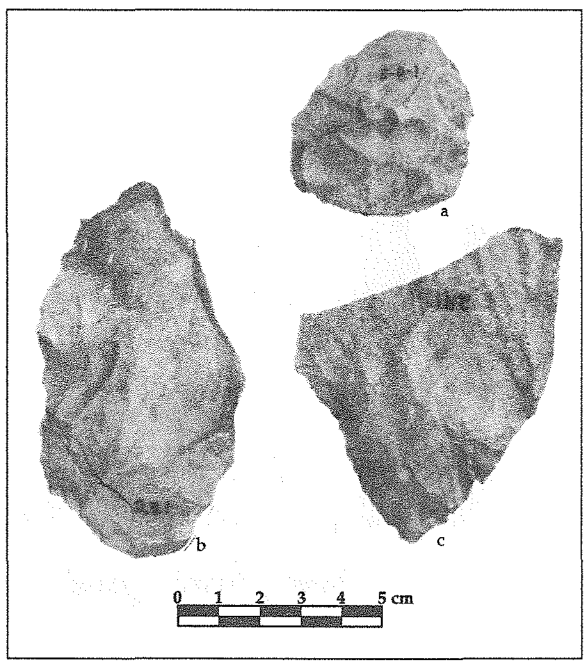


Figure 13. Bifaces.

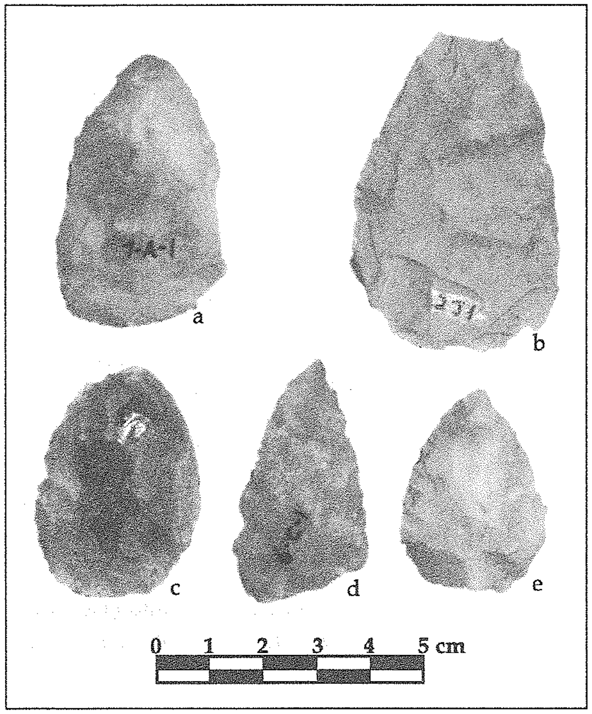


Figure 14. Preforms.

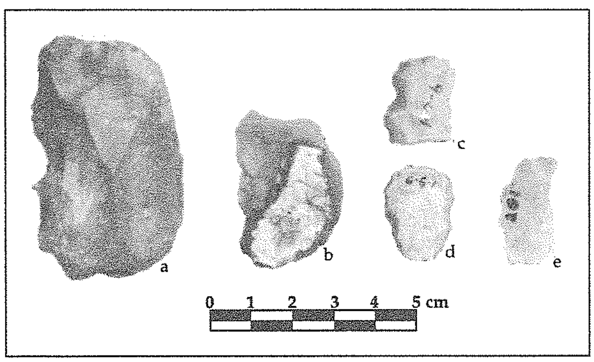


Figure 15. Large and Small Unifaces.

This miscellaneous category also includes several specimens that may be aborted preforms for arrow points, damaged gunflints, or gunflint fragments. Inman (1997:Figure 25a-b, e-f) illustrates representative examples of these expediency tools.

## Clear Fork Tool

The one Clear Fork tool specimen from San Bernardo North has a concave bit end and an edge angle of 81°. The specimen (73 mm in length, 47 mm in width, 19.5 mm in thickness, and 65 g in weight) is made from a black material (similar to basalt), has cortex on the dorsal surface, and is heavily patinated.

## Modified Blades

Of the three modified blades from the site, one has edge damage on both lateral surfaces; the second has one edge trimmed and one unmodified; and the third has a distal tip that has been trimmed to a point and both lateral edges are chipped. The remaining four specimens are blade fragments; one has a notched (denticulate) edge.

## Perforators

Four perforator fragments (all with broken distal tips) were found at San Bernardo North. One is made on a flake and has a bifacial shaft (Figure 17a), and another was made from a side-notched dart point (Figure 17b). A third perforator is made on a flake (Figure 17c). The final perforator is bifacial and has an alternately beveled bit end (Figure 17d). The perforators range from 18-33 mm in width and 5.8-7.0 mm in thickness, and weigh 3.6-5 g.

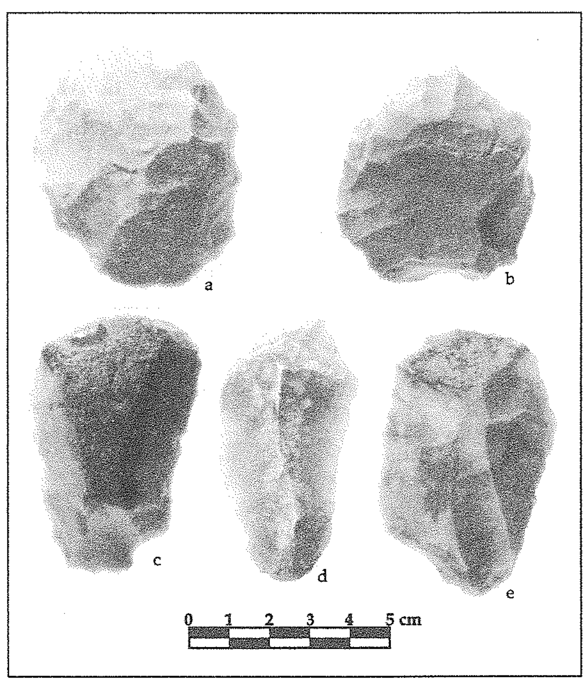


Figure 16. Large Unifaces from San Bernardo North.

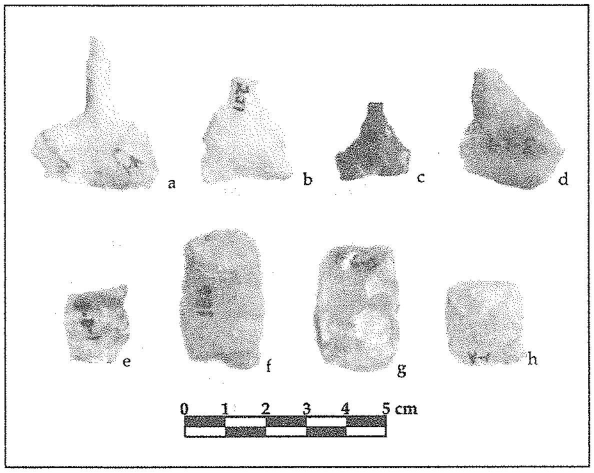


Figure 17. Perforators and Gunflints: a-d, perforators; e-h, gunflints.

### Gunflints

Three gunflints from San Bernardo North are bifacial; one is unifacial. Two are nearly square and two are rectangular forms. Three specimens (see Figure 17e-g) are bifacial and made from a gray chert; the fourth (see Figure 17h) is made from a light tan chert, and is unifacial. Metric data for the gunflints are provided in Table 5.

### Modified Flakes

Modified flakes recovered from the San Bernardo North excavations totaled 113. These flakes have patterned, repeated, edge trimming or flaking. In some cases, it appears that trimming was done to shape and prepare a cutting edge or to resharpen a cutting edge. Twenty-two flakes had slight modification of both lateral surfaces, and 45 were modified on only one edge. The majority of those trimmed on two edges are interior flakes. Six flakes have slightly concave edges opposite one another (similar to spokeshaves or denticulates). The remaining modified flakes are fragmentary specimens of various shapes and sizes.

### Ground Stone

Eleven ground stone tools or fragments were recovered: five hammerstones, two metate fragments, and four manos. The metate fragments were of a dark gray coarse-grained vesicular basalt (see Inman 1997:Figure 28). Other ground stone tools included a loaf-shaped two-handed mano (see Inman 1997:Figure 27), mano fragments of native limestone (Figure 18b) and basalt (see Inman 1997:Figure 29a), and a hammerstone with edge battering (Figure 18a). A heavy, round pebble (probably galena or hematite) was also recovered that had considerable polish (burnishing) and faint scratches on all surfaces. This oval-shaped stone may have been used as a tool for burnishing and smoothing surfaces and/or interiors of pottery vessels.

### Debitage

In general, concentrations of lithic debris in San Bernardo North were found adjacent to structural foundations of the Native habitation area outside of what may have been window and door openings. The debitage is dominated by interior and secondary flakes (Table 6).

Ten percent of the debitage has been heat-treated; several specimens were soot-stained. Of note was a concentration of interior chert flakes (n=69) that may have been minimally modified and used as cutting tools (or used without modification). The bi-polar method of flint knapping (Crabtree 1972; Honea 1965) was also being used

**Table 5. Metric Data for Gunflints, San Bernardo North**

| Length | Width | Thickness | Weight | Figure Reference |
|---|---|---|---|---|
| 19.0 | 16.0 | 5.0 | 2.4 | 17e |
| 35.0 | 21.0 | 7.0 | 6.7 | 17f |
| 31.0 | 21.0 | 8.0 | 6.7 | 17g |
| 21.5 | 19.5 | 6.0 | 3.3 | 17h |

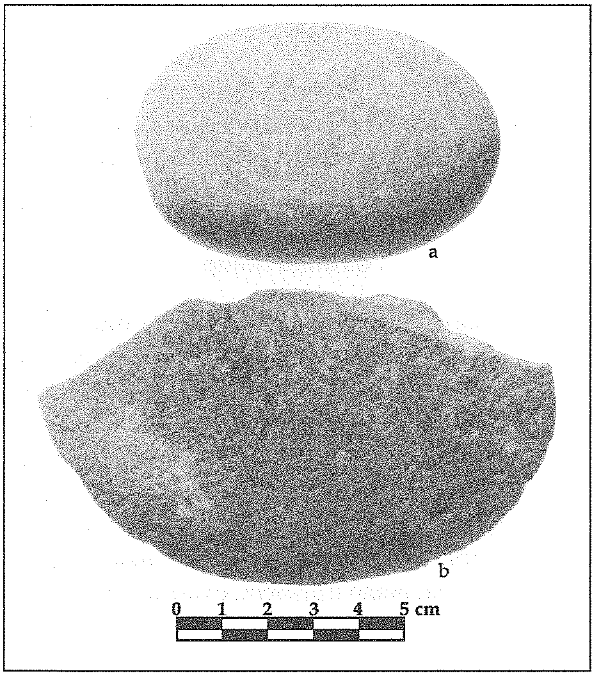


Figure 18. Ground Stone Tools from San Bernardo North: a, hammerstone; b, mano fragment.

at San Bernardo as 11 wedge-shaped flakes were present.

## LITHIC ARTIFACTS FROM SAN BERNARDO EAST

Lithics from excavations in the area east of San Bernardo church include Guerrero arrow points, dart points, bifaces, unifacial tools, cores, modified flakes, and ground stone tools (Table 7). The debitage (n=99) was not available for analysis.

The majority of lithics from San Bernardo East were recovered from excavations along the foundations of the original church structure. The largest concentrations of artifacts occurred in levels 1 and 2.

### Arrow Points

Arrow points (see Inman 1997:Figure 32a-c) are represented by three Guerrero specimens. Two are triangular forms; one is intact (25 mm in length and 1.1 g in weight) and another is fire-fractured, with edge damage on one lateral surface. The remaining arrow point has a distinctly concave base, is more lanceolate in form than triangular, and has a broken distal tip. A distal tip of an arrow point

**Table 6. Categories and Quantities of Debitage, San Bernardo North**

| Artifact | Quantity |
|---|---|
| Primary cortex flake | 253 |
| Secondary flake | 607 |
| Interior flake | 1225 |
| Core fragment | 3 |
| Chert chunks | 16 |
| Thinning flake | 24 |
| Chalcedony fragments | 26 |
| Novaculite flake | 1 |
| Total | 2155 |

was also recovered from the site. The Guerrero points from San Bernardo East range from 7.5-15 mm in width and 3.3-5.0 mm in thickness.

### Dart Points

Six dart points (see Inman 1997:Figure 33) were recovered from San Bernardo East, including one alternately beveled Tortugas point made from light

**Table 7. Types and Quantities of Lithic Artifacts from San Bernardo East**

| Artifact | Quantity |
|---|---|
| Guerrero points | 3 |
| Dart points | 6 |
| Bifaces | 10 |
| Unifaces | 3 |
| Modified flakes | 18 |
| Cobbles (choppers) | 2 |
| Cores | 4 |
| Ground stone | 6 |
| Debitage | 99 |
| Totals | 151 |

tan colored chert. Also among the dart points were two unidentifiable stemmed specimens (one with a broken distal tip and one with a broken barb); an Ensor-like specimen; one triangular form with a broken distal tip; and one crudely reworked specimen of white chert.

### Bifaces

The 10 bifaces include three crudely bifaced flakes; one large, crude biface (a possible quarry blank); one biface fragment (proximal); one medial fragment made from white chert (or possibly chalcedony); and a heavily patinated bifacial preform fragment with a snap fracture on the proximal end. The remaining three specimens are crudely bifaced flakes.

### Unifaces

Of the three unifaces from San Bernardo East, one specimen has modified lateral surfaces and bit end (side and end scraper); the second tool, a possible gunflint, is small, thick, rectangular, and chipped on two lateral edges; and the third uniface is made on a thick flake. This specimen has one trimmed edge with heavy battering and soot-staining.

### Cores

There are four cores from San Bernardo East (see Table 7). These include one small fragment of fine-grained brown chert, and an expended and conical core, with flakes removed from 80 percent of its circumference. The third core is stream-rolled, rectangular, with a platform created at one end, and flakes/blades removed from one face. The remaining chert core (a cobble with battered cortex) has a multi-faceted platform with several flakes removed, as well as several hinge fractures attesting to the attempted removal of additional flakes. The cores are from cobbles (34-59 mm in length, 32.5-43.5 mm in width, and 14.6-51 mm in thickness) weighing between 30-132 g.

### Modified Flakes

Ten flakes have slight modification of one edge (one with some cortex remaining); four flakes (two with cortex) are modified on two edges; and one may be an attempt to make an arrow point. Three additional flakes have two trimmed edges but no remaining cortex. One large flake (a possible "chopper") has one crudely trimmed edge.

### Ground Stone

A heavy, rectangular polished stone galena fragment (similar to a specimen from Mission San Juan Bautista) was found at San Bernardo East. Also recovered was the leg of a large metate; one rectangular "loaf-shaped" two-handed mano fragment (of vesicular basalt), with convex grinding surfaces on both sides; a sandstone mano; a hammerstone fragment of purple quartzite; and one additional mano fragment, ovate and bi-convex in form.

### Summary of Lithic Artifacts from San Bernardo North and San Bernardo East

Lithics from San Bernardo represent an occupation spanning 92 years (1702 to 1794). A large number of Guerrero arrow points (n=65) and seven miscellaneous arrow point forms were recovered. It is likely that the dart points present were collected from nearby Archaic sites and were either being refurbished or used in their original form (perhaps as knives). As at San Juan Bautista, local river cobbles were being selected and the bi-polar method (hammer and anvil) of knapping was employed on smaller cobbles as well as a core-flake technology. Bifaces and preforms are present as well as two formal unifacial end scrapers and one uniface that is chipped on one lateral surface and the bit end (end and side scraper). It is probable that the larger bifaces and formal scrapers also represent curated tools from the Archaic era. Specialized tools include perforators and gunflints. The small perforators are similar to those found in Late Prehistoric sites across South Texas. It is likely that some of the gunflints from the site were of European origin, imported by the Spanish, and that others represent ancient technology being used to produce a new tool form.

## USE-WEAR ANALYSIS OF SELECT LITHIC ARTIFACTS

Use-wear analysis was conducted on select chipped stone artifacts (unifaces, edge modified flakes, and one blade fragment) from San Juan Bautista and San Bernardo. Results of high magnification microscopy (220X) on 29 artifacts indicated that the majority of these tools exhibited some degree of use-wear, usually in the form of generic polish. More diagnostic use-wear indicators on some tools show that various food processing and material processing tasks (butchering, scraping, cutting, sawing) were taking place at the Guerrero missions. These probably included processing of animal products (meat and hides) and wood and plant processing.

Small unifaces had more evidence of use-wear than the modified flakes, supporting the idea that the modified flakes were casual tools used for a short period of time and then discarded. The small unifacial tools (thumbnail in size) appear to have been re-sharpened and used till they were extremely small, then discarded when snap fractures occurred or the bit end could no longer be re-sharpened. Perhaps the finding of poorly developed polish on the majority of tools is characteristic of the mission context, with metal tools being used for some tasks. In addition, it is likely that the processing of meat and hides was taking place outside the mission compound in an area that was not excavated. More in-depth information regarding the use-wear analysis can be found in Inman (1997:87-97).

## SUMMARY

### The Native Peoples

The names of the diverse cultural groups living at the Guerrero missions beginning in 1700 are recorded in various Spanish documents. Campbell (1979) identified 88 Native American groups derived from both northeastern Mexico and southern Texas. The earliest report of Apache movement resulting in the displacement of Native groups from the Southern High Plains south–eastward to the Edwards Plateau took place in 1683-1684. It is likely that the individuals at the Guerrero missions were remnants of numerous groups who, in prehistoric times, had lived in the immediate area and other groups who, having already suffered displacement, were taking refuge there (Campbell n.d.).

In general, total population numbers for San Juan Bautista and San Bernardo did not exceed 300-400 individuals at each mission (Campbell and Campbell 1996). Mission documents indicate that migrations by the Native peoples between missions was common; Campbell and Campbell (1996) noted that some cultural groups were included in census reports at as many as five or six different missions. For example, research by Ricklis (1992, 1996) on the Karankawas, a Texas coastal group, indicates that their adaptation to colonialism was to incorporate the missions into their traditional seasonal rounds, and they might be at the missions for only a few months out of the year. Further hindering determinations of population numbers in the Guerrero missions is that some Spanish reports recorded only births, marriages, deaths, and numbers of individuals who were religious converts.

### Occupation Dates of the Sites

The archeological record at San Juan Bautista reflects an occupation of 54 years (1740-1794) and San Bernardo was occupied continuously for at least 92 years (Inman 1997:Figure 59). Similar lithic artifact forms are found at both sites, although predictably in reduced numbers at the more short-lived mission of San Juan Bautista. In order to have comparable data from the same periods of occupation and to examine the early years of missionization of the Native peoples, cultural materials from the second location of San Juan Bautista (1700-1740) should be studied. It appears, however, that the site is beneath one of the buildings of the modern-day town plaza. Additionally, if data were available from the short-lived Mission San Francisco de Solano, these too may provide insights into the lithic forms and technology used during the early mission years.

### The Lithic Technology

The disparate bands of cultural groups at the missions left an archeological record that attests to their continued manufacture and use of stone tools, and to their adoption and use of a single arrow point style (Guerrero) during the mission era. The presence of stone tools, lithic debris, manos and metates, and a faunal record with abundant wild game indicates that although domesticated animals (cattle, goats, sheep) were introduced by the Spanish, hunting and gathering continued to be an important aspect of Native subsistence. During times of scarcity, it is certain that the Spanish also relied on hunting and foraging.

The extent of the importance of stone tool technology over time in the mission setting is difficult to assess due to various factors affecting the archeological deposits at the missions, including: the apparent sweeping clean of floor surfaces in the Native habitation structures that mixed artifacts in cultural deposits outside doorways and windows; the numbers of different cultural groups moving through the missions; the extended period of occupation; and the removal of building stones after the mission was abandoned, which displaced surface materials and degraded the stratigraphy in the shallow deposits.

Lithic technology (Hester 1977) represented at the mission sites includes the bifacial reduction of cobbles; a core/flake industry (flakes detached from prepared cores were used in the production of unifacial and bifacial tools); and a limited core/blade industry. In addition, the bi-polar flaking technique was used (Crabtree 1972; Honea 1965). The bi-polar technique consists of holding a small to medium-sized pebble core vertically on an anvil and striking the top of the core with a hammerstone. Using this technique, force is induced from both the anvil and the percussor, causing cones of force to form at both ends of the pebble or cobble, not necessarily leaving cone scars. When the force is in direct opposition, the cones exceed the elastic limit of the material and it shatters. The debris will include flakes or chunks that resemble segments of an orange (Crabtree 1972). The debitage from San Juan Bautista and San Bernardo includes distinctive wedge-shaped flakes. Fox (1979) noted the use of bi-polar technology at Mission San José in San Antonio. With minimal flaking, these wedge flakes could be made into gunflints. It is possible that this particular type of lithic technology, used in prehistoric times because it was well suited to available materials (local small river cobbles), resulted in a by-product that could be easily modified and used for a new technological purpose.

## The Lithic Toolkit

While a small number of bifaces (and very few blades) was present at the Guerrero missions, there appears to have been an emphasis on informal tools made from flakes. These expedient tools, minimally chipped to provide cutting and scraping edges, along with small unifacial tools, appear to have comprised the majority of the lithic utilitarian implements. This may mean that it was no longer necessary to produce more formal tools (for example, scrapers) because the Spanish were providing metal implements, although this is difficult to confirm from the archeological record. Only a small number of metal tools were noted in mission inventories and these records highlight the scarcity of metal implements at the mission. The metal tools that were present would have been refurbished and reused until only small fragments survived.

The core/flake technology at the missions reflects a continuity from Late Prehistoric sites in South Texas (Hester and Hill 1975; Inman et al. 1995, 1998). The few Late Prehistoric arrow point styles found in the mission deposits have some Toyah horizon (Black 1986) characteristics.

Both San Juan Bautista and San Bernardo have a unique lithic form: the Guerrero arrow point. Two variations of these stemless points are present: triangular and lanceolate. Guerrero points, for which the Guerrero missions are the type site (Hester 1977, 1989), are also found at southern Texas missions, including Mission Espiritu Santo (both Goliad and Mission Valley [41VT11]), all five missions at San Antonio, at Mission San Lorenzo (Tunnell and Newcomb 1969) in Real County, at Mission San Xavier (Gilmore 1969) in Milam County on the Blackland Prairie, and at an historic site (the Shanklin site, 41WH8) in Wharton County (Hudgins 1986). Six Guerrero points (five triangular and one lanceolate) were recovered from excavations at Rancho de Las Cabras (41WN30), the ranch associated with Mission Espada (Ivey and Fox 1981; Labadie n.d.).

The triangular form of the Guerrero point is predominant at the Guerrero missions (although San Bernardo has two specimens that are lanceolate). Lanceolate forms were recovered from Espiritu Santo (Mission Valley) while both triangular and lanceolate forms were found at Espiritu Santo, the Goliad location. Hester et al. (1996) hypothesized that the lanceolate form may represent the lithic technology of the Aranama, one of three (and the most numerous) Native groups at both the Mission Valley (41VT11) and Goliad locations of Espiritu Santo. The lanceolate and the triangular forms from Espiritu Santo (Goliad) are particularly well made. The Guerrero points from the San Antonio missions are generally triangular in form and sometimes crudely chipped.

Ethnohistoric research by Campbell (1988) indicates that, in a 1708 report by Espinosa, San Juan Bautista is mentioned as a major regional trade center. In addition, Campbell's (n.d.) ethnohistoric study of a southern Texas cultural group, the Pacuache, whose homeland appears to have been approximately 40 km northeast of the Guerrero missions, links the Pacuache with a thriving bison and deer hide trade at the San Juan Bautista presidio and associated missions. This trade is described in terms of exchanges with Native peoples living across the Rio Grande in present-day Texas. The archeological record from both Espiritu Santo locations (41VT11 and 41GD1) contains large numbers of scrapers to support this documentation. In addition, historical records mention the cattle industry at both these sites and it is likely that cowhides were also being processed for use and trade. The following passage by Espinosa (1709) is excerpted from Campbell (n.d.):

> They are much inclined to the chase, the men engaging in no other occupation. The women are trained to cure and tan the hides of buffalo and deer. These they curiously paint to trade to the Spaniards... the red and yellow dirt with which the Indians paint their hides... is very hard.

This ethnohistoric data can be combined with research by Creel (1991) that suggests that the occurrence of beveled knives and end scrapers in assemblages dating after A.D. 1300 reflects the importance of bison hides in a widespread trade network in the early historic period in the Southern Plains and adjacent areas.

When the extremely small number of formal scrapers (two from San Bernardo) and the documented small amount of metal tools brought by the Spanish are considered in light of this extensive trade network, questions arise regarding hide-processing. It appears that workshop areas for bison or deer hide-processing may have been located away from the mission compound and therefore were not excavated. Another possibility is that the hides were being processed elsewhere (i.e., at the Goliad location of Espiritu Santo, where more formal scrapers were recovered) and transported (along with Guerrero points?) to the Guerrero missions to be traded. Large pieces of the mineral red ochre have been found at the Espiritu Santo mission in Goliad that may have been used for decoration of hides.

## CONCLUSIONS

The Native peoples living at San Juan Bautista and San Bernardo represent both local and displaced remnants of different cultural groups. A continuity of technology from the Late Prehistoric period of South Texas is evident in the mission lithic assemblages in the form of a core/flake industry.

At San Juan Bautista and San Bernardo, the lithic artifacts, chipping debris, and abundant faunal remains of wild game attest to the retention of traditional lifeways through continued stone tool manufacture and use. Use-wear analysis of some stone tools from the two mission sites provides evidence for the processing of animal products (hide-processing and butchering), plant products, and wood. Artifacts of chipped glass and gunflints for Spanish-introduced arms document aspects of acculturation, namely the use of traditional technology on a new material, and the use of traditional technology and materials for the manufacture of a new product. Ground stone tools indicate plant food processing also continued to play a part in Native subsistence.

Historical documents attest to the retention of other cultural practices: the Natives would leave the mission to perform their ritual dances (*mitotes*) and to hunt and gather (Weddle 1968). Mission documents from 1727 indicate a food shortage so that while hunting was part of traditional culture, it was also a necessity during this period. Faunal analyses (Davidson and Valdez 1976) verified that bone marrow extraction continued, although it appeared that food was available in sufficient quantity most of the time. These remains also indicate that there was an extremely heavy dependence on wild game, supplemented by domesticated fauna. The large amount of amphibian, reptile, and small bird bones suggest that the Native peoples still spent a considerable amount of time foraging. Rodents, rabbit, deer, peccary, and possibly bison were heavily hunted. Concentrations of *Rabdotus* snails and freshwater mussel shells were also found in midden areas at San Juan Bautista. An historic account by Espinosa (Campbell n.d.) described snails, rabbits, and rats as foods offered by the local Native peoples to missionaries at the short-lived original site of San Juan Bautista on the Rio Sabinas (1699)

It appears the Guerrero point was introduced at San Juan Bautista and San Bernardo early in their history and quickly spread throughout the South Texas and Central Texas missions system. The mobility of the Native peoples during the mission era (Campbell and Campbell 1996) was certainly conducive to the spread of goods and technology. The crowding together in small housing areas at the missions would also have resulted in considerable cultural exchange and standardization (Hagan 1961).

Examination of laboratory notes and sketches indicates that the few metal point forms introduced by the Spanish and found at the missions, were not the origin of the Guerrero point, for they greatly varied in form (see Harris et al., this volume). It is unlikely, therefore, that they were the model for the standardized Guerrero point.

Further research of mission lithic assemblages is warranted, as well as regional syntheses, to determine the origin of the Guerrero arrow point and the mechanisms behind its acceptance and widespread use by all ethnic groups during the mission era. In addition, combined archeological and historical research should be conducted to arrive at a better understanding of changes in lithic toolkits that took place during the mission era.

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# A Study of Glass Beads, Coral Beads, and Bead Spacers from the San Juan Bautista and San Bernardo Missions, Guerrero, Coahuila, Mexico

*R. King Harris, Inus Marie Harris, and Thomas R. Hester*

**ABSTRACT**

During the 1975-1976 excavations at Missions San Bernardo and San Juan Bautista (Guerrero, Coahuila), 546 trade beads, 13 coral beads, and 11 brass bead spacers were recovered. Their contexts are almost entirely mission Indian habitation areas at the two missions and the age determinations derived from these materials reflect the 18th century use of these missions. Certain bead types and the brass bead spacers almost always occur south of the Rio Grande, while the bulk of the bead types are shared with other Texas missions of the Spanish Colonial era.

## INTRODUCTION

From 1975-1976, excavations were carried out at Missions San Juan Bautista and San Bernardo, near the present-day town of Guerrero, Coahuila (Figure 1). This was part of the Gateway Project, a series of archeological and ethnohistorical investigations carried out under the terms of a permit from the Direccion de Monumentos Historicos del Instituto Nacional de Antropologia e Historia. Funding came largely from the National Endowment for the Humanities, the Kathryn Stoner O'Connor Foundation, and the Sid Richardson Foundation.

Several summaries of the project have appeared in print (Adams 1975, 1976, 1977, 1980; Eaton 1981, 1989; Hester 1977, 1989; Hester and Eaton 1990), along with monographs on the ethnohistory of the missions (Campbell 1979) and Spanish colonial history (Almaraz 1979,1980). In addition, a bilingual summary of the research and a guide to the missions, as well as the town of Guerrero (the location of the former Presidio del San Juan Bautista del Rio Grande del Norte), was published by Eaton (1981). Most recently, Inman (this volume) has studied the mission Indian lithic materials from the two sites.

During the initial analysis of the material culture found at the Guerrero missions, the late R. K. Harris, and his wife, Inus Marie Harris, were asked to examine the trade beads found in the excavation of middens and living quarters related to the mission Indians. The Harris' had long been respected scholars in the study of trade beads (e.g., Harris and Harris 1967, 1974) and carried out the analysis reported here, providing the Gateway Project with a manuscript in 1978. The delay in publication has resulted largely from the desire to publish color illustrations of the beads, in order to make the Harris' study more useful for comparative studies with other missions in the Texas-Mexico borderlands. Much of the text that follows is derived from the Harris and Harris manuscript of 1978, with editing and additions by Hester.

## METHODS OF MANUFACTURING GLASS BEADS

Before presenting the analysis of the glass beads, we will discuss methods of manufacture and other terms used herein. The major technical problem in the mass production of glass beads is that of finding some simple and practical means of forming the perforations by which the beads are strung. Two basic methods of accomplishing this end have been devised, and have been in use for centuries.

One of the methods is to draw out a hollow glass tube and then to break the tube into bead-length sections. A second method is to apply viscous

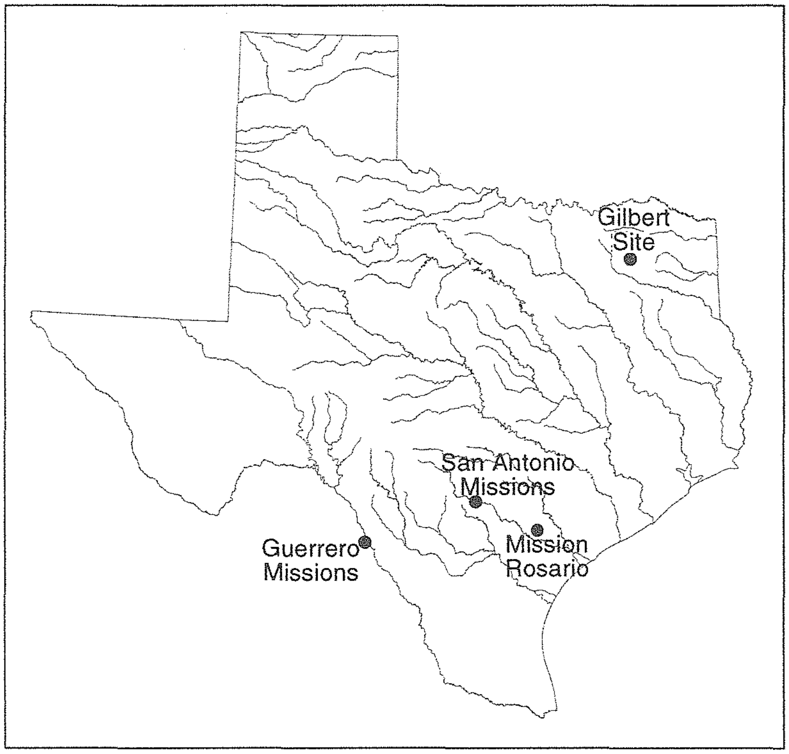


Figure 1. Locations of Selected Sites of the Spanish Colonial Era in Texas. Shown here are the approximate locations of mission localities and sites, several of which are referred to in the text.

glass around a mandrel or wire by any of several techniques so as to form a bead, after which the mandrel or wire is removed.

In reference to trade beads, we employ the terms *hollow-cane* and *mandrel-wound* as standard names for these manufacturing methods. Each method is described briefly below, and criteria are given to aid in the recognition of manufacturing methods through examination of the beads themselves.

### The Hollow-Cane Method

To make hollow-cane beads, the glassblower gathers a mass of molten glass at the end of his blowpipe (this mass is called a *paraison* by glass workers), blows a bubble into its center, and shapes it into a small cylinder a few inches long. An assistant attaches an iron rod to the end of the cylinder opposite the blowpipe and he and the glass blower then move at a fast walk in opposite directions, a procedure which draws out the ductile glass into a long, hollow tube termed a *cane*. The bubble blown into the *paraison* at the beginning is elongated, along with the viscous glass, so as to form a central hollow that runs the entire length of the cane. A cane produced in this manner may be more than 300 feet long. After the cane has been broken into sections about two feet long to facilitate handling, the breaking of the cane sections into bead-length pieces proceeds in the following manner, as described by Lardner (1832:183):

> ...a sharp iron instrument is provided, shaped like a chisel, and securely fixed in a block of wood. Placing the glass tube upon the edge of this tool at the part to be separated; the workman then, with another sharp instrument in his hand, cuts, or rather chips, the cane into pieces of the requisite size; the skill of the man being shown by the uniformity of the size preserved between the different fragments. The minute pieces thus obtained are in the next process thrown into a bowl containing a mixture of sand and wood-ashes, in which they are continually stirred about until the perforations in the pieces are all filled by the sand and ashes. This provision is indispensable, in order to prevent the sides from falling together when softened by heat in the next operation.
>
> A metallic vessel with a long handle is then provided, wherein the pieces of glass are placed, together with a further quantity of wood-ashes and sand; and the whole being subjected to heat over a charcoal fire, are continually stirred with a hatchet-shaped spatula. By this simple means the beads acquire their globular form. [This process is here called tumbling]. When this has been imparted, and the beads are again cool, they are agitated in sieves, in order to separate the sand and ashes; this done, they are transferred to other sieves of different degrees of fineness, in order to divide the beads according to their various sizes.

Structurally, hollow-cane beads may be either simple or compound, with layering being the standard technique for fashioning the compound varieties. In making layered beads by the hollow-cane method, the same procedure is followed as described above, except that the initial cylinder, which is shaped from the *paraison*, is dipped into molten glass of a second color just before the cane is drawn out. As a result, the cane emerges with a veneer of this second kind of glass superimposed over the core component. Multiple layers can be formed by additional dippings. (In several archeological reports, each of the different layers in a bead has been called a cane. This, however, is not in accordance with standard usage among glass manufacturers; therefore, it is suggested that the term *cane* be used in reference to the whole tube, whether simple or compound, and *layer* in reference to the individual concentric components.)

Inlay, usually of stripes in the case of hollow-cane beads, is achieved by laying slender, solid canes of colored glass longitudinally along the surface of the initial cylinder and pressing them in firmly. Then, when the cane is drawn out, the slender inlaid canes are drawn along with it and appear on the finished beads as inlaid stripes. If the tube is twisted as it is drawn, the stripes will come out spiraled around the bead in the manner of stripes around a barber pole.

In cross-section, the shape of the cane may be round or polygonal. Some of the faceted beads are made from hexagonal canes by cutting or grinding facets on each end of the bead, leaving the original shape of the cane in the middle (Woodward 1965:9).

### The Mandrel-Wound Method

In making beads by this method, molten glass is formed around a mandrel (bar or shaft) and, after the glass has cooled, the mandrel is removed, leaving a perforation through the bead. We have been unable to locate any detailed description of the techniques by which the glass is actually formed around the mandrel, but probably the mandrel-wound beads were made by rolling a thread or ribbon of molten glass around a revolving mandrel so as to build up the body of the bead, in much the same manner as yarn is rolled onto a spindle. Since the mandrel-wound method is inefficient—as compared to the hollow-cane method—for making seed beads, it is seldom if ever used for that purpose.

### Structure

In spite of their small size, some glass beads are made up of numerous structural components. Most striped Cornaline d'Aleppo beads (Harris Types No. 67 and No. 68), for example, contain at least 38 distinct structural elements: three sets of stripes, each set consisting of three separate stripes, and each stripe made up of four or five tiny glass rods (minimum of 36 tiny rods); plus a core of green glass, a layer of opaque red glass, and sometimes a thin veneer of transparent glass on the surface.

Simple beads are those composed of a monolithic, structurally undifferentiated mass of glass. Both hollow-cane and mandrel-wound forms are common.

Compound beads are those consisting of two or more concentric layers of glass, one over the other. These are normally hollow-cane beads.

## COUNTRY OF ORIGIN

The problems involved in trying to determine the countries where beads were manufactured between 1700 and 1850 are especially perplexing. Woodward (1965:4) states, "In general, the bulk of the glass beads, traded on the North American continent from the 16th until around the first half of the 19th centuries, were made in the glass factories of Murano, Venice" (Dubin [1995:39] states that Venice dominated the world bead market until the 20th century). This is undoubtedly an accurate statement with regard to the trade beads of the 16th, 17th, and early 18th centuries, but it may not fully apply to the period of our particular concern, which is roughly 1700-1830. With the fall of the commercial Republic of Venice in the 1730s, it is reported that the glass production of Murano declined drastically, until by about 1735 what had once been a flourishing enterprise supporting 300 glass houses was quickly reduced to less than 20 (Rodgers and Beard 1937:40). During that time, many of the Italian bead makers reportedly moved to other European countries, including England, Holland, Belgium, France, and Spain, where some of them were employed in glass factories. Because of the secrecy of the guilds that surrounded the manufacture of beads, it will be extremely difficult—perhaps impossible—to ever unravel the historical details concerning the places where 18th and 19th century trade beads were manufactured (Dubin 1995:39). Possibly the changes in bead types between Time Periods 1 (1700-1740) and 2 (1740-1767) reflect this shift in locus of manufacture (cf. Harris and Harris 1967).

## GLASS BEAD TYPE DESCRIPTIONS

In the following descriptions, a standard color chart used by the Harris' (Bustanoby 1947:28-29 and Plate 8) was used to indicate the hues of the beads. The color illustrations here (Figure 2) are derived from photographs provided by the National Museum of Natural History, Smithsonian Institution, where the complete set of the Harris Bead Boards are housed (a partial set is curated at the Texas Archeological Research Labortory [TARL]). Figure 2 was composed from scanned images done by Robin Benson (TARL) from the Smithsonian color prints.

It should be noted that bead surfaces are frequently altered by age and weathering, and it is sometimes difficult to determine the original color. However, the color can often be restored by immersing the bead in a weak solution of muriatic acid for about two hours and then washing it in water. It is surprising how many beads that would have otherwise been classified as dirty-white turn out to be red, green, yellow, or blue when cleaned.

General terms are used to describe the bead shapes: barrel-shaped, donut-shaped, round, and tube-shaped (bugle). Some of the larger (necklace) beads are described as being olive-shaped. This term was taken from an early 18th century document (Thwaites 1959:143) and was apparently


Figure 2. Examples of Harris bead types found at the Guerrero missions. Lengths for selected examples: No. 10, 9 mm; No. 51, 3 mm; No. 53, 17 mm. The very small beads (i.e., Nos. 45, 46, 50 and 83) are generally about 2 mm long and 3 mm in diameter.

widely used by the French to describe certain of the trade beads.

There is documentary evidence that mission Indians used the larger beads mainly for necklaces and the small and medium-sized ones principally on skins, garters, and the like. The large beads will here be referred to as necklace beads, while the medium and small ones are called garter beads. The beads were sorted into size groups as follows (the measurements are for bead diameter, perpendicular to the hole axis; length is disregarded in the Harris classification): 0-2 mm=extra small; 2-4 mm=small; 4-6 mm=medium; and over 6 mm=large.

At the end of each type description, it will be indicated whether the bead is *tumbled* (that is, as in the manufacturing process described above), *untumbled* (with ends left sharp), and/or *twisted* (while the hot canes were being stretched lengthwise). The abbreviations T, UT, and TW will be used to indicate the respective processes (Harris and Harris 1967:139).

## BEAD TYPES AT GUERRERO MISSIONS

The 547 glass trade beads found at San Juan Bautista and San Bernardo comprise 20 types using the bead charts of R. King and Inus Marie Harris (Harris and Harris 1967:129-160 and Figures 52-53):

*No. 5.* Medium, white, opaque, barrel-shaped garter bead, of compound construction. The inner layer of glass has a porcelain-like texture, while the outer layer is clear glass but has a slightly frosted appearance, probably due to age. One specimen. T.

*No. 10.* Large, peacock blue, opaque, barrel-shaped necklace bead of simple construction. The glass has fine lines running lengthwise with the bead, giving it a texture reminiscent of stripped sugarcane. Six specimens. T.

*No. 10-A.* Large, emerald green, translucent barrel-shaped necklace bead of simple construction. Three specimens. T.

*No. 15.* Medium, Gobelin blue, opaque, barrel-shaped garter bead of simple construction. The glass is porcelain-like in texture. One specimen. T.

*No. 44.* Small, white, opaque, doughnut-shaped garter bead of simple construction. The glass has a porcelain-like texture. Three specimens. T.

*No. 45.* Small, white, opaque, doughnut-shaped garter bead of compound construction. The inner layer has a porcelain-like texture, and the outer layer is clear but has a slightly frosted appearance, probably due to age. Twenty-four specimens. T.

*No. 46.* Small, peacock blue, opaque, doughnut-shaped garter bead of simple construction. The glass of this bead has a sugarcane-like texture. One hundred and one specimens. T.

*No. 48.* Small, dark bluebird blue, translucent, donut-shaped garter bead of simple construction. One hundred seventy-three specimens. T.

*No. 49.* Small, clear, doughnut-shaped garter bead of simple construction. Twenty-three specimens. T.

*No. 50.* Small, black, opaque, doughnut-shaped garter bead of simple construction. The glass is porcelain-like in texture. One hundred and sixteen specimens. T.

*No. 51.* Small, red, opaque (outer layer), doughnut-shaped garter bead of compound construction. The outer layer of opaque glass is brick red, and the inner layer is a translucent light green. This bead is generally referred to as "Cornaline d'Aleppo." Eleven specimens. T.

*No. 53.* Large, milk-glass, translucent, round necklace bead of mandrel-wound construction. Three specimens.

*No. 57.* Small, red, opaque (outer layer), tube-shaped (bugle) garter or necklace bead of compound construction. The outer layer of opaque glass is brick red and the inner layer is translucent light green. This bead is the same as No. 51 except the diameter equals that of a small size bead. One specimen. T.

*No. 62.* Small, fern green, opaque tube-shaped (bugle) garter or necklace bead of simple construction. The glass is porcelain-like in texture. Two specimens. T.

*No. 81*. Small, Colonial yellow to brass-colored, opaque, doughnut-shaped garter bead of simple construction. The glass often has a cane-like texture. Two specimens. T.

*No. 82*. Small, Colonial yellow to brass-colored, translucent doughnut-shaped garter bead of simple construction. Fourteen specimens. T.

*No. 83*. Small, emerald green, translucent, doughnut-shaped garter bead of simple construction. Forty-five specimens. T.

*No. 84*. Small, emerald green, opaque, donut-shaped garter bead of simple construction. The glass sometimes has a cane-like texture. Fifteen specimens. T.

*No. 88-A*. Large, black, opaque teardrop-shaped bead of mandrel-wound construction. The surface of the bead appears to have been turned, thus smoothing the surface of the bead. One specimen.

*No. 164*. Medium, bluebird blue, translucent, barrel-shaped garter bead of simple construction. Two specimens. T.

## TYPE DESCRIPTION FOR CORAL TRADE BEADS

*No. 1*. Round to barrel-shaped, small bead made from salmon-pink coral. Thirteen specimens.

The coral beads were made by taking pieces of coral and drilling the hole with a metal drill, as the holes are the same diameter all the way through. Then the beads were cut off and finished.

## TYPE DESCRIPTION FOR BEAD SPACERS

*No. 1*. Small flat disk-shaped pieces of brass used between beads as they are strung. They vary in size from 2 to 3 mm. Fourteen specimens.

## CHARACTERISTICS OF THE GLASS BEAD TYPES

### Structure

Of the 20 bead types from San Juan Bautista and San Bernardo, Types 10, 10-A, 15, 46, 48, 50, 53, 62, 81, 82, 83, 84, 88-A, and 164 are made up of one layer of glass (simple structure). Types 5, 45, 51, and 57 are made up of two layers of glass (compound structure).

### Methods of Manufacture

Of the 20 glass bead types at San Juan Bautista and San Bernardo, Types 5, 10, 10-A, 15, 44, 45, 46, 48, 49, 50, 51, 57, 62, 81, 82, 83, 84 and 164 were made by the hollow-cane method. Types 53 and 88-A were made by the mandrel-wound method.

### Beads Overheated in Tumbling

In Operation (Op.) 101-T-2 at San Juan Bautista (a linear apartment structure built for mission Indians), two beads of Type No. 48 were found fused together. In Op. 9-D-1 (midden near mission Indian apartments) at San Bernardo, two beads of Type No. 50 were found fused together. In both of these cases, when the cut beads were placed in sand and ashes in a drum for tumbling, they were heated too hot, and the beads fused together.

## DISCUSSION OF GLASS BEADS: TIME PERIODS

In this section, the utility of bead types as time markers will be discussed. Some bead types are not definitive of a certain time period, but extend through three or four of the periods recognized here (see below). For example, some types of small garter beads may be present in about the same percentage from about 1700 to around 1836. In general, it can be said that the most definitive bead types are the medium and large-size complex, striped ones, and the medium and large-size faceted forms. However, a few small bead types are definitive. Sometimes a bead type may come into the trade in large numbers in a certain time period, and drop down to very small numbers in the following time periods.

The time periods utilized by Harris and Harris (1967:130) are: Period 1:1700-1740; Period 2:1740-1767; Period 3:1767-1820; Period 4:1820-1836, and Period 5:1836-1850. In discussing the various proveniences we will use the word "Operation" to refer to the locality in which the beads were found. "Operations" (Op. or Ops.) and "Suboperations" (Subops.) were used to designate excavation units, trenches, and other proveniences during the Gateway Project (see Eaton 1989).

### Contexts of Beads at San Juan Bautista

Most of the beads at San Juan Bautista come from an area of the mission church, Op. 100-Q, which was likely the baptistry (Almaraz 1980:6). Operation 101 is a linear apartment structure used as mission Indian quarters, with a bastion (101-W) at the west end. In 1772, the Indian quarters are described as built of stone (Almaraz 1980:14); Op. 105 is a mission Indian midden deposit, not far from Op. 101.

Op. 100-Q has Type Nos. 5, 10, 15, 46, and 164. Type Nos. 5, 10, 15, and 164 indicate a time period between 1700-1740. Type No. 46 is not a good time indicator, as it dates from 1700-1836. Additionally, since this location of San Juan Bautista was not constructed until 1740, these types either have a longer time span that once thought or were brought from the earlier location.

Op. 101-W-1 (bastion) has only one specimen, Type No. 45. This type dates from 1700-1836, and is not a good time indicator. Since the 1772 inventory does not mention the bastion (Almaraz 1980:14), it was likely built late in the 18th century.

Op. 105-D-3 (midden) has only one specimen, Type No. 57. This type dates from 1740-1767, consistent with its context at San Juan Bautista.

Ops. 101-P-2, 101-R-1, 101-R-3, 101-S-3, 101-S-4, 101-T-2, 101-U-1, 101-U-3, and 105-B-1 (Indian quarters, separate Indian house mound [101-R; Structure III], and associated middens) have four types of glass beads present that are good time indicators: Type Nos. 81, 82, 83, and 84. They are present in various numbers in the operations, and indicate a time period of 1740-1767. Type Nos. 44, 45, 46, 48, 49, 50, and 51 are not good time indicators as they each date from 1700-1836. Type Nos. 53 and 164 are present in very small numbers and probably date around 1740.

From the above feature data, it appears that nine of the operations at San Juan Bautista date from roughly 1740 to 1767. Indeed, the mission was established at its present location in 1740 and continued in use until around 1810. Although we have few data on the Indian populations at San Juan Bautista, research by Campbell (1979:59) reports a census of 238 individuals in 1772.

### Contexts at San Bernardo

At Mission San Bernardo, a great deal of excavation was done in linear mission Indian apartments, with six such structures (I-VI) constituting a mission Indian *pueblo* in the northwest part of the site. Op. 6 represents Structure IV and Op. 7, Structure VI. These stone and adobe structures were apparently built after 1756, and by 1772 there were 40 houses forming two streets (Almaraz 1980:46). Ops. 8 and 9 are mission Indian middens associated with these structures.

Ops. 6-F-1, 9-C-1, and 9-D-1 have beads of Type Nos. 81, 82, and 83 present. This would place the operations in Time Period 2, or between 1740-1767. Type 88-A is a rosary bead dating to the same period.

Ops. 7-A-1 has only two beads of Type No. 10-A. This type dates from 1700 to 1740. It would have been nice to have had a larger sample of beads from this operation.

Op. 8-D-1 has Type Nos. 48, 50, and 51 present. These types are not very definitive as to dating, as they occur from 1740 to 1836. This operation, however, and Op. 6-F-1, each have one specimen of Type No. 62 present. This type is very interesting in that only two specimens of this type are known from sites north of the Rio Grande. One is from the Gilbert site, a Norteño (Wichita) site in Rains County, Texas, dating between ca. 1740 and 1767 (Jelks 1967). The other specimen comes from an undated site near Colorado City, Texas. This bead is the only historic item from the site (Skinner 1978:44).

About 1965 an artifact collector reportedly from Dallas, Texas, Robert Shelton, excavated two 5 foot squares at the site of San Bernardo (probably in the middens associated with the structures of the

Indian pueblo described above; notes by R. K. Harris sent to T. R. Hester in 1978). He recovered 72 specimens of the Type No. 62 bead, along with a spoon-shaped *higo* (R. K. Harris, personal communication to Hester, September 15, 1978, distinguished two types of *higos,* the spoon-shaped [noted here] and the clenched-fist [*fica*] styles), and five metal arrow points of the Benton type (Figure 3; Harris and Harris 1967:160). Similar metal arrow points were found in the Gateway Project excavations in the Indian quarters area. The *higo* and the metal points date from about 1740 to 1820.

From the above data, it can be seen that three out of five operations at San Bernardo date about 1740-1767, while others date as early as 1700. The mission was established in 1702 and was officially secularized in 1794; however, it continued in operation for several years thereafter (in 1797-1798, there were 73 mission Indians still at San Bernardo [Almaraz 1979:40]). There are widely varying figures given for the 18th century mission Indian population at San Bernardo (e.g., Weddle 1968). Campbell (1979:59) reports a total population of 46 individuals in the 1734 census, growing to 156 by 1772.

## DISCUSSION OF CORAL BEADS

Ops. 101-R-1, 101-R-3, 101-S-4, and 101-T-2 (Indian quarters and middens) at San Juan Bautista, and Op. 9-C-1 (midden) at San Bernardo produced 13 small, round, or barrel-shaped beads made from salmon-pink coral. The Harris' have records on one site in Texas and one site in California where coral beads are present. The Texas site is Mission Rosario in Goliad County (Harris and Harris 1974:71), and the California site is San Jose Mission (May 1977 Harris and Harris bead study). In a discussion with Catholic priests, they are inclined to believe that

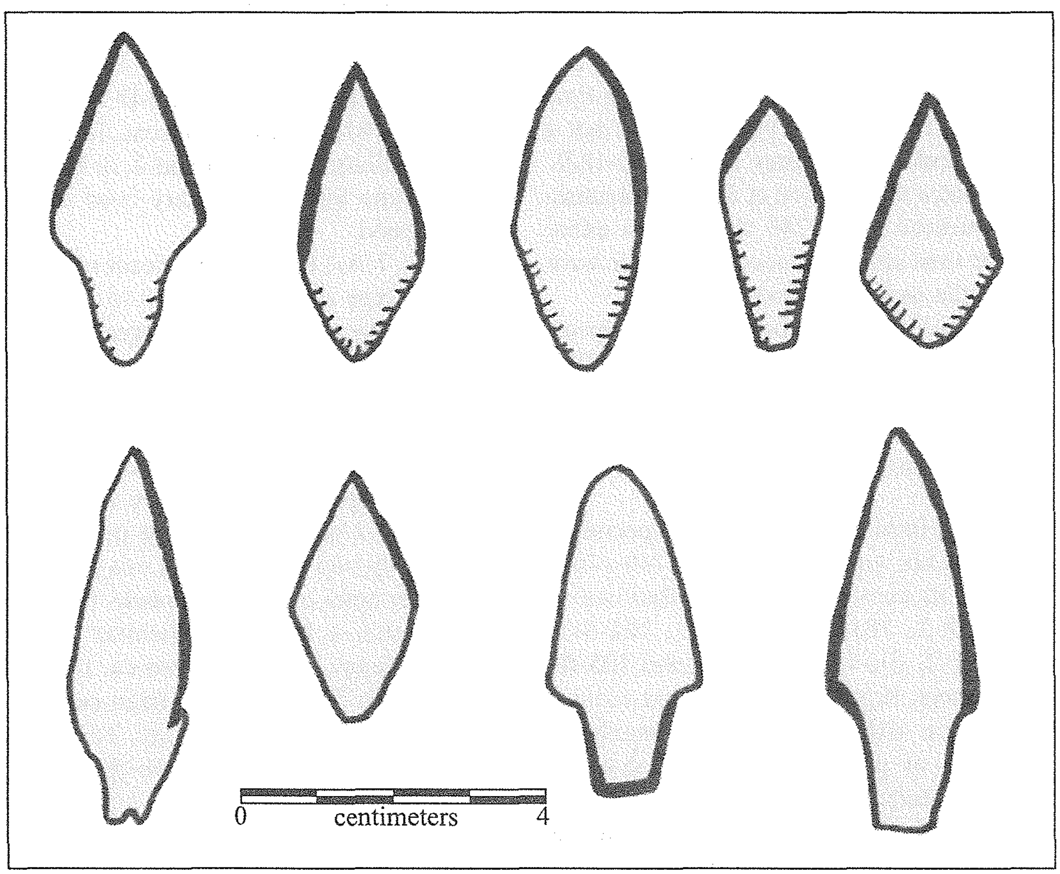


Figure 3. Metal Arrow Points from the Guerrero Missions, Coahuila. Top row: sketches provided by R. K. Harris of the Shelton collection from Guerrero. These are described by Harris as Benton points. Sketches of similar arrow points found during the Gateway Project excavations are on the bottom row.

these are beads from rosaries given to the Indians. At Mission Rosario these beads probably date between 1750-1780. They are probably dated around 1790 in California at Mission San Jose.

## DISCUSSION OF BRASS BEAD SPACERS

Ops. 101-P-2 and 101-T-2 at San Juan Bautista (Indian quarters) produced 14 brass bead spacers. In making these spacers, a tiny ring was made from a brass wire. This was then hammered flat. These spacers looked somewhat like a sequin used on ladies' dresses. Under a magnifying glass one can see the joint in the brass wire. In size, they vary from about 2 to 3 mm in diameter. When beads were strung, the spacers were placed between the beads. The Harris' have never seen these bead spacers north of the Rio Grande.

## CLOSING COMMENTS

Detailed descriptions of Spanish Colonial period glass trade beads, coral beads, and bead spacers have been presented for the missions of San Bernardo and San Juan Bautista, at present-day Guerrero, Coahuila. The analyses were done using the Harris system and through referencing bead boards prepared by R. K. and Inus Marie Harris. Unfortunately, no comprehensive study of mission-era trade beads has been done for Texas, making comparative comments difficult. Fortunately, we have been able to use color illustrations in this paper, hopefully allowing broader comparisons by scholars working at other sites.

The dating of the trade beads generally reflects the known historic ages of both missions, with beads of post-1740 age present at San Juan Bautista, while the bulk of the earlier beads were at San Bernardo, founded in 1702. The indication that some of the bead types continue into the early 19th century is not surprising, as both missions continued to work with local Indian groups after the official orders of secularization in 1794.

Two beads of Type No. 62 have been seen by the Harris' only twice north of the Rio Grande, one example coming from the Gilbert site. The coral beads and brass bead spacers were also unusual in terms of their occurrence at Guerrero. In addition, Benton metal points, known mainly from the Red River area, are reported here, based on a relic-collector's unauthorized excavations at San Bernardo in 1965. However, since these missions were truly the "gateway to Spanish Texas" for many decades, with a variety of Indian groups moving in and out (Campbell 1979), and with trade going back and forth through this area between Mexico and Texas, it is not terribly surprising that artifacts were found outside the realm of what might be normally expected.

## ACKNOWLEDGMENTS

The junior author and all participants in the Gateway Project are very grateful to the late R. King Harris for his expert analysis, aided by his wife, Inus Marie (Mrs. Harris also provided permission for the publication of this present paper). Mrs. Robert Stuckenrath at the Smithsonian Insitution kindly arranged for the photography of parts of the Harris Bead Boards in their collections (catalogue numbers 516240-46).

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# San José de Corralitos, A Spanish Colonial Ranch in Zapata County, Texas

*Sharon E. Fleming and Timothy K. Perttula*

## ABSTRACT

San José de Corralitos is a Spanish Colonial site located on the left or north bank of the Rio Grande near Laredo. Associated with the 329,000 acre Spanish land grant to José Vásquez Borrego in 1750-1753, the ranch at San José de Corralitos was developed by Borrego's grandson, José Fernando Vidaurri. The site includes two historic ranch buildings and archeological deposits dating to the late 18th and 19th centuries. The architectural and archeological resources are discussed and a framework is posited for the architectural development of ranch buildings during the colonial, post-colonial, and modern periods.

## INTRODUCTION

The founding of ranch settlements in the mid-18th century figured prominently in the overall strategy for colonizing Nuevo Santander (see Alonzo 1998; George 1975; Rocha 1997). Ranches located in modern Zapata County, Texas were within the original jurisdiction of the colonial town called Revilla, now known as Guerrero Viejo, Mexico. A significant number of these historic ranches were inundated by Falcon Reservoir in the 1950s.

Along the Rio Grande's north bank, ranchers were granted *porciónes*, allotments of about 5,000 acres, with a single exception of the large tract assigned to José Vásquez Borrego in 1750. The subject property, San José de Corralitos, is a sub-grant of the Nuestra Señora de los Dolores hacienda.

This study of San José de Corralitos, also called "Los Corralitos," includes archival testimonies that provide dates for permanent settlement of the ranch in 1766 and for construction of the *fortaleza*, or fort, by 1786. The archeological and architectural analyses confirm the late 18th century origin of the single-room building and occupation of the site, thereby suggesting that Los Corralitos contains the earliest known house or ranch building still standing in Texas. This conclusion contradicts the 1977 National Register nomination data that posits a late 19th century date of construction (1977 Los Corralitos National Register of Historic Places nomination form, on file at the Texas Historical Commission), and the late 18th century age confers a much greater historical and architectural significance to this site.

Architectural features of Building 1 fit into a morphology of historic colonial and post-colonial ranch buildings proposed by Fleming (1998:226-237). The shift from a fortified building type to a non-fortified building type is a critical architectural distinction whose clarification may assist interpretation of other ranch buildings and architectural remains in the lower Rio Grande region.

## SPANISH COLONIAL SITES IN THE REVILLA AND LAREDO JURISDICTIONS

In the early 18th century, between New Spain's colonized centers in Mexico and the outlying posts on the northern frontier, lay a great unoccupied territory surrounding the Rio Grande valley. The Spanish decided that this area must be settled to discourage French settlement and possible English encroachment.

The King of Spain issued a royal edict on July 10, 1739 ordering the colonization of the Rio Grande valley, and in 1746 he appointed José de Escandón as the leader of the colonizing venture. Escandón determined that 14 settlements would be established at selected locations; the settlers would originate from nearby jurisdictions and would obtain numerous concessions in addition to a land grant; a Captain-General would supervise the military, civil, and judicial requirements of each town, thus negating the need for a presidio; and missionary responsibilities would be granted to the College of San Francisco of Mexico and the College of Guadalupe of Zacatecas.

The new province of Nuevo Santander was the first among the Internal Provinces of New Spain to be established by civilians as the leading force rather than missionaries or soldiers. The royal mandate dictated careful selection of families with character and moral integrity from well established ranch settlements in the province of Coahuila. To attract such families, the first settlers were offered allotments of both farm and pasture lands as well as a bonus of 100 or 200 pesos to buy the implements necessary for the first year's use (Crawford 1925:44).

On October 10, 1750, Vincente Guerra, a rancher from Monterrey, together with 40 families, established the Villa San Ignacio de Revilla at a site called Los Moros. The community was established near the junction of the Rio Grande and Salado rivers. Within seven years, 29 ranches were established within the jurisdiction of Revilla and it contained 357 people (Sánchez 1994:27).

In a second wave of settlement, Don Tomás Sánchez de la Barrera y Garza petitioned Escandón to establish a town on the north bank at a ford known as Paso de Jacinto. He, along with three families from his ranch, reached the site on May 15, 1755, and began construction two days later. By 1757, this settlement of Laredo was still quite small, comprised of only 11 families numbering 85 person (Garcia 1970:12).

In 1767, a Royal Commission was specially appointed to award grants of land to settlers. These grants included town lots and farm tracts (Almaráz 1978:16). When the Commissioners surveyed Laredo on June 25, 1767, there were 35 families already living on the north bank of the Rio Grande.

An additional group of land grants was given to a limited number of individuals between 1767 and 1810 in Nuevo Santander. Land on the north side of the river was granted only for ranching and grazing with the exception of the town of Laredo (Vigness 1948:13). The result was the establishment of historic settlements such as Capitaneño, Clareño, Ramireño, and others in present Zapata County.

By 1795, the entire population of the province was 30,450, and the total number of livestock 797,874. The populations of the colonial towns were: Laredo, 636, Mier, 973, Camargo, 1,174, Reynosa, 1,191, and Revilla, 1,079 (Jones 1979:69). The population of Nuevo Santander dwarfed its neighbor province, Tejas.

A census of the town of Laredo by Ildefonso Ramón, mayor in 1819, noted a total of 1418 persons in the jurisdiction, making the city larger than any on the north side of the Rio Grande other than San Antonio de Béxar. Although the town had tripled in size during the last three decades, war with Native American groups had made living conditions very difficult. Ramón noted:

> Of the forty-four ranches noted, thirty-seven of them are abandoned [depopulated], on account of the desolating war that the barbarous Indians of the North wage against us, and the other seven are only being operated at great risk during the seasons of planting, cultivating and harvesting...for before the revolution against the [Spanish] Kingdom and before the barbarous Indians had begun the hostilities that they are so frequently making, they busied themselves in caring for their stock of all kinds, but many of these have been exterminated, and now they have nothing else to live upon until the arrival of the troops that are garrisoning in this place...In the prairies are roaming a great number of wild horses unbroken; there are also 160 mares that we have not been able to groups in orderly manadas [bunches] because we have been unable to give them attention. Likewise, quite a lot of cattle, the number of which cannot be calculated because they are scattered far and wide, and have reverted to the wild state. Between two of our citizens who were the principal ones to have a considerable number of them, they still have 1,000 head of sheep and goats, but they have had to suffer in their efforts to maintain them, the death of some shepherds and have to stand considerable expense,

> strengthened by the hope that when the barbarous nations give us peace, they will have a chance to make an increase in these species, as it happened when times were quiet, then all the citizens of this place made great progress up to the time of the declaration of the war against the barbarous Indians (Green 1990:12-13).

After the independence of Mexico from Spain in 1821, no new towns were founded along the lower Rio Grande. Vigness (1948:17) states that colonization efforts by the Mexican government "failed because of the menace of the Indians and because the most desirable locations in the area had been assigned as porciónes or larger grants, leaving available for colonization only lands unsuited for grazing, much less for agriculture, which were the chief interests of the colonizers of the time."

By 1836, more than 200 Spanish and Mexican land grants existed between the Nueces River and the Rio Grande (Figure 1). These *porciónes* covered large areas of territory. The south bank of the river east of Reynosa was the property of José de Escandón and his heirs, estimated at 100 miles of riverfront and 2.8 million acres (Vigness 1948:13-14). The riverfront settlements in Nuevo Santander were occupied by families of Spanish descent throughout the Spanish Colonial and the Mexican Colonial era. The 1846 census shows that there were no Anglo-Americans living in Laredo.

## SAN JOSÉ DE CORRALITOS

The initial years of Spanish colonization of the lower Rio Grande introduced settlers to new challenges of the sparsely-occupied northern frontier. For those obtaining large grants for cattle ranching, such as José Fernando Vidaurri, success carried the burden of defending their families and stock at great effort and risk. The legacy of the Vidaurri family—as mainfested in the architectural and archeological remains at their ranch—provide tangible physical evidence of their struggle.

### Archival data

José Vásquez Borrego owned a large ranch known as Hacienda San Juan del Alamo located northeast of Montclova in the province of Coahuila.

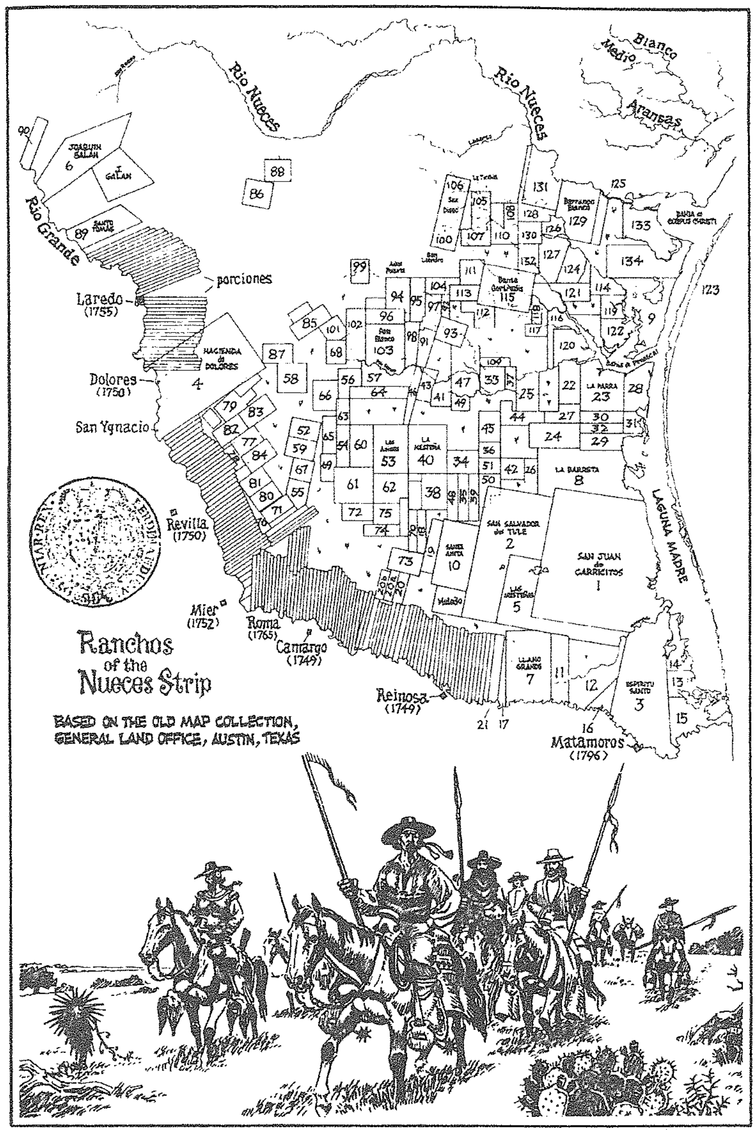


Figure 1. Jackson (1986) map of land grants in South Texas.

However, like many colonial ranchers, his interests lay northward. When José de Escandón announced the colonization of Nuevo Santander, Borrego petitioned him for the right to settle at the juncture of the Arroyo Dolores and the Rio Grande on its north bank, eight leagues northwest of Revilla and 30 leagues downriver from the presidio at San Juan Bautista. Strategically, the settlement was significant in its location on "the road which is the most direct, best and safest from the new Kingdom of León and the Province of Coahuila to the Fort of the Espíritu Santo Bay on the Nueces River and the other Missions" (Lott and Martinez 1953:129).

Borrego's oldest son, Juan José Vásquez Borrego, closed the agreement, which included exemption from taxes for 10 years on the huge land grant situated in modern Webb and Zapata counties (see Figure 1). The request for 50 *sitios de ganado mayor* (a parcel for large stock totaling 4,428 acres) and 25 *sitios de ganado menor* (a 1,985 acre parcel for small stock) totaling over 270,000 acres was fulfilled on August 12, 1750 when Escandón dedicated the grant. Twelve families from San Juan del Alamo were present (Jackson 1986:24).

A nephew, Bartolomé Borrego, was put in charge of the settlement known as Rancho de Nuestra Señora de los Dolores (Our Lady of Sorrows) located less than a hundred yards upriver from the Arroyo Dolores. It was the first of many ranch settlements on the north bank of the Rio Grande in the new province of Nuevo Santander and the only human habitation in a 100 mile radius.

A few years later, in 1753, Borrego asked Escandón for additional tracts known as San Ygnacio, named for the patron saint of Revilla, and San José de Corralitos. As part of the agreement, one or two boats "for conduct of the royal service of the new colony" would be provided at the river crossing by Borrego. He would also provide a water supply from the Rio Grande, Arroyo Dolores, or Arroyo Salado to the open fields. With the addition of the San Ygnacio and San José de Corralitos tracts, Borrego's holdings totaled approximately 329,000 acres (Garcia 1970:2).

Settled by families accustomed to ranching on the frontier, the Dolores hacienda quickly grew and prospered. Escandón's visitation report in 1754 mentions that cattle raising was the principal occupation of the 123 residents of Dolores. José Tienda de Cuervo's official inspection report dated July 20, 1757 lists 23 families, totaling 122 persons all living in *jacales*. The livestock included 3000 head of cattle, 3000 mares, 400 saddle horses, 1600 mules, and 1050 donkeys.

Don José Vásquez Borrego and his wife had four children: Juan José, Macario, Fernando, and Manuela (Garcia 1970:2). Manuela married Juan Antonio Vidaurri and bore five children: José Fernando, José Maria Margíl, Francisco, Jesus, and Josefa. The oldest child of Manuela, José Fernando, was raised by his grandfather, José Vásquez Borrego.

Upon the death of Bartolomé Borrego in 1765, José Fernando Vidaurri Borrego, 22, married his cousin's widow, Alejandra Sánchez, the daughter of Captain Tomás Sánchez (Laredo Archives). The newlyweds lived in Laredo for almost a year before returning to live with Vidaurri's grandfather at El Pato (*South Texas Citizen* 1934).

In 1766, Borrego ordered that the ranch known as San José de Corralitos be vacated of stock so that his grandson, José Fernando Vidaurri, and his new bride could be given the property free and clear. The couple immediately settled on the property and established a sucessful ranch.

After Don José Vásquez Borrego died in 1770, Corralitos was the subject of dispute among the heirs: Borrego's son, Fernando Borrego, and grandson, José Fernando Vidaurri (*South Texas Citizen* 1934). Relative to the litigation in 1786, Don José Ignacio de Treviño, Justicia of Mier testified:

> that sometime in the September of 66 [1766] the applicant settled the aforementioned ranch and pasture land of San José de Corralitos with his own servants and equipment [.] It is true that he placed the fields in cultivation [and built] the corrals and jacales de viviendas he mentioned at his own expense with a fortaleza unlike all other buildings and places of work built on the margins of the Rio Grande of the North [.] These buildings were built for permanence [and] have remained in place for over twenty years, they have withstood the many enemy indians and were never abandoned [Moreover,] this ranch has served in the defense of his Royal Majesty (God keep him) with four armed men who [the applicant] has kept until this day at his own expense [.] With these men the applicant has provided

armed support for skirmishes, pursuits and military forays against those barbarian [natives and he] has provided at this own expense and without expectation of Royal reward, horses [and mules or donkeys] as well as supplies to several of those who were in need of them [.] These [acts] were done both for military purposes [against the natives] as well as for ranging and other Royal purposes; [.] It is also known to me that the above mentioned ranch and pasturelands were inherited by the applicant from his grandfather, Don José Vásquez Borrego, who removed from it all his belongings and conveyed this property free and clear of all charges to Vidaurri in order that the later could settle and enjoy it as his own without encumbrance [.] This [his grandfather did] as reward for the integrity and love with which [Vidaurri] assisted, served and helped him [Vásquez Borrego] with all his affairs, trade deals and other businesses. [T]his I know [and testify to] because I was living at the house of Commander [Vásquez Borrego] his grandfather [on the occasion of these events] and I was no longer a toddler [. On such occasion] the Commander requested again the presence and assistance of Vidaurri (who had left a few days before to the place of El Pato taking all his possessions) because [the Commander, his grandfather] could not be without Vidaurri, as he told me many times, because he missed him so [. Because of this request from his grandfather] said Vidaurri continued to perform the same duties for his grandfather without the slightest conflict arising from the manner Vidaurri assisted and served him; [.] This I declare before you with great esteem; because all that I have declared is what I know (Andres n.d.:11).

Many children were born to Alejandra Sánchez and José Fernando Vidaurri, including: Maria Encarnacion, Maria Luz, José Fernando, Jr., José Alejandro, José Ildefonso, Jesusa, and Guadalupe. By 1782, the population of Corralitos had increased to 66 residents while that of Dolores was reduced to 29 residents. Don José Fernando Vidaurri was known to have gotten along very well with the Laredo priests (Brown and Cadena n.d.:6).

After the turn of the 19th century, the Borrego-Vidaurri family aligned themselves politically with the insurgent priest, Father Hidalgo. As the revolution of Mexico against Spain began in 1810, Spanish troops were withdrawn from the area and Indian raids on the settlement increased. In 1811, several family members, including Macario Borrego and Fernando Borrego, were arrested as suspects in the revolution for the liberation of Mexico (Lott 1950).

During the Revolution, military defense of the ranchers waned. In response to recurrent Indian attacks, in 1814, José Maria Margíl Vidaurri, Fernando's brother, built a stone tower, or *torreón*, at Dolores. Cylindrical stone towers were typical of colonial presidios until the 1772 presidio realignment on the frontier (Moorhead 1975:161-165). The tower's advantages, however, were insufficient to sustain the community against assailants. In 1818, Margíl Vidaurri lost his oldest son to an Indian attack; the family was forced to abandon Dolores and retreat to Corralitos.

In 1829, after the Mexican Republic was established, the original Vásquez Borrego land grant was reaffirmed and partitioned into three large subdivisions that fronted on the river. The Dolores Subdivision, the most northerly tract, was set aside to José Maria Margíl Vidaurri. The San Ygnacio Subdivision was set aside to Fernando Borrego. The Corralitos subdivision "embraces about 1,000 varas wide, from said San Francisco Hills on the southeast, across said Corralitos Subdivision, to the 'Lomas del Difunto Flores' on the northwest boundary line of said Corralitos Subdivision." It was awarded to the children and heirs of José Fernando Vidaurri: José Alejandro Vidaurri and his wife, Leonor Canales, as well as his son Laureano and his wife Trinidad Cuellar, and his other son, Juan (Martinez 1950:3).

Laureano and Juan Vidaurri lived at the Corralitos ranch until their death in about 1882. The son of Laureano Vidaurri, Alejandro, was shot in 1889 by the foreman of La Perla, a ranch established by the Bruni family on the former Dolores hacienda. Alejandro and other members of the Vidaurri family were buried at a small family cemetery.

Mr. Everett Love of Laredo purchased Corralitos in 1917 from the surviving children of Laureano Vidaurri: Narciso Vidaurri and his wife Adela Garcia de Vidaurri, Jesus Maria Vidaurri, and Soledad Vidaurri. In 1939, Mr. Harvey Mecom of Liberty County purchased the Corralitos property, consisting of about 5000 acres, from Everett Love et al. (Webb County deed records). The ranch is currently owned by the descendants of Harvey Mecom.

Los Corralitos was surveyed by the Texas Historical Commission in 1976 and listed on the National Register of Historic Places in 1977.

## Architectural Data

San José de Corralitos, or Los Corralitos, is located in Zapata County, about 3 km north of the town of San Ygnacio and 30 km south of Laredo along Highway 83. The ranch occupies about 5,000 acres surrounding the site of the historic ranch buildings.

The historic ranch complex is situated within about 100 m of the Rio Grande. It contains two sandstone buildings with metal roofs, positioned at right angles about 45 m apart, and several frame structures, including a foreman's house, cowboy quarters, and a metal shed located at the north side of the complex.

"Building 1" is a single room structure with thick sandstone walls, a single door, and six gunports (Figure 2). These architectural features are consistent with early fortified ranch buildings (see below). Therefore, it is likely the *fortaleza* constructed by José Fernando Vidaurri by 1786.

The *fortaleza* measures 33 feet long, 18 feet 4 inches wide, and 13 feet six inches high. It is located nearest to the river on the west side of the complex. A single splayed door opening, 3 feet wide and 6 feet 2 inches high, with original framing, is located on the east elevation facing away from the river.

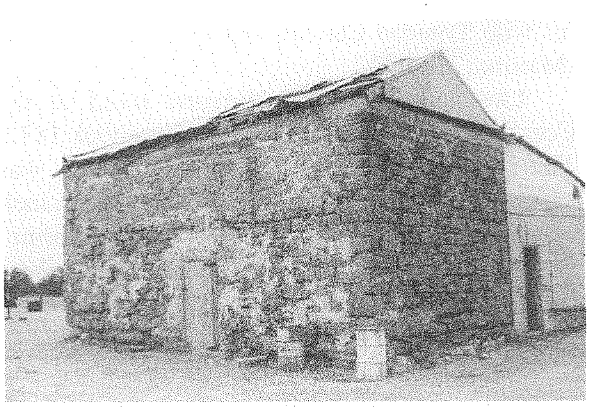

Figure 2. Photo of general exterior, Building 1, Corralitos.

Six gunports, or *troneras*, are regularly spaced around the perimeter wall at about 3 feet above the floor. The gunport openings are about 13 to 17 inches high and 24 to 49 inches wide at the interior, and reduce to an average height of about 8 inches near the exterior. The openings are lined with single thin stones on the upper and lower surfaces; the sides are splayed rubble masonry lined with plaster. They appear to be oriented to allow enfilade fire to the surrounding terrain (Figure 3).

The walls are constructed of roughly dressed sandstone blocks with mud mortar. Sandstone blocks at the four building corners are dressed at two faces to provide a smooth corner. Between the irregular sandstone blocks are smaller chinking stones to fill the gaps. The wall thickness varies between 2 feet 5 inches and 2 feet 10 inches. Both the interior and exterior walls were probably plastered, limewashed, and decoratively painted.

Additional interior features include a niche on the west wall, a wooden shelf set on projecting wood brackets on the north wall and many rectangular wood blocks, or *manitas*, set into the masonry. The niche is almost 30 inches square in elevation, and has a stone sill and wood lintel.

Although the roofing itself is typical, the framing system is unusual. The sawn wood members spanning the width of the building do not bear solely on the masonry wall. They are also end supported by a transverse beam resting on a series of brackets or *zapatas*. The *vigas*, or beams, are now missing, but pockets in the masonry indicate that there were about 20, each 13 feet 9 inches long (or 5 *varas*) and 6 inches square.

A small portion of roofing material remains at the northeast corner of the building interior. The original roof construction appears to have been *terrado*, or layered materials. First, 1 x 4 inch boards were placed over and perpendicular to the *vigas*. Next, small flat stone were mortared in place and coated with a lime, sand, and pea-sized gravel mixture known as *chipichil*. The finished roof surface sloped about 4 inches from east to west to provide drainage.

The west elevation features five equally spaced *canales*, or roof drains, at the base of the projecting

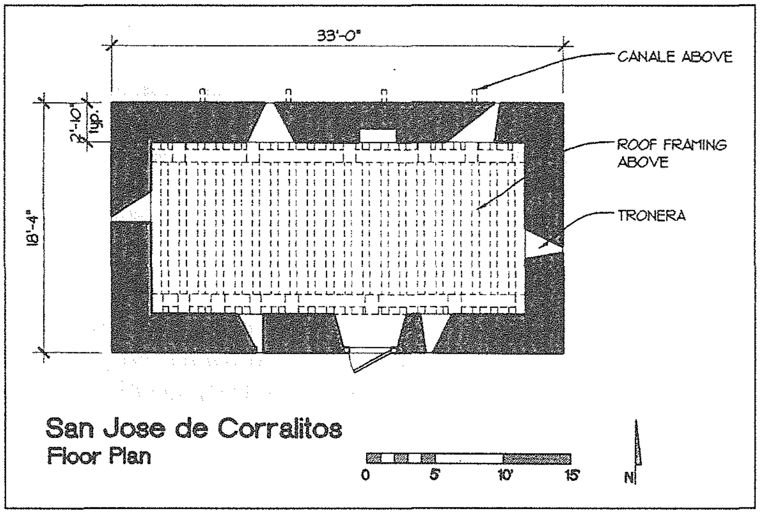


Figure 3. Measured floor plan of San Jose de Corralitos.

parapet. The roof drains, similar to the gunports, are formed by a wide splayed opening at the interior wall surface that reduces to a narrow opening in the exterior wall surface. The projecting wood gutters are now missing.

Another unique architectural feature illustrates the defensive capacity of the *fortaleza*. Recessed into the top ledge of the parapet are six battlement-style firing positions. Their use afforded protection to defenders firing from the roof.

Building 1 has been modified in the 20th century with the addition of a corrugated metal addition, now reduced to only the west side, and a portland cement cap on the parapet walls. A gabled, wood framed, and corrugated metal roof replaced the original roof. In addition, the original door and most of the original interior and exterior plaster surfaces have been lost.

Building 2, another historic sandstone building, is located on the south end of the complex, and probably dates to the late 19th century. It measures 51 feet 10 inches x 20 feet 2 inches and contains two rooms. It has two doors, one at the north elevation and one at the south. The opening at the south elevation has hand-made double doors with beveled panels. The north elevation contains a modern door. Heavy wooden lintels span both openings. It has no gunports.

A ledge, or *banqueta*, 16-18 inches wide, comprised of *chipichil* with sandstone cobbles and a large amount of aggregate, surrounds the building. Tie rods made from old plow parts were added to provide lateral support to the upper walls.

The roof framing and construction is typical for a flat roofed building: wood beams span between the end walls and are overlaid with a board ceiling and *chipichil*. A later shed addition exists on the south side of the building. Building 2 is currently used as a storage barn.

## ARCHEOLOGICAL INVESTIGATIONS AT SAN JOSÉ DE CORRALITOS (41ZP74)

Our June 6-7, 1998 investigations at Corralitos consisted of a pedestrian survey and surface collection over approximately 5 acres around Buildings 1 and 2 at the ranch, along with the excavation of 16 shovel tests (ca. 30-40 cm in diameter) in areas where archeological materials were apparent on the surface or suspected to be shallowly buried in proximity to the buildings (Figure 4). Surface conditions were excellent, as the field immediately to the west of the buildings had been recently plowed, a dirt road cut through the Rio Grande terrace that enhanced visibility, and there was an open gravel-covered area to the east of Building 1 and north of Building 2 (see Figure 4).

Although historic archeological materials are not abundant on the surface at Corralitos, three areas have been recognized that have historic ceramics and bone, as well as glass, metal, and other artifacts. Area A is an elliptical area about 80 x 15 m in size around the north, south, and back (west) sides of Building 1 (Figure 5). Area B covers ca. 50 x 20 m along the dirt road that leads to the Rio Grande, in the road cutbank, and primarily on the north side of the road, about 45 m northwest from Building 1. The Area C artifact concentration is much smaller in size than areas A and B, perhaps 20 x 15 m to the immediate north, south, and west of Building 2 (see Figure 5).

Based on the kinds of historic artifacts found in the surface collections and shovel testing, including plain and decorated English whiteware ceramics, mid-19th century Guanajuato Polychrome majolica, and olive green bottle glass, areas A and C represent primarily archeological deposits

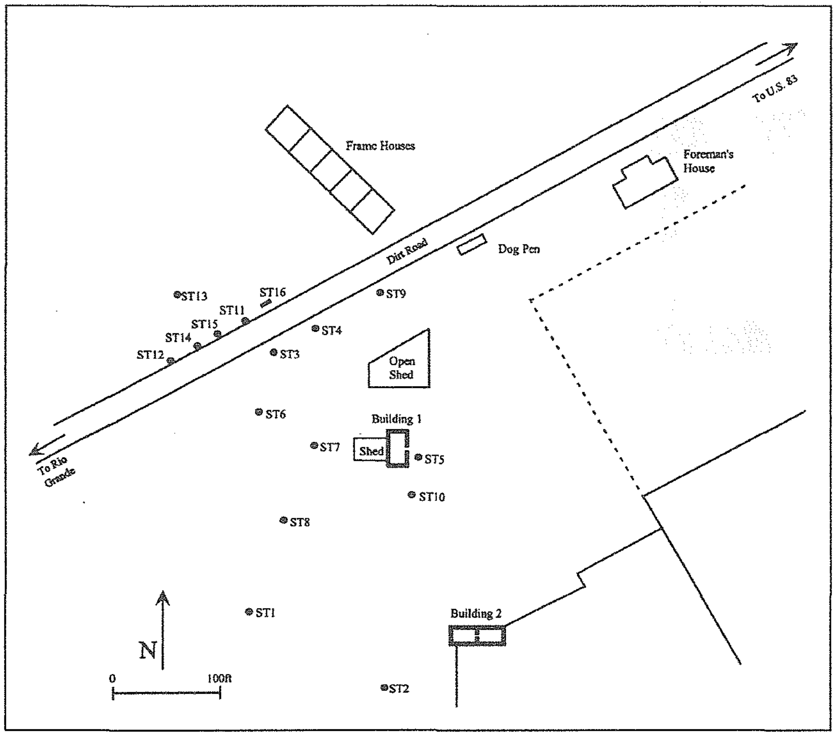


Figure 4. Map of the Corralitos Ranch Site, Showing Buildings 1 and 2, and Location of Shovel Tests.

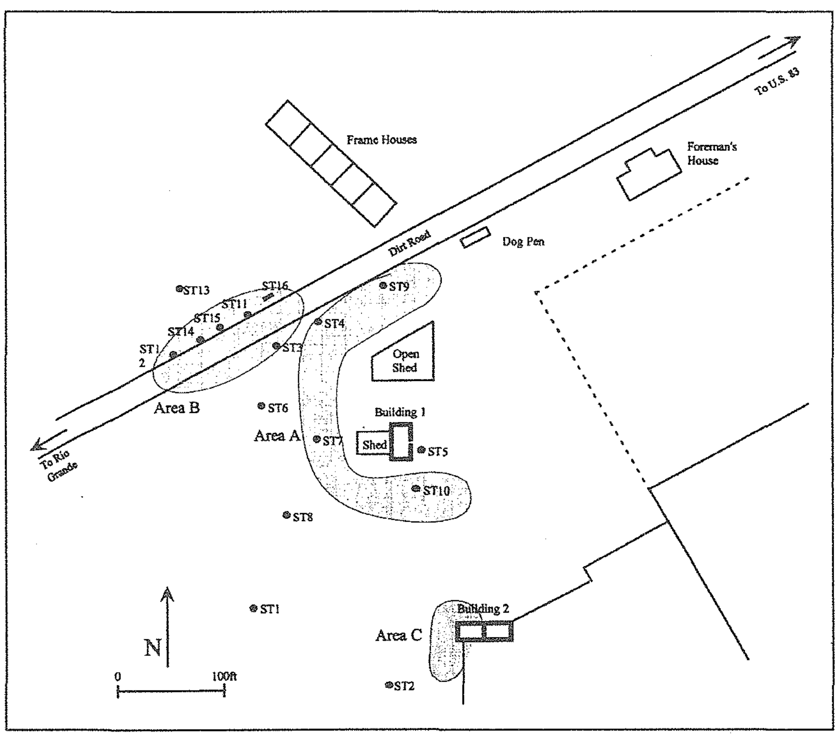


Figure 5. Areas A, B, and C defined at the Corralitos Ranch Site. Area B is the late 18th Century Spanish Colonial Component.

(including midden debris) from an early to mid-19th century residential occupation at Corralitos. More recent materials are also present on the surface and shovel tests in and around Building 1, such as clear bottle glass, wire nails, and gun cartridges, but these are not considered here. One Aranama Polychrome (1750-1800) majolica sherd was collected from the surface in the vicinity of ST 9, about 30 m north of Building 1 (see Figure 5).

Area B, on the other hand, has archeological materials from a Spanish Colonial component that dates between ca. 1775-1825. The late 18th-early 19th century component is clearly associated with the construction and early use of Building 1, apparently built by 1786 (see discussion above).This temporal estimate is based on the kinds of Mexican ceramics recovered from surface and subsurface contexts, particularly the Mexican majolica (*loza blanca*) from production centers in Puebla and Guanajuato, Mexico (see Carlson 1994; Fournier 1997), and the Galera Polychrome lead-glazed chocolate or bean pots (Table 1).

Not including the animal bones, 102 artifacts were recovered in the initial limited investigations at Corralitos, most of these from the road surface collection, ST 11 (n=18), and ST 16 (see Figure 5). Represented were plain and decorated majolica, a burnished or polished redware sherd from the Basin of Mexico (Fournier 1997:246)

**Table 1. Cultural Materials from Area B at the Corralitos Ranch**

| Category | Surface | ST 11 | ST 12 | ST 14 | ST 16 |
|---|---|---|---|---|---|
| Majolica | | | | | |
| Plain | 14 | 4 | 0 | 0 | 4 |
| Aranama Polychrome | 2 | 1 | 0 | 0 | 2 |
| San Elizario Polychrome | 2 | 0 | 0 | 0 | 0 |
| Puebla Green/White | 5 | 2 | 0 | 0 | 0 |
| Huejotzingo Blue/White | 0 | 1 | 0 | 0 | 1 |
| Monterey Polychrome/ Nopaltepec Polychrome | 1 | 0 | 0 | 0 | 0 |
| prob. Puebla Green/White | 2 | 0 | 0 | 0 | 0 |
| Guanajuato Polychrome | 5 | 1 | 0 | 0 | 1 |
| Burnished Redware | 0 | 1 | 0 | 0 | 0 |
| Lead-glazed Earthenware | 14 | 7 | 2 | 3 | 16 |
| Hand-made Coarse Earthenware | 7 | 1 | 0 | 0 | 3 |
| Animal bone | 0 | 26 | 0 | 1 | 30 |
| Totals | 52 | 44 | 2 | 4 | 57 |

that was manufactured in the 18th and 19th centuries, several kinds of lead-glazed earthenwares, and hand-made unglazed earthenwares (Figure 6).

Late 18th-early 19th century majolica is abundant in Area B. Included in the small assemblage are five rim sherds of Aranama Polychrome (1750-1800) with yellow and dark brown bands (see Figure 6a-b), two Huejotzingo Blue on White (1700-1850) rim sherds from ST 11 and ST 16, two San Elizario Polychrome (1750-1850) rim sherds (see Figure 6c-d), seven Puebla Green on White (1780-1800) body sherds with dark green flowers and petals (see Figure 6e), and one distinctive Nopaltepec Polychrome/Monterey Polychrome (1775-1825) body sherd from the surface collection (see Carlson 1994:117 and Figure B5b; Fournier 1997:224 and Figure 8.2h). This particular sherd has brown and black horizontal lines and light orange bands with a yellow floral motif outlined by brown lines (see Figure 6f). One of the San Elizario rims is classified as San Elizario Polychrome, green variant (Fournier 1997:222 and Table 8.2), the only difference being a green band replaces the blue bands edged in black-brown lines documented in the typical San Elizario Polychrome.

The few sherds of Guanajuato Polychrome (see Table 1) date to the 19th century. There are also two other 19th century majolica sherds from the surface collection with light green bands. Fournier (1997:228) suggests these are from plates or bowls manufactured in Puebla and/or Guanajuato, Mexico.

The lead-glazed Mexican wares include sherds from both fine and coarse-paste vessels. The fine-paste vessels are from Galera Polychrome (made after 1750; Fournier [1997] notes that these vessels have been manufactured since 1780) *chocolateras* or bean pots (see Figure 6g-h), as well as wheel-made bowls with a clear lead glaze applied on the interior and exterior vessel surfaces (see Figure 6i-j); one rim from the surface lacks the clear glaze,

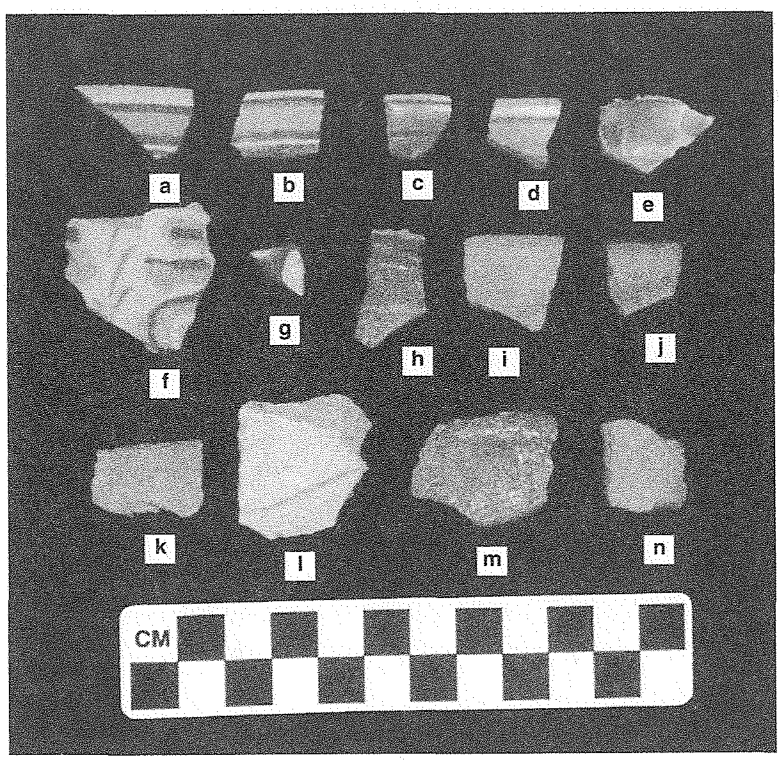


Figure 6. Majolica, Lead-Glazed Wares, and Coarse Earthenwares from Area B at the Corralitos Ranch: a-b, Aranama Polychrome rim; c, San Elizario Polychrome rim; d, San Elizario Polychrome rim, green variant; e, Puebla Green on White body; f, Nopaltepec Polychrome/Monterey Polychrome body; g-h, Galera Polychrome; i-j, lead-glazed rim sherds; k, wheel-made rim sherd without glaze; l, coarse-paste lead-glazed earthenware, interior green glaze; m, coarse paste lead-glazed earthenware, interior/exterior brown glaze; n, unglazed, hand-made coarse earthenware.

however (see Figure 6k). The coarse-paste wheel-made vessels, probably jars or ollas, have either an interior green glaze (see Figure 6l) or a brown glaze on interior and exterior surfaces (see Figure 6m).

There are 11 sherds of an unglazed hand-made coarse-paste earthenware, probably from jars or ollas (see Figure 6n). The sherds are from vessels that have been incompletely oxidized during open air firing, and they have crushed rock and bone temper. Similar coarse-paste earthenwares were dubbed "Mier Plain" by Alex D. Krieger in his study of the historic ceramics from Falcon Reservoir, a few miles downstream from San José de Corralitos. Such sherds are particularly abundant in late 18th century contexts at the Cabaseño site (41ZP79; see Perttula et al., this volume), recently exposed by low water levels at Falcon Reservoir, but have been found in good contexts on Falcon Reservoir ranch sites occupied at late as the first quarter of the 20th century. This distinctive earthenware probably represents ceramics made locally by potters in the Mexican and Tejano ranching communities along the lower Rio Grande from the late 18th century to the early 20th century.

Fragmented animal bone comprises 36 percent of the remains recovered in surface collections and shovel testing in the Spanish Colonial component at Corralitos. The animal bone in Area B is part of a larger late 18th-mid-19th century bone midden behind Structure 1 (Figure 7). None of the 57 bone fragments from Area B is identifiable to species, but their size and thickness indicates that they are the butchered remains from large and very large mammals, probably cattle (Schniebs 1998).

## ATTRIBUTES OF COLONIAL, POST-COLONIAL, AND MODERN RANCH ARCHITECTURE IN ZAPATA COUNTY

On the middle and lower Rio Grande, historic ranch buildings remain at many sites associated with original Spanish land grants. Architectural resources located in Zapata County (e.g., Martinez 1963) are of particular interest since many were recognized in the 1930s, evaluated in the 1950s, and were the subject of architectural documentation and publication in the 1970s. Documents associated with these research efforts, such as Historic American Buildings Survey (HABS) drawings and photo archives at the University of Texas at Austin's Texas Archeological Research Laboratory (TARL), provide a unique treatise of modern scholarship on almost vanished historic sites at the Falcon Reservoir. Also, the 1994 survey and historic designation of historic sites in conjunction with the Los Caminos Heritage project (Sanchez 1994) provides broad contextual data on sites in adjacent counties.

While detailed historical records of the ranch sites in Zapata County are not readily available, roughly accurate dates are available through prior documentation efforts. When placed in a chronological context, detailed observation of the buildings' various attributes allow a framework to be posited for architectural developments.

During the third quarter of the 19th century, the form and technology of historic ranch buildings in Zapata County shifted from: (1) a traditional fortified building type, to a (2) non-traditional fortified building type, to a (3) non-fortified building type. The complete shift from fortified to non-fortified buildings occurred after the Treaty of Guadalupe Hidalgo in 1848, the permanent establishment of troops at Fort McIntosh in 1849, and perhaps, most importantly, the demise of the generation who began life as colonists of Nuevo Santander and lived its entirety fighting against intruders. That this shift occurred later and more gradually than previously thought is supported by a survey of various sites in Zapata County.

Although the initial and terminal dates associated with these architectural changes cannot be conclusively proven, the senior author contends that the shift began in the 1850s and was not complete until at least 1874. This observation is significant as it characterizes Spanish Colonial and Mexican period ranches exclusively as the traditional fortified dwelling type. In addition, it suggests that a fortified building type, albeit modified, survived well after the area's incorporation into the United States. The following framework is provided to explain the evolution of this architectural resource and the features associated with it. The architectural trends apply specifically to ranch houses in Zapata County.

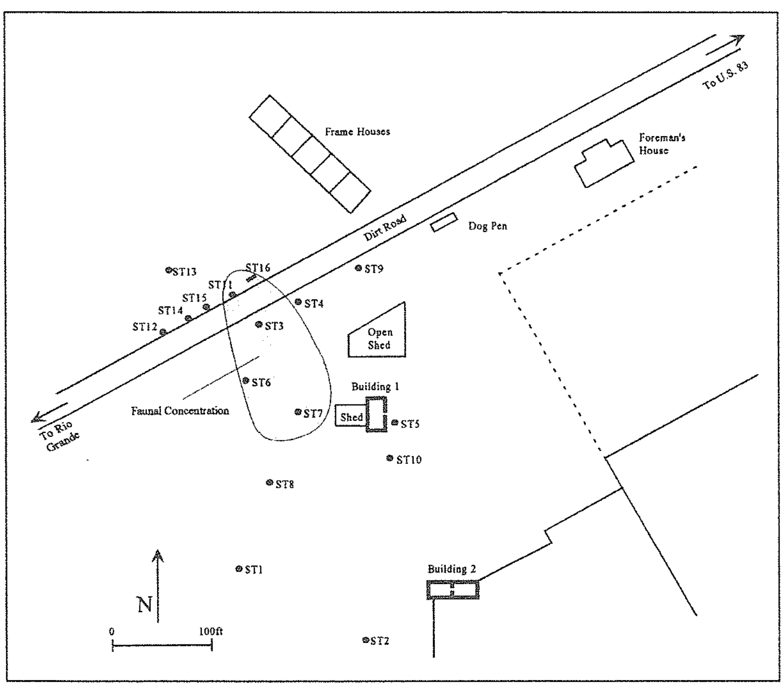


Figure 7. Distribution of Animal Bone at the Corralitos Site.

## Spanish-Mexican Colonial Ranch Buildings (1750-1848)

### *Characteristics*

The Spanish-Mexican colonial ranch house is a simple, masonry structure and notably most, if not all, of the building's significant architectural features are associated with defense. The exclusive predominance of fortified ranch architecture through the mid-19th century attests to the dangers of living on the colonial frontier.

This architectural form reflects the fact that perils continually affected the ability of the ranchers to occupy their lands during the first century of cattle ranching in Zapata County. Many settlers were killed or captured while protecting their homes and possessions. The inhabitants of the frontier were subjected to an unusually high number and long duration of threats, including: (1) the harshness of the natural environment; (2) the retaliation of Native tribes to non-native settlement; (3) the War for Mexican Independence; (4) a power struggle between the Texians and Tejanos from 1836 to 1848; and (5) the vigilante actions of Texas Rangers in the Rio Grande area after statehood.

Examples of sites dating to the colonial period are the José Vásquez Borrego hacienda at Dolores, and several smaller ranch establishments such as Ramireño, Uribeño, and Clareño in the Falcon Reservoir area. Each of these sites exhibit a similar architectural vocabulary of fortification. The architectural features, common also to presidios and mission compounds, include gunports, very thick sandstone walls, a flat inflammable concrete roof, heavy doors that could be barricaded, and a round defensive tower (Fleming 1998:165-169). Additional features typical to colonial period buildings include stone-lined gunports, wooden *canales*, a relatively narrow door opening, and square roof beams.

### *Relevant sites*

Hacienda Dolores probably predated other regional ranch settlements by more than a decade and supported an unusually large independent community, but the struggle to maintain a viable ranch and keep from death was a concern common among *hacendados* and the less wealthy ranchers. The one-room sandstone building, built after 1767 and probably before 1786, served as the nucleus, headquarters, and main sanctuary of the community's residents. The 21 x 53 foot building featured almost 3 foot thick sandstone rubble walls with mud mortar (1972 Dolores Viejo National Register of Historic Places nomination form, on file at the Texas Historical Commission). Hypothetical reconstruction of the ruins suggests as many as 12 gunports. All extant gunports have a thin stone lintel and plastered embrasure.

A round tower, 21 feet in diameter, undoubtedly also equipped with gunports, afforded the watchman an opportunity to sight trespassers along the riverfront. Testimonials by the founder's grandson indicate that the tower was added in 1814 in response to repeated attack from Native tribes. Dolores' ruined tower and walls speaks to its function as a fortress for its inhabitants.

Ramireño, although smaller in size (33 x 17 feet 9 inches), is similar to the ruins at Dolores. The single-room building served as a residence for the Ramírez family on their typical *porción* and was reportedly constructed between 1781 and 1810 (HABS, TX-3130). The masonry walls, 2 feet 6 inches thick and 15 feet 8 inches high, are comprised of sandstone and mud mortar and terminate in a parapet with a flat concrete roof.

The minimal fenestration includes two doors and no windows, but several gunports are located on each wall and flank the south door. Other details include 6-inch deep beams of varying width and mesquite *canales*.

Building 1 at Corralitos also corresponds to the major attributes of the foregoing sites. The walls are 2 feet 10 inches thick and are 13 feet 6 inches high. The building closely corresponds to the overall building dimensions, framing, and gunport placement of Ramireño.

Although the details or daily events in the lives of Spanish settlers at these sites are not known, clearly their concern for protection marked almost every aspect of their architecture. As the land and people who were once Spanish became Mexican in 1810, and then citizens living on the southern boundary of the United States in 1848, the threats to their safety mandated an architecture of fortification.

## Post-Colonial Ranch Buildings (1849-1874+)

### *Characteristics*

The continued erection of fortified buildings well into the 1860s indicates that the U.S. Army's protection against the continued threat of the Apache and Comanche was not immediately effective upon establishment of Fort McIntosh in 1849. The prevalence of fortified buildings for almost a generation following the 1848 Treaty of Guadalupe Hidalgo, when the area became part of the United States, may also reflect the old settlers' distrust of their new Anglo-American government.

Several sites illustrate that in the 1850s, ranchers continued to produce new buildings or additions to existing building complexes with remarkable similarity to the early fortified prototypes. The exclusivity of design features associated with defensive purposes is, however, eventually supplanted by other recognizable regional vernacular architectural features. The decorative and functional features developed during this transitional period eclipse the fortified character of the vernacular ranch buildings by about the third quarter of the 19th century.

### *Relevant sites*

The Treviño-Uribe Fort contains both colonial and post-colonial period construction episodes. The initial building, dating to 1830 or earlier, contained one room, several gunports, and a 2 feet 9 inch wide, single leaf, paneled door on a pivot (Myers and Heck 1998; HABS, TX-3112). Wooden *canales* characterize the roof drainage system for this original portion of the building complex.

Rooms and enclosing compound walls 12 feet high, added by Blas Uribe about 1851, also feature gunports. The enclosed compound, a unique surviving example, evidences the lingering concern of its owner for the security of his family and property. Uribe's inclusion of such defensive features reflects the existence of real threats and his memory of appropriate architectural responses.

Notably in 1851, Uribe also embellished his fortified compound with sundials, decorative interior wood framing, and carved stone *canales*. By 1870, thin-walled room additions to this relatively urban residence each include numerous doors facing onto the public streets. Roof framing members of these later rooms are considerably deeper than they are wide, indicating modern lumber milling practices.

At Rancho San Francisco, located between San Ygnacio and Corralitos, two buildings constructed during this period illustrate the trend toward a less fortified architecture. The earlier building, dating between 1854 and 1874, has 10 gunports, no windows and, originally, a nearly flat roof draining to wood *canales*. The second building, constructed in 1874, contains only three gunports (1973 San Francisco National Register of Historic Places nomination form, on file at the Texas Historical Commission). Its design emphasizes architectural ornaments, such as the carved stone *canales* and stone medallion inscribed with its date of construction. They communicate the fact that a building's defensibility was no longer a primary concern of its residents, although aspects of the fortified house—such as flat concrete roofs and the absence of windows—were carried forward.

A third example of a post-colonial period ranch community is Dolores Nuevo, just south of Laredo. The site includes one fortified residence constructed in 1859 by the ranch founder, Cosme Martínez. His house contained the classic features of fortification: a flat roof, at least four gunports, few doors, and no windows. It confirms that hostilities affecting ranching warranted that such private fortresses continued to be built, even in late 19th century America. Dolores Nuevo reputedly featured an inscribed center ceiling beam to verify occupancy of the property, a necessary practice to support land titles after the Bourland and Miller report of 1852.

### Unfortified Ranch Buildings (Late 19th Century to the Present)

#### *Characteristics*

In the last quarter of the 19th century, it appears that defense waned as a primary concern of the lower Rio Grande area ranchers. Gunports are absent and windows, although protected, emerge as a common architectural feature of newly constructed ranch houses.

#### *Relevant sites*

Dolores Nuevo, a ranching community founded after the area became part of the United States, supported members of the extended Martinez and Juarez families (1973 Dolores Nuevo National Register of Historic Places nomination form, on file at the Texas Historical Commission). Built in 1914 as a two-room residence about 18 x 24 feet in size, the "Mama Manuela's house" features sandstone walls that are 1 foot 7 inches thick (Juarez 1976).

The building contains a fireplace and, on the north wall, there were two large windows once protected by metals bars. The gabled roof, covered in wood shingles, indicates little fear of arson. Two doors on the south wall were wider than earlier examples and probably could not be barricaded. Ranch houses like these freestanding, sturdy masonry buildings with shuttered windows and pitched roofs become the standard for later residential building types in the Laredo region.

## CONCLUSIONS

With the exception of the Dolores Nuevo site, the buildings described above dating from the Spanish-Mexican colonial (1750-1848) and post-colonial (1849-1874) periods are examples of the fortified architectural type. These sites provide a new understanding of the character of conditions for the inhabitants of the lower Rio Grande valley as well as its architecture. If the existence of fortified buildings is considered as a measure of truth for Turner's (1920) definition of the frontier, as "the meeting point between savagery and civilization," then the historical changes proposed herein have several interesting implications.

First, the Spanish Empire's directive to conquer unpopulated lands was carried out by its subjects' descendants long after Spain had no right to claim the land or its occupants as its own. Second, even after the region was incorporated into the United States it remained a dangerous settlement frontier not only to the "norteamericanos," but also to those who had lived there for as long as a hundred years. That security was not assured; in fact, that it was so notably absent as to require a radically protective built environment, changes the popular view of late 19th century America.

On the Rio Grande, especially in the vicinity of Laredo and San Ygnacio, the most significant consideration influencing early ranch architecture was the functional ability of the building to serve as a defensible place of refuge. As the safety of the Hispanic ranchers became somewhat more secure during the third quarter of the 19th century, other concerns surfaced and became transcendent, producing a richer and more varied architectural style. New standards for craftsmanship, privacy, and, in some cases, an urbanized context, altered the form and technology of the architecture. After about 1875, defensive architectural features appear to be completely absent from local ranch buildings. Contemporary with the de-emphasis of fortification is the debut of new architectural features. Decorative ornaments appear as a result of increasingly sophisticated craftsmanship and include stone medallions, rosettes, and sundials; inscribed and shaped roof beams and corbels; and carved stone *canales*. This period also marks the beginning of multi-room residences, thinner walls, and rectangular rather than square beams. The last benchmark is attributed to mechanized milling practices, better transportation, and dwindling local resources.

The delineation between colonial fortified ranch buildings and post-colonial fortified ranch buildings has not been formally presented prior to this study (see also Fleming 1998). We contend that the traditional flat-roofed, fortified ranch house was constructed in the Zapata County area well past the mid-19th century. An unpublished manuscript dating to the early 1950s by Joe Cason, an archeologist with the National Park Service, states that such simple, fortified buildings were only constructed prior to 1800 (Cason n.d.).

Cason documented over a dozen vernacular ranch buildings in Zapata County prior to construction of the Falcon Reservoir. He identified and labeled flat-roofed, single-room buildings with thick walls and gunports as "Type One" buildings and pitched roof, thinner-walled, multi-room structures as "Type Two" buildings. Notably, at a site known as Lopeño, at least one of the buildings contains gunports and Cason dates this structure either to 1821 or 1850. However, he states that the "Type Two" buildings:

> present something of a paradox: although they are much more recent than the type one structures, neither the local population nor the historians of the area have much information on them...consequently, the writer [Cason] was unable to find examples dating from the early 1800s (Cason n.d.:3).

As Cason hints at the contradictions in his own observations, the question arises why he chose 1800 as the terminal date for the fortified building type when his manuscript references incidents of Indian raiding between 1755-1848 in the Falcon Reservoir area. Further, he was told personally by area residents that "raiding of a sporadic sort continued until the early 1860's" (Cason n.d.:3). Thus, Cason prematurely ascribed the demise of defensive features to 1800 and the reasons are unclear for his belief that this date was accurate. This article's review of architectural changes in Zapata County since the mid-18th century disproves Cason's theory for the terminal date of the early building type. His "Type One" description largely fits the Treviño-Uribe Fort additions of 1851, the 1859 "casa grande" at Dolores Nuevo, and both buildings at Rancho San Francisco dating between 1852-1874.

Unfortunately, the extensive physical history of many early Zapata County ranches has now been lost to the Falcon Reservoir tides (see George 1975). Buildings may no longer be observed in the detail that Cason had available prior to their inundation. Cason's mistaken theories may be partially attributed to a lack of archival rather than architectural information. Interestingly, he does hint that a change in door placement, wall construction, roof form, and materials occurred after the 1840s.

Errors in previous analysis of ranch sites throughout Zapata County indicate the difficulty of interpreting the early history of historically significant ranch complexes. For example, the National Register of Historic Places nomination form for Rancho San Francisco, developed in the mid-1970s by the Texas Historical Survey Committee, states that the early stone building dates to the 1840s. Emory's boundary survey map of 1853-1854 does not indicate the presence of a settlement at the site. Research to date for San José de Corralitos similarly lacked analysis of the available archival, archeological, and architectural data and unfortunately resulted in a misrepre–sentation of history. Through this recent multi-disciplinary effort, the site is now much better understood and the extant *fortaleza* is recognized as possibly the oldest standing secular building in the state.

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# Archeological Investigations at the Spanish Colonial Villa de San Marcos de Neve

*Christopher E. Horrell*

## INTRODUCTION

Recent archeological reconnaissance at the Spanish colonial town site of San Marcos de Neve has obtained information about the settlement of this small community in New Spain's far northern province of Texas. As part of a global empire, Spain pushed for the settlement of towns to protect and conquer the crown's possessions within the New World. The town of San Marcos de Neve was no exception. Spain not only wanted to protect her imperial interests in the New World but also sought to recreate the social, political, and economic institutions found in the Iberian Peninsula. This political and economic framework is demonstrated in Immanuel Wallerstein's world-systems model (Wallerstein 1972; Shannon 1989), and the establishment of this town on the frontier fits some of the model's expectations. However, the archeological and historical evidence suggests that the settlement of San Marcos de Neve, and the behavior of these people who settled on the Texas frontier, was much different from the rules and laws prescribed for establishing towns. By examining the settlement of this town it is possible to understand the material and cultural differences that existed in Spanish Texas at the end of the colonial period.

## HISTORICAL SETTING

The archeological remains of the town of San Marcos de Neve can be best understood by first discussing the broader historical context of Spanish Texas at the end of the colonial period. In April 1808, the Spanish colonial community of San Marcos de Neve was established in the province of Texas on the banks of the San Marcos River (Figure 1). The new town was situated near the El Camino Real de Arriba and a military post in present-day Hays County, Texas (Jones 1979:3; Benavides 1991:387). The establishment of this community came at a time when Spain was suffering from a period of social, economic, and political difficulties (Clark and Juarez 1986:89; Carlson 1994:4; Kenmotsu et al. 1995:1).

At the beginning of the 18th century, the first of the Bourbon Monarchs set in motion reforms that would affect the administration of Spain's colonial possessions in the Americas (Poyo 1996:3-4). By 1759, these reforms sought to solidify the Crown's authority in both the Iberian Peninsula and in New Spain (Poyo 1996:4). By reasserting Royal authority over the Creoles, who had become entrenched in a self-serving colonial system at the

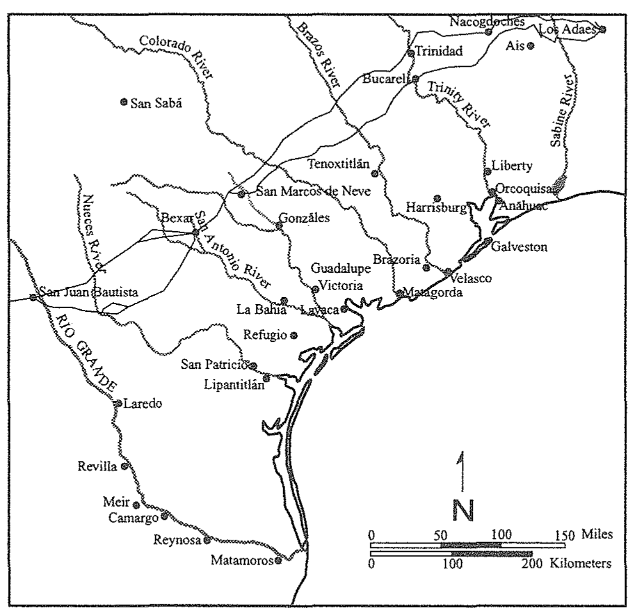


Figure 1. Texas ca. 1775-1812. San Marcos de Neve was situated along the Camino Real de Arriba.

expense of the crown, it was possible to shift the balance of power in the colonies back to the crown (Poyo 1996:4). Essentially, the Bourbon rulers had initiated political and economic changes that increased the export and profit potential of the Iberian Peninsula. However, Spain's increased wealth was short-lived. In 1788, Charles IV, the last of the Bourbon Monarchs, ascended the thrown. Bad political decisions and an ineffective Prime Minister, Miguel Godoy, marred his reign (Clark and Juarez 1986:89; Kenmotsu et al. 1995:1). Additionally, Spain was consistently at war with other European powers. Unable to maintain the funding needed to fight these wars, the colonies suffered the crown's persistent hardships. Consequently, Spain's position was weakened. By 1808, Charles' forces were defeated by Napoleon, and a puppet government was established under the authority of Joseph Bonaparte. As a result, rebellions ensued and the colonies gradually drifted from Spanish control (Clark and Juarez 1986:89; Kenmotsu et al. 1995:1).

Although a distant province of New Spain's far northern frontier, Texas felt the pressures that affected the Spanish Empire. In 1763, the Treaty of Paris ended the Seven Years War and transferred the province of Louisiana over to Spanish control. As a result of this newly acquired territory and the Bourbon Reforms, Spain encouraged foreign settlement within Texas as a means of promoting economic and political control within the region (Hatcher 1976:3). However, in 1800 this policy changed when Spanish control of Louisiana ceded back to the French. In 1803 a new nation, the United States, purchased the Louisiana territory. It was after this transaction that Spanish colonial provinces once again felt threatened by a foreign power (Hatcher 1976:3; Jones 1979:39; de la Teja 1995:5-7; Cruz 1988:52-54). Problems were amplified by the loss of the Spanish throne to Napoleon in 1808. And by 1810, a series of rebellions broke out in New Spain, lasting until 1821, with the eventual loss of Spain's colonies (Clark and Juarez 1986:89; Kenmotsu et al. 1995:1). The province of Texas felt these growing pressures of revolution and would eventually suffer the consequences.

San Marcos de Neve was part of a plan to establish civilian settlements within the interior province of Texas. This plan was implemented for three reasons. First, Texas was considered excellent ranching country, and the abundant wild livestock would provide a stable economy for new settlement (Jones 1979:53; Jackson 1986:10-12). The early entradas into Texas, and the subsequent establishment of missions and presidios brought cattle into the region. By the mid-18th century, cattle that had strayed from these herds had produced wild livestock throughout the province. As a result, the hunting and rounding up of these animals by *vaqueros* became routine, and provided some economic stability for Texas. In 1778, Commandant General Teodoro de Croix approved the establishment of the *Mestena Fondo* (Mustang Fund) as a means of providing added income to the crown through taxes (Jackson 1986:155-157). By establishing a cattle industry in Texas, cattle markets could operate in San Antonio and in cities such as Saltillo in northern Mexico (Jackson 1986; Cutter 1995). As a result, new *ranchos* and civilian settlements moved northward and were established along the Rio Grande as well as in northern Mexico. Over time, new settlements would eventually move into the area that is now present-day South Texas.

Second, new settlements would arrest the smuggling activities that existed within the province. According to Faulk (1964:97-98), smuggling was a common practice throughout the history of Spanish Texas. Spanish law made trade with foreign governments illegal, as well as virtually impossible between the colonial provinces without excessive royal taxes; the need for permits and passports further hampered legal trade (Faulk 1964:109; Jackson 1986:481; Jones 1979:60). These restrictions made goods scarce and extremely expensive, turning goods such as tobacco, cloth, and horses into contraband. By establishing settlements on the frontier, government officials believed they could control the exchange of contraband as well as maintain control over the economic activities within the province (Faulk 1964:40; Hatcher 1976:65).

Third, and more importantly, the settlement was part of a larger agenda to thwart any attempts made by Americans or any other foreigners to enter into the province of Texas. Like previous attempts to settle Texas, namely the presidios and mission system, the Spanish reacted only when their territory was threatened. Primarily, the Spanish crown feared that if the Americans or other foreigners were allowed to encroach on the province of Texas, they might eventually move towards New Spain's interior and threaten control over her silver mines, thus adversely affecting what economic stability was left for the crown. As a buffer province, Texas offered the added protection New Spain needed (Hatcher 1976:69; Weddle 1992:100; Faulk 1964:113; Cruz 1988:56; de la Teja 1995:15). It is no surprise that after the Louisiana Purchase, Spain implemented a plan for new towns to be established within the province of Texas. The last of these towns included the Villa de San Marcos de Neve.

The settlement of San Marcos de Neve was doomed from the start. Governor Antonio Cordero y Bustamante, who had pushed for settlement in Texas, solicited the help of Don Filipe Roque de la Portilla. Cordero provided only 75 pesos out of the *Mestena Fondo* to help establish the new town on the banks of the San Marcos River. The rest of the financial investment was to come from Portilla himself (Benavides 1991; Jones 1979).

The first settlers and livestock left the interior of Mexico and arrived at the site of the new town in February 1808. By April, town lots were distributed to the settlers around a central plaza. At this point only 52 individuals along with 1600 head of livestock were living in the colony (Benavides 1991; Jones 1979). By June, a flood swept through the plaza of the town. It is unclear if official permission to move the town to higher ground was ever granted (Hatcher 1976:125-126; Jones 1979:5 ).

In September, Portilla brought additional settlers and livestock to the struggling colony. Arriving in October 1808, Portilla wrote that the crops had failed and that people were camping in the woods and subsisting only on the existing cattle herd (Benavides 1991:391-392; Jones 1979:5). A census given by Portilla in May 1809 indicates that the additional 30 settlers brought the total population to 82 individuals. Additionally, Native American depredations to the colony continually diminished the livestock herds and caused enormous grief to the settlers. At this point the documents indicate that a few homes and buildings existed at the site. What structures that did exist appear to have been *jacales*. By late 1809, the rebellions of Mexico began to slowly drift northward to Texas. Additional problems with the Native Americans and the lack of government aid would force this tiny group of settlers back to Mexico by 1812 (Faulk 1964:127; Hatcher 1976:125-126; Jones 1979:11).

## ARCHEOLOGICAL INVESTIGATIONS

In 1995, the Department of Antiquities Protection (now the Archeology Division) at the Texas Historical Commission, conducted an archaeological reconnaissance in Hays County, Texas. The purpose of this investigation was to locate and survey the site of San Marcos de Neve. Fieldwork was conducted by a team led by Dr. Nancy Kenmotsu, and consisted of pedestrian survey, shovel testing, and mapping (Kenmotsu et al. 1995). The team was successful in locating a site (41HY273) that contained Spanish colonial period artifacts, including Spanish ceramics (Figure 2). Additionally, an aerial photograph of the site revealed a rectangular-shaped anomaly approximately 335 feet from the early 20th century structures on the property. On the basis of these findings, it was determined that this was the site of San Marcos de Neve (Figure 3; see Kenmotsu et al. 1995:4-10).

In 1997, a second team of archeologists completed survey and test excavations for a proposed water and fiber optics line near the site of San

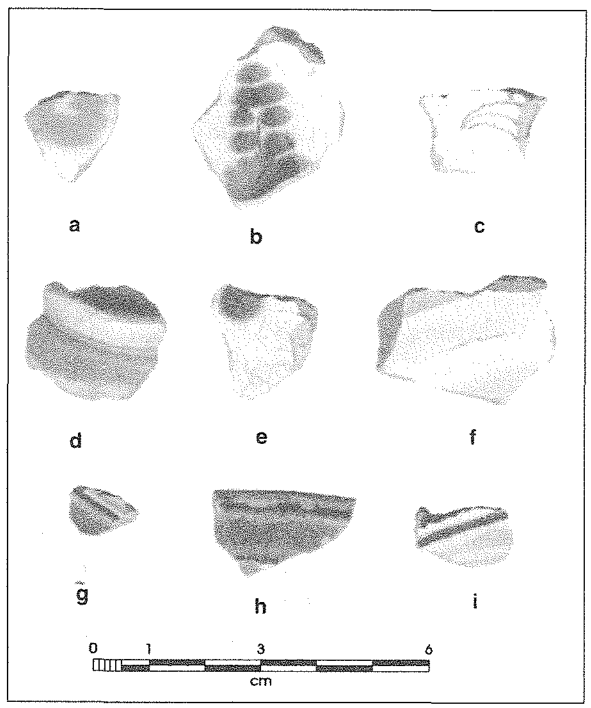


Figure 2. Ceramics found in 1995: a, Monterey Polychrome; b, possible San Elizario Polychrome; c, Aranama tradition; d-f, Puebla Blue on White; g-i, Aranama Polychrome.

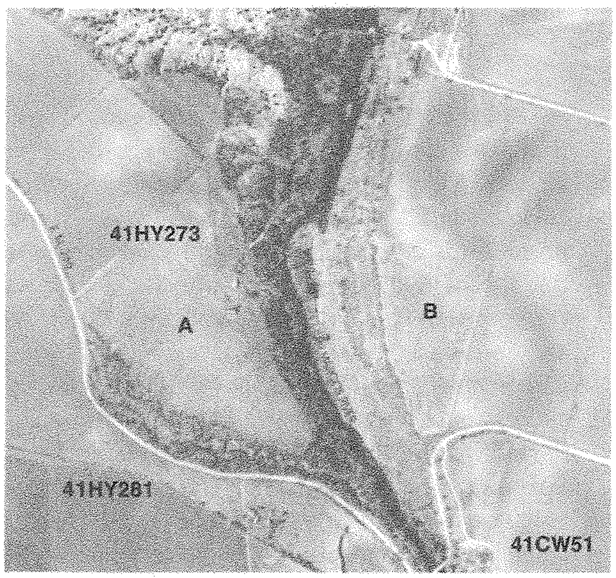


Figure 3. Locations of Sites: A is the recorded site of San Marcos de Neve (41HY273); the area across the river (B) and 41HY281 also have colonial materials; 41CW51 is a prehistoric site.

Marcos de Neve. Majolica in at least one shovel test was found east of the present site at 41HY281 (Eric Schroeder, 1998 personal communication). Additionally, Alton Briggs found a piece of majolica and one piece of Spanish Colonial period floor tile on the property directly across from 41HY273 (Briggs 1997; see Figure 3).

Most recently, I have conducted archeological investigations at 41HY273. This site is on a hill above the San Marcos River and near a section of the Camino Real de Arriba. I have also conducted an archeological survey of the property directly across the river in the area where Briggs found Spanish Colonial materials (see area B on Figure 3). This work included a pedestrian survey and controlled surface collection; no excavations were carried out because of the need to preserve this site. Goals of the fieldwork included: (1) collecting information about the landscape and the different peoples who occupied the site over time, (2) determining the size of the colonial settlement, and (3) gathering additional colonial period material culture data to learn more about the settlers that occupied the town and environs. A Total Data Station (TDS) was employed to map the various properties and point plot surface artifact locations and elevations. Transects were laid out at 30 m intervals perpendicular to a base line at 41HY273, and they were systematically walked 5 m apart looking for artifacts. This information from the TDS was downloaded into a computer database in order to produce maps of the site as well as the distribution of any Spanish Colonial artifact clusters

Upon completion of this phase of the project, approximately 390 artifacts were collected from the surface of 41HY273 (Table 1). These indicate that in addition to the Spanish Colonial settlement, several other occupations existed at the site: (1) a prehistoric component of unknown age; (2) a mid-19th to late

**Table 1. Artifacts Recovered from 41HY273**

| Prehistoric Artifacts | N | Mid-to Late 19th century | N |
|---|---|---|---|
| Cores | 44 | Stoneware | 16 |
| Flakes | 23 | Ironstone | 39 |
| Core Flakes | 51 | Medicine Glass | 8 |
| Bifaces | 24 | Clear Glass | 10 |
| Goliad Wares | 2 | | |
| | | | |
| Colonial Artifacts | N | 20th century | N |
| Majolica | 39 | Whitewares | 18 |
| Lead-glazed | 16 | Clear Glass | 11 |
| Olive Jar | 3 | Brown Glass | 9 |
| Burnished Ware | 1 | Milk Glass | 18 |
| Glass | 8 | Brick | 3 |
| Mortar | 1 | Roof Tile | 5 |
| Metal | 1 | Porcelain Doll fragments | 2 |
| French Faience | 3 | Horseshoe | 1 |
| Edge Ware | 3 | Nail | 1 |
| Transfer Ware | 1 | Hinge | 1 |
| Pearlware | 2 | Unidentified metal frags. | 27 |

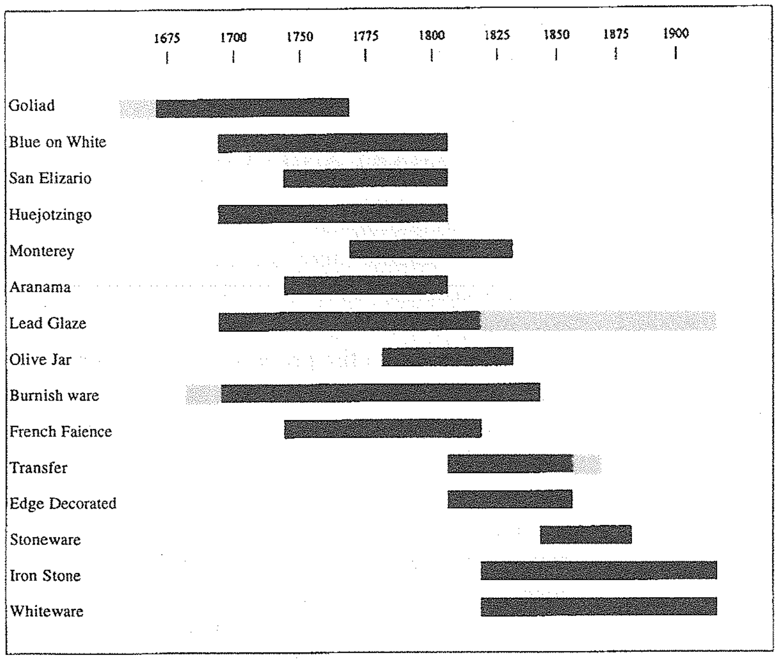


Figure 4. Approximate Ceramic Chronology of San Marcos de Neve. Dark areas indicate periods of popularity (Hard et al. 1995; Tomka et al. 1998).

19th century component; and (3) an early to mid-20th century component.

Seventy-eight of the 390 artifacts collected were Spanish colonial in age, and they date within the time frame associated with the town of San Marcos de Neve. Among the colonial artifacts, tin-glazed ceramics were the most abundant. Tin-glazed ceramics or Mexican majolica are earthenwares that have a lead glaze, and tin was added to create an opaque background. Colored designs were used to decorate the vessels, and these changing decorative styles are reasonably well-dated through time (Figure 4). The majolicas from San Marcos de Neve include several unidentified fragments, Puebla Blue on White, Huejotzingo Blue on White, San Elizario Polychrome, and Monterey Polychrome (Figures 5 and 6).

Other ceramics found in the surface collections were several lead-glazed ceramic sherds and three Olive jar sherds (Figures 7 and 8), sherds of French faience, and possible colonial-era English wares, including both edgeware and transfer-printed wares (see Table 1). Among the glass are eight pieces of olive-green bottle glass (Figure 9), comparable to the bottle glass found in colonial deposits at the San Antonio missions (Hard et al. 1995:48; Tomka et al. 1998:24). The other recognizable colonial metal artifact is a possible wax scraper (Figure 10). One fragment of daub, probably from a *jacal*, was also found on the surface at San Marcos de Neve.

The Spanish Colonial artifacts at San Marcos de Neve cluster near the remains of the early 20th century structures at 41HY273 (Figure 11). The colonial deposits, while masked by later historic occupations, cover a ca. 240 x 90 m area of the toe slope.

In our survey of approximately 40 acres across the San Marcos River from 41HY273 (see Figure 11), we located an area that may have been a low water crossing, as well as a grove of Anaqua trees; these trees occur at colonial sites throughout Texas and may have been utilized by the Spanish. Forty-eight artifacts were recovered in this area, among them one piece of undecorated white majolica and one piece of colonial glass. The others included three prehistoric lithic artifacts and 43

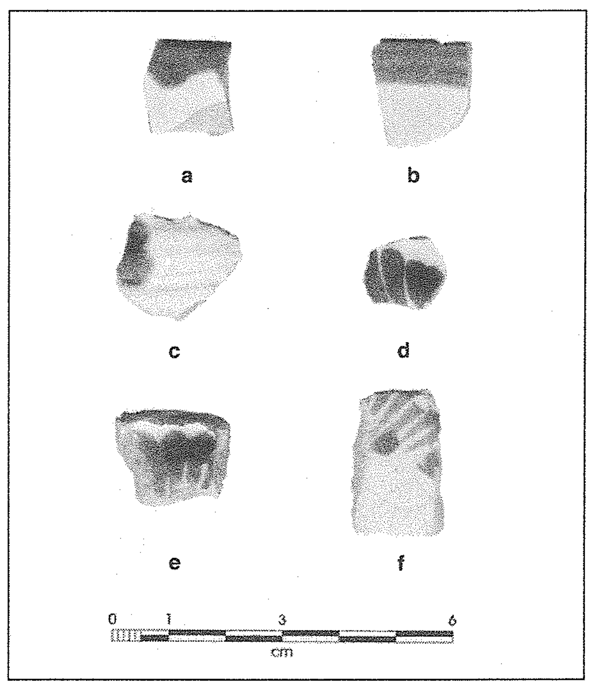


Figure 5. Majolica from 41HY273: a-b, Huejotzingo Blue on White, wavy and straight band variants; c-d, Puebla Blue on White II; e-f, Puebla Blue on White.

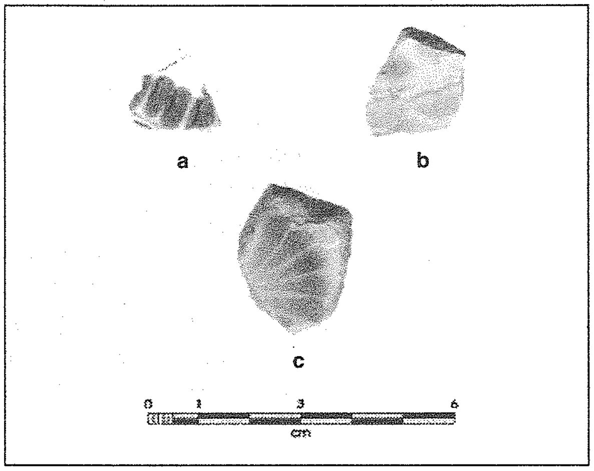


Figure 6. Polychrome Majolica from 41HY273: a, San Elizario Polychrome; b, possible Monterey Polychrome; c, Monterey Polychrome.

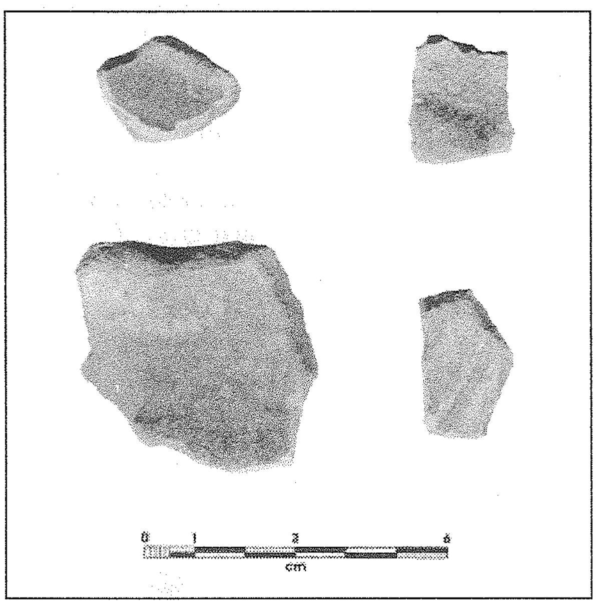

Figure 7. Lead-glazed ceramics from 41HY273.

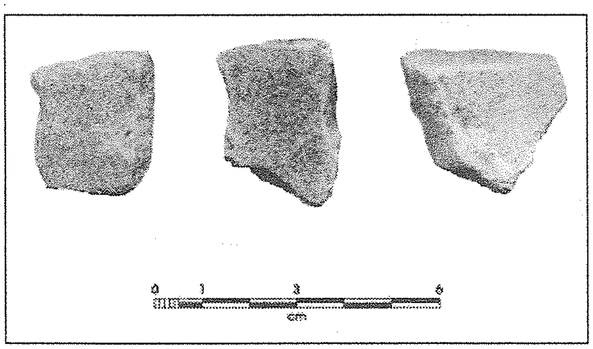

Figure 8. Olive Jar sherds from 41HY273.

glass, ceramic, brick, and plastic artifacts from mid-19th to 20th century age.

## SUMMARY AND CONCLUSIONS

The archeological investigations discussed in this paper indicate there is a significant amount of Spanish colonial material at 41HY273. Additionally, one piece of majolica and colonial green glass were recovered on the property on the other side of the river. Based on the evidence gathered at the two sites as well as the material recovered at nearby 41HY281, I expect that Spanish colonial archeological remains may be present throughout the area around 41HY273. Furthermore, the Spanish colonial town of San Marcos de Neve appears to have been characterized by a dispersed settlement pattern with people living on elevated areas as well as areas close to the river. Additionally, people would have wanted access to areas where they could grow crops. The property directly across from the recorded site of San Marcos de Neve may have served that purpose. The area would have provided the necessary resources for both humans and livestock to survive within the colony. While a dispersed settlement pattern may have been problematic with the frequent Native American depredations that took place at the town, it would provide enough space for the ranching activities that would have taken place there.

Because this community was predicated on ranching, it may have followed similar settlement patterns of other ranching communities in Northern Mexico. Although strict rules for establishing towns in New Spain were in place since 1573, this ideal was modified the farther away the new towns were from the seat of power. At San Marcos de Neve, a town plaza was established with town lots distributed to the settlers (Benavides 1991:375; Jones 1979). However, this occurred two months after the arrival of the settlers to the proposed town site. It is possible that the settlers took up residence outside the proposed town plaza in order to secure a living and manage the existing livestock herds.

In essence, what may have occurred at San Marcos de Neve were that the town's inhabitants made settlement choices that differed from the Spanish rules and laws that would have governed them. This town was indeed influenced by the laws of settlement created by the Spanish government. But,

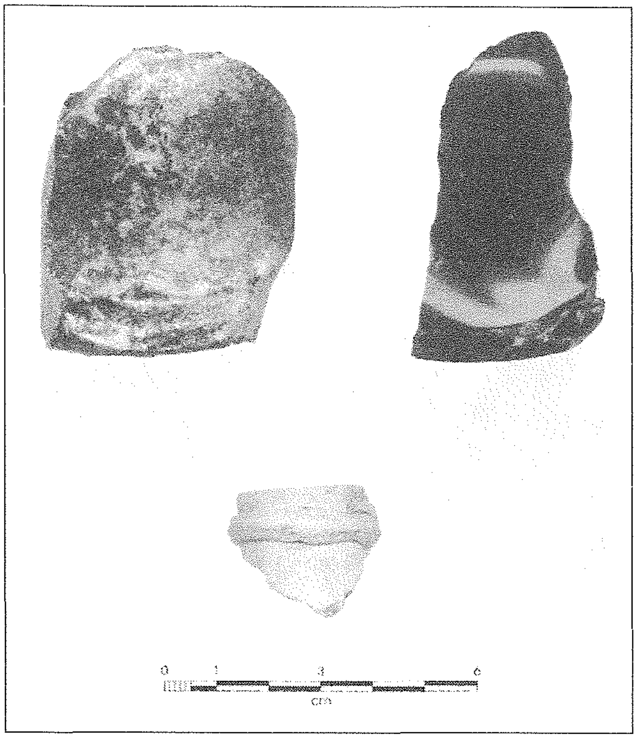


Figure 9. Colonial-era Glass from 41HY273.

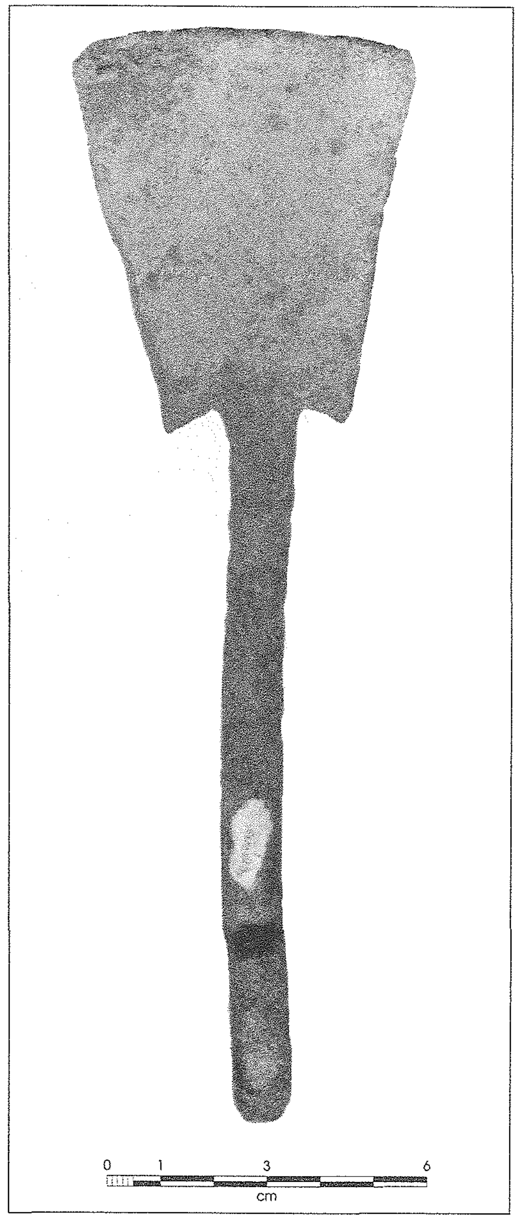


Figure 10. Possible Metal Wax Scraper.

instead of merely participating in a larger political and economic framework where settlement of semi-peripheries and peripheral areas were dictated by Mexico City, this town (like others on the frontier) was also making its own decisions. As Carol Crumley (1995:1-5) explains in her work dealing with heterarchical and hierarchical systems, communities and institutions that are dominated and influenced by the larger political and economic institutions of which they are a part, are also participants within this larger political and economic framework, and exert their own restrictions and influences upon those larger institutions (Crumley 1995; Levi 1997).

This is seen in the small *rancheros* in Northern Mexico. Although marginalized from the larger and more vibrant economy in Mexico, these *rancheros* were themselves involved to some degree with the market economy. As such, these communities were also somewhat autonomous and self-sufficient. This autonomy is apparent in the settlement patterns exhibited in the region. For example, Armando Alonzo (1998:42-43) indicates that the towns of Mier and Revilla, both on the Rio Grande, were established on paper and town lots were distributed to the new settlers. The settlers, however, preferred to spread out over the area, distributing themselves around the town as opposed to living within its boundaries or on the plaza. As time passed, the people slowly moved into the town, as they were able to establish a living on their *ranchos* raising their livestock (Alonzo 1998:43).

As the historic documents indicate, a town plaza was established and town lots distributed at San Marcos de Neve. However, they do not indicate whether the homes were built on the plaza or whether they were destroyed by flood. Further, the documents do not indicate if people ever lived on

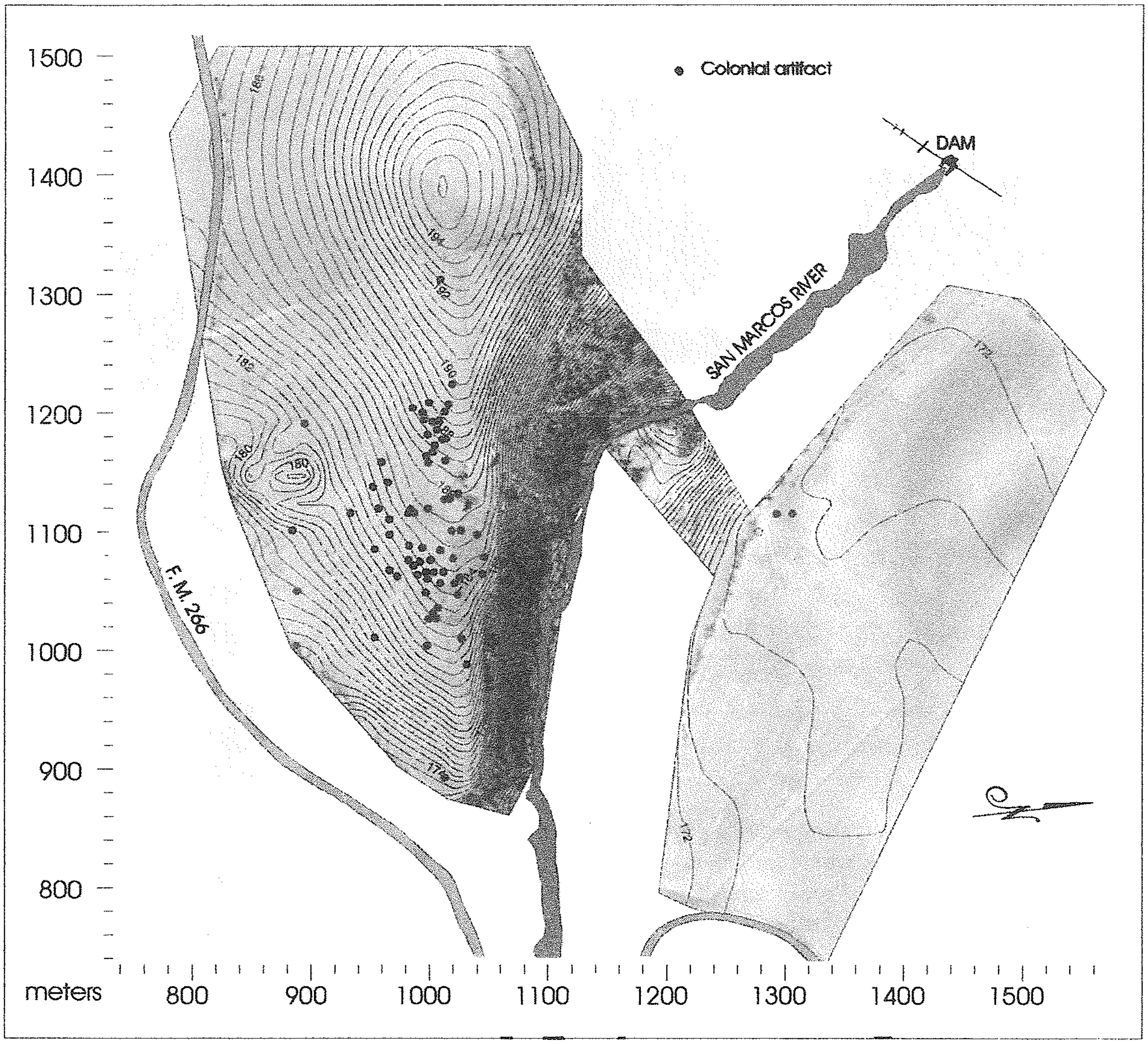


Figure 11. Distribution of Spanish Colonial Artifacts from 41HY273 and 40 acre tract across the San Marcos River.

the plaza. The archeological evidence to date, along with the historic documentation, suggests that these people may have indeed followed settlement patterns like that of the *ranchero* communities that were established in northern Mexico.

Finally, the colonial community of San Marcos de Neve is extremely important in that it allows archeologists and historians to trace the indelible cultural mark left on the landscape by the Spanish, specifically, the development of Tejano culture within Texas. This town did not last for more than four years, but yet it provides a starting point from which archeologists may began to understand the development of cultures and societies in Texas (Tijerina 1994). By examining these phenomena, we ultimately enrich our interpretations and advance the study of humans in the past.

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# Discourse in Clay: Ceramics and Culture in Historic Socorro, Texas

*David O. Brown, John A. Peterson, and David V. Hill*

## ABSTRACT

The production and use of historic Native American ceramics in the El Paso, Texas, area are examined through archeological and ethnohistoric data. While little is known about the ceramic traditions of Native peoples in the region between A.D. 1400-1680, there are abundant data associated with the post-Pueblo Revolt occupation of the El Paso area by northern and middle Rio Grande immigrants. Native brownware and red-on-brownware traditions for local ceramic use incorporated European forms and design motifs. Nonetheless, the brownware tradition appears to have been a strong marker of Native American identity in an increasingly colonial world.

## INTRODUCTION

The investigation of Native American ceramic production is one of the most important aspects of the study of prehistoric traditions in the Southwestern U.S. Finely defined chronologies and the social relevance in the evolution, production, and dispersion of various ceramic styles within the Southwest have yielded some of the best archeological examples of our ability to understand past ceramic traditions beyond the most simplistic assessments of social contact and population movement. The Southwest has also seen some of the most intensive studies of historic Native American ceramic traditions.

The El Paso area has often been overlooked as a participant in this important regional ceramic tradition—despite a long historical tradition of indigenous ceramics—probably because of the relatively poor artistic quality of the specimens relative to the finer traditions to the north and south. While perhaps not a part of the mainstream of Southwestern cultural development, studies of the indigenous El Paso Brownware tradition constitute an important key to the larger picture of prehistoric adaptation and human ecology in the region. Likewise, historic Native American ceramics from the El Paso area provide a unique opportunity to understand cultural processes because of the acculturation of Native American groups under Spanish Colonial political control.

The Río Grande Valley of El Paso, Texas, lies in the shadow of Spanish colonial era history in the American Southwest (Figure 1). The attention given to the modern towns of Santa Fe, Taos, and Chimayó, and the charm of the northern New Mexican mountainscape obscures the role of Paso del Norte in the settlement of northern New Spain. The Pass was critical to the success of the frontier settlements, in its role as a site of early exploration, and as a node along the Camino Real from Santa Barbara, Chihuahua and Santa Fe, New Mexico. The Paso del Norte also was the refuge for Spanish colonists and their First Nations allies during the 12 years of exile following the Pueblo Revolt of 1680. Even following the resettlement of the northern Río Grande valley in the 1690s, Paso del Norte and the lower valley of El Paso were among the most productive agricultural landscapes in the region, thus drawing both indigenous peoples and Europeans alike (Hendricks 1994a, 1994b). The Mission wines and brandies of the area were the pride of the frontier, and the perennial gardens of the lower valley of El Paso were balm to travelers fresh from the desert.

Throughout its history, this region has been an amalgam of different peoples, from the indigenous Manso and Suma and *naciones* from surrounding

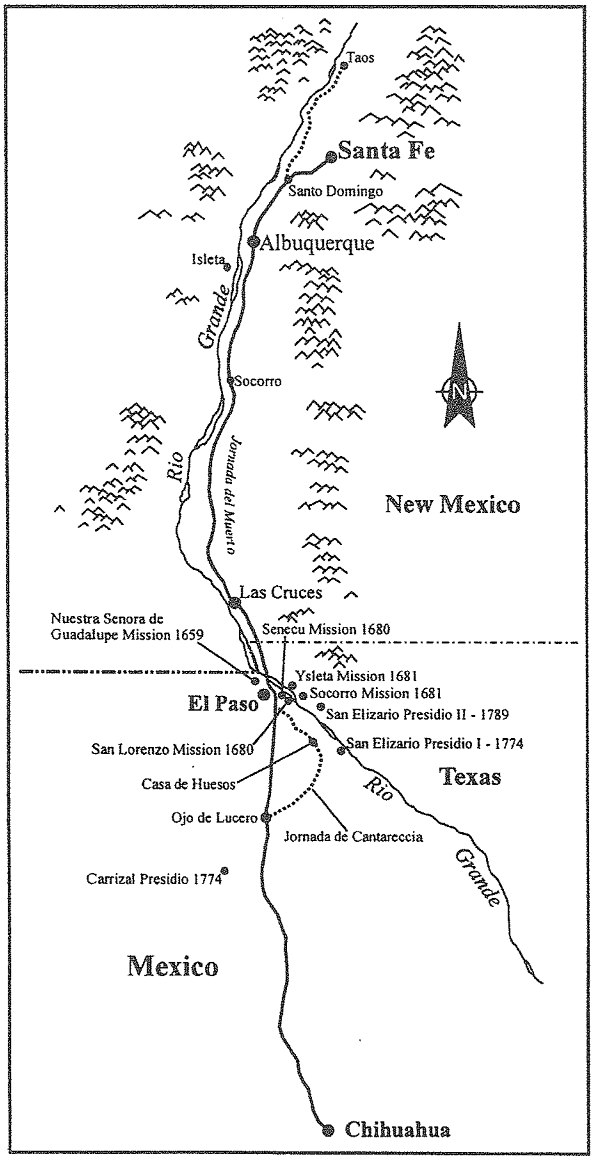


Figure 1. El Paso, Texas, region.

regions (including the Janos, Jumanos, and Jocomes); the northern Puebloans who were swept south following the Pueblo Revolt in the 1680s; raiding Apache who settled peaceably in the last years of empire under the Apaches de Paz settlement program; the caste Spanish colonists who ranged in ethnicity from Hispanics to mestizos; and finally the Anglo-Europeans who came in force beginning in the 1830s, but most critically immigrated in the 1880s with the railroad and in the 1910s with the advent of industrial irrigation cotton agriculture. This sweep of history was a polyglot of ethnic groups, languages, and cultures, ranging from a variety of indigenous traditions to that of the Spanish colonists who were establishing hegemony throughout the region (Peterson and Brown 1994).

The diversity and variety of local ethnic groups continued into the late 19th century. Adolf Bandelier was drawn to explore the archival records and the diverse communities of the area in his sojourn in Paso del Norte in the 1880s (Lange and Riley 1970). Because of his diligence and detailed diaries and watercolors of indigenous pottery from the region, we have excellent accounts and representations to compare with the archeological record of the region.

This paper examines the production and use of historic Native American ceramics in the El Paso area, comparing available archeological data with limited 19th and 20th century ethnographic data relevant to ceramic production. Although the main producers of the pottery of this tradition were probably peoples moved from the middle Rio Grande during the Pueblo Revolt of 1680, from its earliest days these ceramics seem to be very different from the former traditions of these transplanted pueblos. Like the harried Native American populations of this region, the local historic ceramic tradition represents a mixing of regional populations and also reflects the variation in raw materials available to local potters. Although the local brownware tradition seems to have been produced by and for the local Native American mission populations, from its beginnings this transplanted tradition incorporated European forms and design motifs. Despite the recent origins of the tradition and in spite of the strong influence of European traditions, the style survived, albeit continually evolving, into the 20th century. As such, it reflects the survival of the region's Native American community.

## NATIVE AMERICAN HISTORY IN THE EL PASO AREA

Native peoples have roamed the Jornada region since the end of the Pleistocene. Although the earliest history is still less well known than in some adjacent regions, considerable knowledge has been acquired over the last few years (Miller 1989).

Ceramic production has a long history in the El Paso area. Ceramics with plain brown-colored pastes and occasional red-slipped sherds have been associated with radiocarbon dates from the first two centuries of the common era (LeBlanc 1982). The ceramic types El Paso Brown, El Paso Bichrome, and El Paso Polychrome are widely distributed throughout southern New Mexico, West Texas, and northeastern Chihuahua and are associated with pueblo groups. Based on extensive petrographic studies, the ceramics representing the El Paso types contained granites of variable composition. Granite is available in the nearby Franklin Mountains (Hill 1991). Red clay and granite boulders are available near prehistoric residential zones on the alluvial fans of the Franklins.

Introduced ceramics represent material evidence of social contact. Mimbres Black-on-white produced in southwestern New Mexico is commonly recovered from prehistoric sites in the Paso del Norte area in contexts dating prior to A.D. 1150. Occasional Pueblo pottery from the north and west have also found their way into the region. Ceramics representing the Casas Grandes ceramic tradition have been reported from sites dating between A.D. 1000-1450.

There is a distinct break in the aboriginal adaptation and material cultural traditions of the Paso del Norte region. It would appear that most of the pueblo occupations may have disappeared by A.D. 1450. The year 1450 was one of the worst droughts that can be documented in the past. In any case, there is little in the way of continuity between the prehistoric and historic brownware traditions in the El Paso area.

## THE EARLIEST HISTORIC BROWNWARES

Spanish explorers traveling through the Paso del Norte, beginning with Francisco de Coronado in 1541, reported indigenous peoples, namely the Manso and Suma (Peterson 1991). While little was reported on the production and use of ceramics by these groups, the excavation of sites dating to the late 17th century has produced evidence in the form of pottery made using clay and temper resources that were located in the Rio Grande trench (Hall 1994).

Excavations at historic sites in the El Paso area have obtained extensive collections of Native-produced ceramics. These ceramics are characterized by brown to tan bodies that are either plain or decorated using red pigment. The paste of these ceramics is somewhat variable, reflecting the use of clay deposits and sediments located along the Rio Grande (Hill 1991, 1997; Hill and Peterson 1998b).

While the historic brownware tradition of the El Paso area is generally regarded as having been introduced by Pueblo potters from the middle Rio Grande/Rio Abajo area, there is reason to suspect that local influences, in the form of Manso, Suma, or even Apache potters, may have been present as well. In fact, the Late Prehistoric pottery of the Rio Abajo region is quite different from that of the El Paso historic brownwares, and known types from the middle and upper Rio Grande are rare to nonexistent on early historic sites in the El Paso area. A sample of brownware ceramics from LA67321 has a light brown silty paste with rounded quartz sand inclusions, strongly resembling those of the El Paso area of the same age (Hill 1997). The similarities in the ceramics from LA67321 to many of those from contemporary sites in the Paso del Norte reflects the use of clays derived from terraces of the Rio Grande at both locations.

Gerald (1968:54) was one of the first to mention the local historic brownwares, in his discussion of the Spanish presidios of New Spain, when he wrote that:

> One or more of the locally made brownwares, red-on-browns, redwares, and white wares were found on every presidio site. These are presumably the common utility wares which were made by local specialists or by each presidial wife. The paste of most of this local pottery is fairly coarse texture though a finer paste was utilized at some sites.

Graves (1982) provides a brief description of the locally produced brownwares from the Old Socorro Mission (41EP1532). From a sample of 748 sherds excavated from the site, he described two types based on simple technological attributes. One was a dark brown color with a coarse paste while the other, a lighter brown color, had a finer paste. He suggested the differences were the result of the proportions of clay and sand temper and suggested that the variation may have little cultural significance (Graves 1982:5-6).

The first thorough description of the historic brownwares from El Paso was undertaken by Tice (1987), who studied 218 rim sherds and five partial vessels from the Old Socorro Mission. Tice defined two basic types, Socorro Brown, and Socorro Brown Smudged, and identified several other miscellaneous historic brownwares.

According to Tice, the paste of the Socorro Brown ceramics is quite variable, being either coarse or fine textured, with a core color that ranged from black to yellowish-red depending upon the firing temperature and the degree of oxidation of the paste (Tice 1987:19-20). Refiring sherds with gray and black pastes to ca. 600⁰ C yielded a brown paste color in the 7.5YR range. Tempering material was also found to be variable, with 77 percent of the sherds exhibiting sand temper, 3 percent crushed rock, and 20 percent a combination of both (Tice 1987:20). Tice noted that the sand evidenced procurement from both alluvial and eolian environments, while he described the highly variable crushed rock as "exotic." Vessel surfaces were smoothed or "wiped" but not generally highly polished or burnished. Tice described the vessel forms as primarily small bowls, large bowls, narrow mouth jars, wide mouth jars, and plates.

Tice (1987:33) distinguished Socorro Smudged from Socorro Brown by its characteristic intentionally smudged interior. These smudged sherds accounted for less than 9 percent of the brownware sherds from the mission site. Technological attributes were essentially the same between the two types, although he noted no sherds with only crushed rock temper, and there appeared to be a greater degree of smoothing or polishing on the smudged sherds.

Sale et al. (1987) recovered 736 brownware sherds from a trench monitoring project in the community of Ysleta. Their analysis of the 728 undecorated brownware sherds indicated that all were sand-tempered (Sale et al. 1987:31). High percentages of fine- to medium-grained sub-angular and rounded particles suggested an origin in drainage bottoms or arroyo fans but not in the river floodplain where sand grain sizes tend to be larger. Vessel surfaces were typically well smoothed and about 40 percent were smudged; the great majority were smudged only on the interior, but with a substantial number on both surfaces, and a few on the exterior surface only (Sale et al. 1987:32). Vessel forms included bowls (the most common single form comprising two-thirds of the sample), plates, jars, and ollas.

The most extensive discussion of historic brownwares to date has been by Miller and O'Leary (1992) from the Ysleta Clinic Site (41EP2840). Their sample included 19,048 historic brownware sherds, which they call Ysleta Brownwares (in deference to possible ethnic or cultural differences between the Ysleta Tigua potters and the Socorro Piro potters who may have made Socorro Brown as defined by Tice [1987]). On a general level, they note four primary characteristics of the assemblage:

1. A limited range of vessel forms and rim styles, indicating little temporal and/or functional variability;
2. A diverse range of firing conditions and other production aspects, indicating unstandardized production techniques;
3. Close similarities in vessel forms and styles to Spanish-influenced wares from Tiwa and Tewa communities of the middle and upper Rio Grande valley of New Mexico; and
4. Evidence that some of the Ysleta brownwares were not produced locally (Miller and O'Leary 1992:143).

Miller and O'Leary's analysis of Ysleta brownware ceramics focused on a sample of 1069 rim sherds after it was determined that body sherds were unreliable in determining vessel form. Excluding those rims which were too small or too damaged to analyze left a sample of 628 rim sherds. Three general vessel forms were identified within this sample: jars, bowls, and plates. Jars (51 percent) were slightly more common than bowls (44 percent). The third form, plates, was restricted to only 5 percent of the sample.

Analysis of the rim forms linked to the three vessel types indicated little variation among the ollas or jars, with only a single basic form featuring a highly everted rim above a small globular, but not bulging, body (Miller and O'Leary 1992:148). Two plate variations were noted: one was a flat plate with a thickened rim and the other, somewhat rare in the sample, had a flat rim above a sunken midsection, characteristic of "soup plates." The bowl rims, on the other hand, were more variable, with five basic types, including: (1) large to moderate-sized hemispherical bowls with direct or slightly outcurved rims, (2) direct rim bowls with carinated inflection points identical to Tewa polychrome bowl forms, (3) large to moderate-sized bowls with incurved rims, (4) small bowls with flared rims, and (5) small cups (Miller and O'Leary 1992:148).

Of these types, the combined direct and carinated bowl types formed the greater part of the collection, with 72 percent overall, while the incurved types were found in about 22 percent of the sample. The flared variety accounted for only 5 percent of the rims. The least common was the small cup, with only one example.

Miller and O'Leary (1992:154) note two kinds of temper: fine to medium-grained sands and angular crushed rock. Ollas or jars were tempered almost exclusively with crushed rock, while bowls had both tempers. Surface finishing was found to be generally simple, with most ollas simply wiped while bowls and plates were more carefully finished. Overall, 22 percent of the jar interiors were intentionally smudged, as compared to less than 9 percent noted by Tice (1987) at the Old Socorro Mission site. A small percentage of the collection had a thin, easily eroded white slip.

## LATER HISTORIC BROWNWARES

The most important type of ceramics in terms of understanding the interaction of indigenous peoples with those of European descent are the historic brownwares. These ceramics form the largest component of the historic ceramic samples in the lower Valley (see Graves 1982; Tice 1987; Sale et al. 1987; Miller and O'Leary 1992; Peterson and Brown 1994; Marshall 1996; Leach et al. 1996). Where there are differences among these samples, the ceramics we discuss from the Phase II Socorro project (Peterson and Brown 1994) appear to match most closely those described by Tice from the Old Socorro Mission. The decorated examples include probable examples of what Miller and O'Leary (1992) have called Tigua Red on Brown (in this case, perhaps Socorro Red on Brown would be more appropriate for the Piro area), but also examples of what may be Tardio period ceramics from Mexico.

In general, the broad statements made by Miller and O'Leary (1992:143) are applicable. As they note, there is a limited range of vessel and rim forms. Although the actual number of rim forms in the Phase II Socorro sample may be slightly greater than that in the Ysleta sample, the number of vessel forms is similarly limited. With a few exceptions, bowls, plates, and jars are essentially the only forms; jars may be less common than in the Ysleta sample. Various bowl forms appear to be the dominant type. Miller and O'Leary (1992) also note the diverse range of firing conditions and production traits. Although not readily quantifiable, the Phase II Socorro sample is extremely diverse in this regard and is probably similar to that recovered from Ysleta. With respect to the observation that the forms are closely related to those common in the early historic period of the middle and upper Rio Grande communities, there is little supporting evidence. Ethnic differences may account for the lack of similarity, as would temporal changes, because the Socorro sample is as much as a century later in many cases.

A number of special brownware forms were recovered during the investigations. The most unique of these is a fragmentary brownware candleholder from 41EP3606. This specimen has the approximate form of a flattened circular glass paperweight with a narrow central section that has been broken off and an apparent handle extending from one side of the base (also broken). It is not like the examples described by Tice (1987) from the Old Socorro Mission.

Another unusual functional class of brownware ceramics is the *comal,* or tortilla griddle (Figure 2). Comal sherds are either perfectly flat or have low walls that extend upward at 90$^0$ from the base. Based on large sherds recovered from excavations conducted near Ysleta, both round and rectangular *comales* were produced (Leach et al. 1996). *Comales* represent a cooking technology that was apparently imported from Mexico during the historic period as no unequivocal *comales* are known from prehistoric sites in New Mexico.

In addition to the candleholder, a single large, heavy spindle whorl was recovered from 41EP3011. A number of ceramic disks, some of them possibly ceramic tools, game counters, or spindle whorl blanks, were recovered from various sites. Several crudely shaped sub-circular worked sherds were also recovered, along with several varieties of vessel handles.

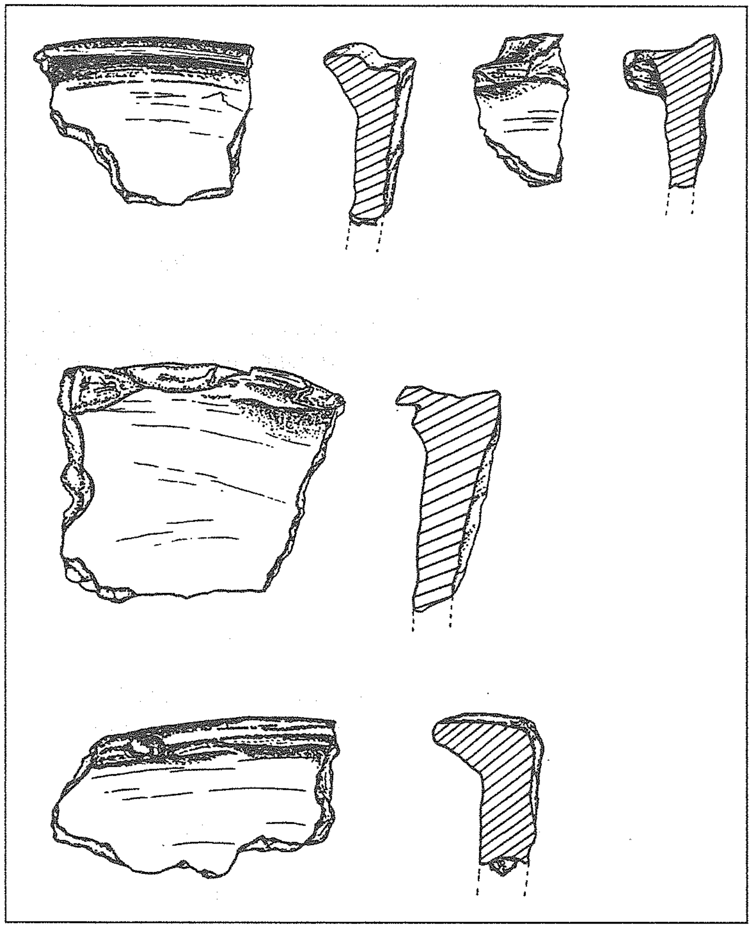

Figure 2. *Comales* recovered from sites 41EP5203 and 41EP5204 (illustration by R. D. Harrison from Leach et al. 1996).

## Red-on-Brown Native-made Ceramics

This class of ceramics was Native-produced using a red iron-based paint for decoration. Designs appear to reflect a merging of Native and European decorative traditions (Figures 3 and 4). These decorated types bear some resemblance to the decorated pottery described by Tice (1987) as 19th century or post-Mission Red-on-Brown.

There is evidence that red-on-brown ceramics were not produced until the late 18th or early 19th centuries in the El Paso area (Leach et al. 1996). Unfortunately the only contexts where red-on-brown ceramics have been recovered from independently dated contexts are at military posts and a Butterfield Stage stop in Doña Ana County, New Mexico, all of which date to the mid-19th century (Hill 1986; Staski 1990). The presence of two sherds of red-on-brown pottery in the lowest levels at the Ronquillo House in San Elizario suggests an early 19th century or earlier date for this style of pottery (Hill 1998).

However, red decorated sand-tempered ceramics are present in the ceramic assemblage from San Antonio de Padua (A.D. 1660-1684) at Casas Grandes, Chihuahua (Di Peso et al. 1974). Capote Red-on-brown (A.D. 1600-1700) and Conchos Red-on-brown (A.D. 1700-1800) are present in ceramic assemblages from the La Junta area of West Texas (Cloud et al. 1994). Problems with sample size and the lack of comparative studies among these red-on-brown variants suggest the need for further research, especially as the overlap in territory as ascribed to Puebloan period (Figure 5) and protohistoric period settlement is so striking (Figure 6).

Overall, the brownware ceramic sample from the El Paso area is extremely interesting and has great potential for further analysis. Most

Figure 3. Socorro Red-on-Brown vessel recovered from excavations at the Old Socorro Mission site (see Tice 1987; illustration by R. D. Harrison from Leach et al. 1996).

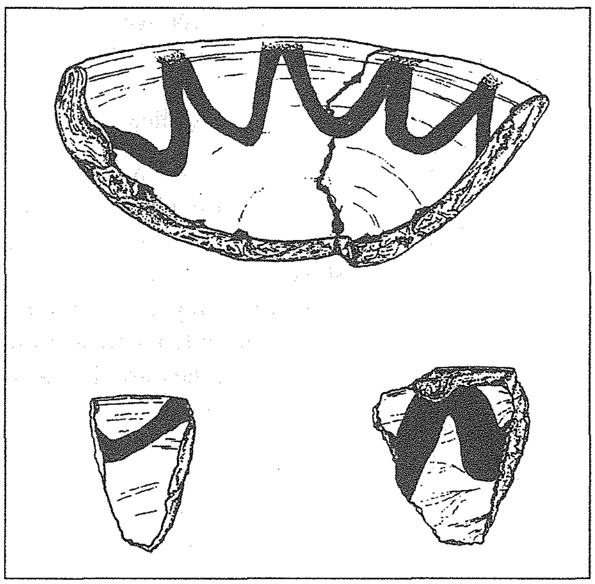

Figure 4. Selected Red-on-brown ceramics from sites 41EP5203 and 41EP5204 (illustration by R. D. Harrison from Leach et al. 1996).

intriguing are the differences between sites, especially those between the Socorro sample and that recorded for Ysleta. Further research in this area may determine if indeed the differences are due to site age, site function, or ethnic affiliations. In general, however, it is thought that all of the above play an important role in their different characteristics.

### Tardio Period Red-on-Beige Slipped

Ten decorated sherds recovered from the investigations at 41EP3011 and 41EP3625 appear to be non-local historic imports. It is suspected that the closest relatives of these red-on-beige slipped brownwares can be found in the Casas Grandes region (Di Peso 1974; Phillips 1989).

### Red-Slipped

These red-slipped or red-painted sherds have a very dark red slip applied to a paste that is quite different from the typical locally produced brownwares. It may be akin to several varieties of redware (and/or polychromes) described in Miller and O'Leary (1992). They note that some of the red-painted sherds may be from Ogapoge or Tewa Polychrome bowls. Red-slipped vessels were also a part of the ceramic industry of several northern New Mexico Pueblos, following the exploitation of lead sources for the production of bullets by the Spanish. Alternatively, redwares could be forms of local "Piro" finishes documented by Bandelier in his watercolor sketches of vessels found in the area in the 1880s.

## RIO GRANDE GLAZEWARE

One sherd from the present-day Socorro Mission site (ca. 1840s, with other archeological components from as early as the mid-18th century) is the rim of a Rio Grande Glazeware bowl, probably one of the Glaze VI (Glaze F) forms

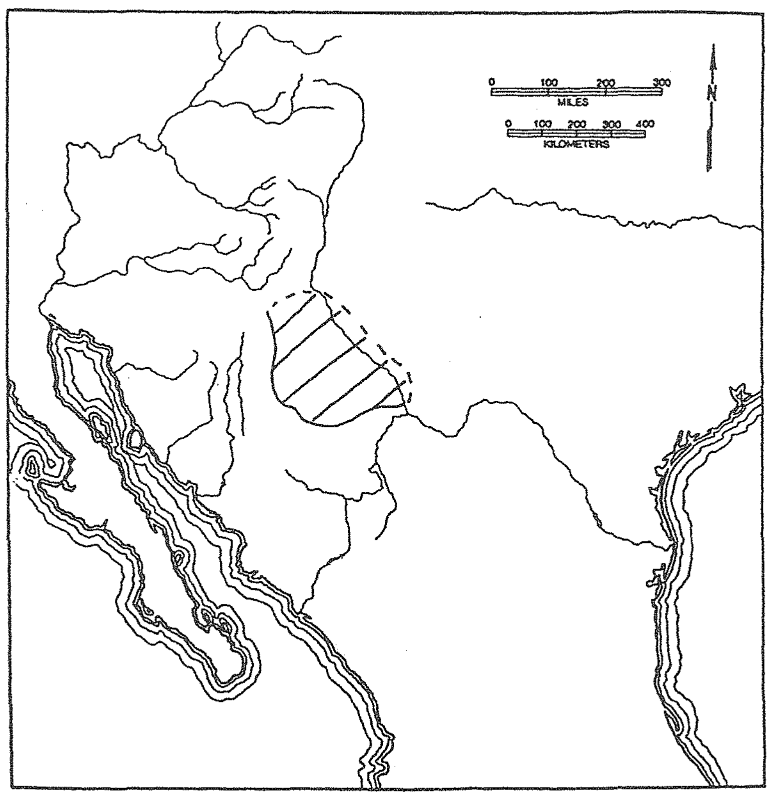


Figure 5. Conchos Phase according to Sayles (1936).

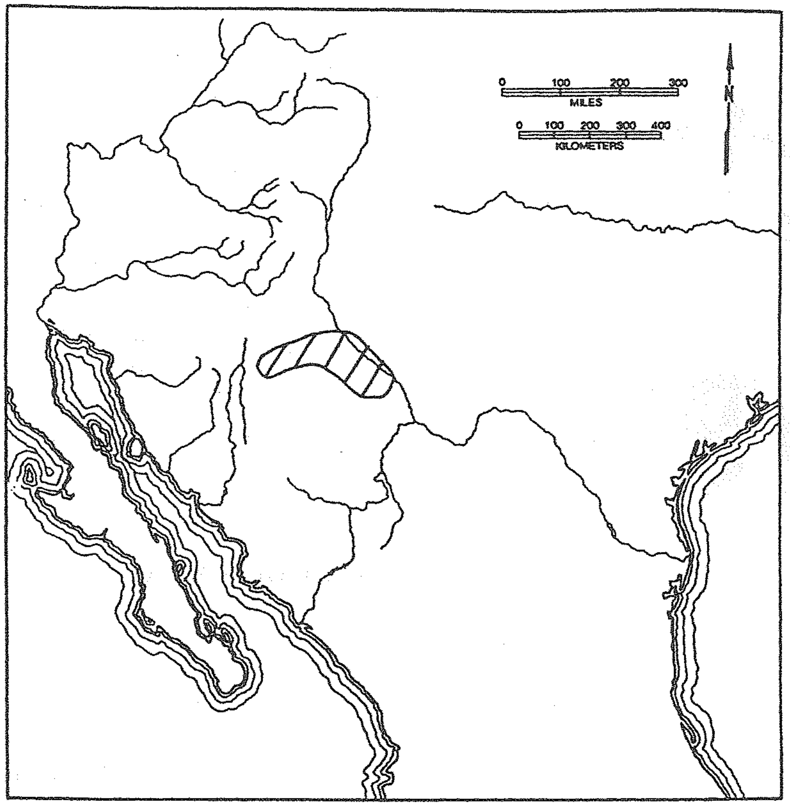


Figure 6. Suma settlement according to Gerald (1973, 1974).

## EUROPEAN/MEXICAN CERAMICS

### Majolica

Numerous tin-enameled ceramics were recovered from the sites in the Socorro area. Most of the sherds are quite small and many are plain, precluding definite identification. As a group, they are the earliest European-influenced ceramics to occur in the assemblages and, while they are found at most of the sites, and throughout the excavations levels, from top to bottom in the units, they dominate the lower, earlier levels in the archeological deposits. While most, even the decorated wares, are not temporally diagnostic, those that are appear to be quite late, spanning the period from the mid-18th to the mid-19th centuries.

(Mera 1933). This vessel is a bowl with a strongly everted rim that is thinned toward the lip. Traces of eroded black glaze paint are found on the exterior surface below the rim. The paste of this vessel is different that those of the locally produced brownwares. At least one other body sherd from that site may also be a Glazeware example. Additional Glaze F ceramics have been reported from the Ysleta Clinic sites and from the surface of the Keystone Dam site (Miller and O'Leary 1992).

The presence of Tewa and Ogapoge Polychrome and Rio Grande Glaze F style ceramics in historic assemblages in the El Paso area indicates occupation during the late 17th and early 18th centuries. These occupations are also well documented in the contemporary literature. The presence of ceramics produced in northern New Mexico also is evidence for the movements of goods and peoples along the Camino Real, the route linking northern Nuevo Mexico with Nueva Vizcaya, modern Chihuahua.

#### Puebla Blue on White

This is one of the most easily recognized of the extant types, and perhaps the most widely distributed majolica, although it is less common in the Socorro area than the later San Elizario Polychrome. Manufactured in Puebla, Mexico, as early as the late 17th or early 18th century, this type is recognized by a blue floral pattern marked occasionally by raised designs (Goggin 1968; Deagan 1987). There is considerable variability in the few specimens identified from the Socorro project area, including differences in paste color, glaze color, decoration color, thickness, and care in execution. Most of the fragments are small, however, and tend to be rims rather than body or base sherds. Although a few bowls are present, the sample appears to be dominated by plate forms. This is probably the earliest type found in the El Paso area, although both Goggin (1968) and Deagan (1987) note that it persists well into the 19th century.

### San Elizario Polychrome

This type was originally defined by Gerald (1968) for the northern New Spain presidios and it is indeed common in the Socorro and San Elizario areas. San Elizario Polychrome in our samples is characterized by the use of dark blue designs, usually in a band encircling the rim, that were framed in narrow brownish-black to black lines. Blue elements, typically individual wide brush strokes, are pendant from this band. Each of the brush strokes often has a single brownish-black line within the stroke. Many of the securely typed specimens from the El Paso area belong to this type and a number of other questionable specimens may be examples of this type.

### Aranama Polychrome

This type was initially defined by Goggin (1968). Aranama Polychrome sherds had yellow bands, framed by narrow brownish-black lines similar to those observed in San Elizario Polychrome (Barnes 1980). Green abstract floral elements were also present, pendant from the band. Brownish-black lines are also present within isolated yellow elements. Aranama Polychrome represents the latest end of a highly variable decorative continuum in majolica that began with the 17th century type, Abo Polychrome. Aranama Polychrome is thought to have been produced sometime between 1700 and 1830 (Lister and Lister 1976). It is represented by a single sherd from site 41EP3625, one possible example from 41EP3010, and in sherds from the San Elizario Plaza excavations (Hill 1998).

### Unidentified Green on White

A relatively large number of green on white or green and black on white or cream polychromes are found in the El Paso area, particularly at 41EP3625 and 41EP3010.

### Miscellaneous Orange Line Polychrome

Several sherds of this type were found at various proveniences in the Socorro and San Elizario areas. It may be a variant of Aranama Polychrome, although this is unclear; it does appear, however, to date later in time than earlier at San Elizario and Socorro. These sherds probably relate to a series of types defined by Gerald (1968) and Barnes and May (1972).

### Miscellaneous 19th Century Polychromes

In the upper levels of most of the sites are a bewildering variety of multi-colored majolicas that have relatively sloppy designs, lack traditional majolica design elements (such as the well-defined rim band or central figure), and are without blue coloration. Deagan (1987) has pointed out that such late sherds seem to copy design elements from 19th century imported English ceramics such as transfer wares.

Two late majolica sherds recovered from San Elizario represent examples of Guanajuato Blue-on-white. These ceramics were characterized by a thick white slip with dark blue designs on a yellowish-red paste. Given the stratigraphic association of these sherds, it is likely that they belong with the 19th century occupation of San Elizario.

## LEAD-GLAZED WARES

One of the most common, and indeed most interesting, non-brownware ceramic types recovered from the El Paso area is Mexican lead-glazed ware (Figure 7). This ware reflects a blending of European and indigenous ceramic traditions. These wares have been described in some detail by Barnes (1980); Deagan (1987) has also presented data regarding their manufacture and distribution. More recently, Carlson et al. (1994; see also Carlson and Malicse, this volume) have investigated their chemical composition with the goal of understanding their origins and distribution. For the most part, the lead-glazed ceramic bodies are soft-paste earthenwares not unlike the brownwares found in the Lower Valley (Hill 1998).

Brown paste Mexican glazeware is characterized by a clear lead glaze on a reddish-yellow to reddish-brown, or less commonly yellow, paste. Decorations observed on examples of brown paste Mexican glazeware included brown, white, black, and green. The beginning date of this class of ceramics is unknown. Clear lead-glazed ceramics

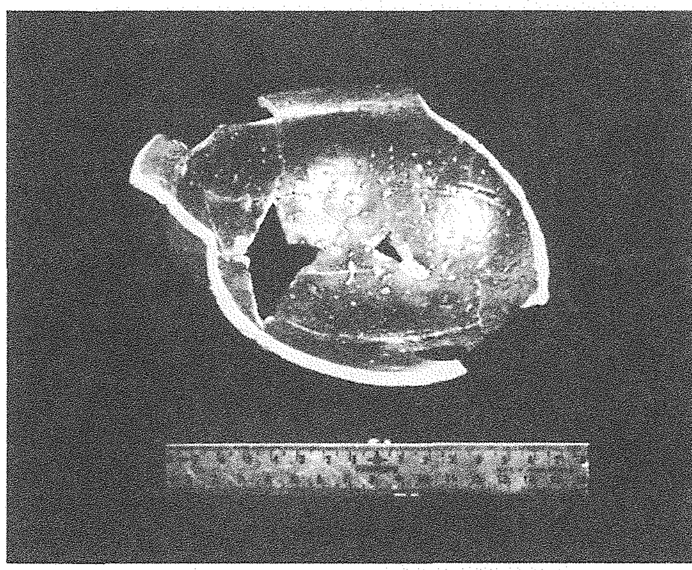

Figure 7. Lead-glazed (Presidios Green) earthenware vessel from Socorro, Texas.

continue to be produced today over much of Mexico.

Green-glazed ceramics were categorized based on the color of the paste. Green-glazed sherds with an orange to brown paste were classified as Guanajuato Green-Glaze ware. Guanajuato Green-glazed sherds had similar colored pastes to those observed in the brown paste Mexican glazeware tradition and the Guanajuato Blue-on-white majolica. Most commonly the pastes were reddish-yellow or occasionally dark brown in color. It has been suggested that Guanajuato Green-Glaze ware was produced between 1750 and 1850 (Barnes 1980). However, Guanajuato Green-glazed ceramics were recovered in later contexts in the San Elizario and Socorro areas, and are produced in Guanajuato today (Fournier 1997).

Green-glazed ceramics with a white, gray, or pinkish paste were identified as Presidios Green. Presidios Green had a pinkish-gray, pink, or occasionally brown paste. While the majority of the sherds had a dark green glaze, one sherd had a grayish-green glaze. Presidios Green was defined based on collections from Carrizal, Chihuahua (Brown et al. 1998). Presidio de San Fernando de Carrizal was occupied between 1774 and 1847. However, occupation of the site area continues into the present (Gerald 1968; Ben Brown, 1996 personal communication). Presidios Green has a long and poorly defined span of production that ranges from the 17th into the 19th century (Brown et al. 1998; Hill 1998).

### Green Lead-Glazed Olive Jars

These thick sherds have a thin, almost transparent, green glaze on the interior surface and no exterior glaze. This form was originally studied by Goggin (1968), who defined Early, Middle, and Late Styles, although more recent analysis of larger collections has discounted his developmental sequence. Four Olive jar sherds were recovered from 41EP3625 during the Phase II investigations in Socorro (Hill 1994).

## WHITE EARTHENWARES

The largest category of European-produced and influenced ceramics is white earthenwares or whitewares. Overall, 148 white earthenware sherds were collected from the investigations in the Socorro and San Elizario areas. These sherds vary from a relatively soft paste ivory-colored variety that may be a creamware to hard, chalky white, high gloss clear glaze ironstones. A few sherds with a slight bluish tint may be pearlware, although the tentative identification is based on very small fragments.

White earthenwares dominate the assemblage from several of the Socorro and San Elizario sites, and are found in the upper levels of excavation units at most of them. Majolica was clearly the dominant European type throughout the 17th and 18th centuries in the El Paso area, with a small amount of porcelain; in contrast, whitewares became the dominant type of the 19th century. It is not known how early these wares were introduced into the area but English ceramics are likely to have become more common after the El Paso area came under United States rule at the end of the Mexican War. Several of the decorated types, such as shell-edge and hand-painted floral wares, probably date to this early period. Some of the transfer-printed wares may also date to the mid-19th century. In general, decorated types are relatively uncommon, however, and plain whitewares are dominant; the decorated types found date to the earlier portion of the 19th century. Late 19th century decorated types such as decalcomania are rare in the ceramic assemblages.

## PORCELAIN

Chinese porcelains quickly replaced Spanish majolicas as a luxury item in Mexico, perhaps after the extensive production and distribution of Mexican majolicas from Mexico City and Puebla. The amount of porcelain recovered from El Paso area investigations is small, and much of it is not from unequivocally early contexts. With the development of porcelain technology in Europe during the 18th century, without chemical analysis it is difficult to discriminate Chinese from European porcelain. Most of the porcelain is probably 19th century in age, and much of it may be from Europe rather than China (Hill and Peterson 1998a).

## STONEWARE

Utilitarian stoneware vessels are found throughout the upper levels of the excavation units at several Socorro sites, although they comprise only a small percentage of the total ceramic sample. The stonewares observed include those typical of mass-produced, widely distributed vessels probably introduced into the area in significant numbers only after the railroad was built to the El Paso area in the late 19th century. These include primarily Albany glazes, with large cylindrical forms such as churns, and a few stoneware mixing bowls. Notably absent are stoneware ginger beer or ale bottles, generally ubiquitous in ceramic assemblages from mid- and late 19th century historic sites in other parts of Texas.

## BANDELIER AND THE SEARCH FOR ETHNIC SURVIVAL AT PASO DEL NORTE

When Bandelier visited the Paso del Norte area in 1883, Piros, Tiguas, Apaches, and Manso peoples were still living in the area. The Mansos, who were the least documented of the groups, had a clan system similar to the Tiguas with four different clans, and they still had claim to a communal tract of land. They danced at the feasts in Paso del Norte, kept grapes from which they made wine, and made pottery (Lange et al. 1984:249).

Bandelier was among the first historians to study the archives of the Juárez Municipio. These records had been used as campfire tinder by Kearney's troops in the Mexican-American conflicts of 1846, but what had survived provided some documentation of local indigenous groups as well as the colonial history of the area, sporadically settled since the late 16th century.

The Mission of Nuestra Señora de Guadalupe was established in 1659 by Fray García San Francisco y Zuñiga. A mission and an *acequia* were constructed within the first few years, and the Mansos and Suma apparently lived with some Piro, Tigua, and Tompiro even before the Pueblo Revolt of 1680. After that time, the northern Puebloans intermarried and lived in close contact with Mansos and Sumas as well as other groups probably Taracahitan in their language affiliation. In 1684, the Mansos rebelled against the Spanish, and several years of strife ensued, where Janos, Suma, Mansos, and other Indian groups destroyed the missions and returned to the hinterland. Even after 1686, when the Mansos returned to the missions, the missionaries frequently complained that they were hard to corral in Paso del Norte and they often left for the country. From 1693 to 1709, smallpox epidemics affected the population, and uprisings of Mansos, Sumas, Janos, Jocome, and Apache occasionally disturbed the Spanish settlements. According to Bandelier, the Mansos he encountered in 19th century Paso del Norte attributed their dwindling population to this period.

Bandelier commented that he had heard from Cura Ramón Ortiz of the Mission of Our Lady of Guadalupe that the Mansos had originally been in that place, but that they had become so mixed with the Puebloans from the northern Pueblos that they had "given up their nationality and language." Ortiz told him that the Zumas (Sumas) had almost completely died out during the smallpox epidemic of 1780, except for a Camargo "who himself died 14 years ago, leaving only one son" (Lange and Riley 1970:162).

On November 6, 1883, Bandelier noted:

> I walked over and found Nicomedes Lara or [y?]Leyva. He is alone in his

> house, his people left him; his wife is dead. Very soon became acquainted. He is Manso! They have now forgotten their language completely and speak only Spanish. But he says that they know they came from the north and they are Piros. He even says that some of his people [speaking of the Leyva] are at Zuni! Of course he began with the fib of Montezuma, but when I told him that I was adopted at Cochiti, he changed tune and interrogated me as to "que era la primera cosa en un Pueblo?" (Lange and Riley 1970:160-161).

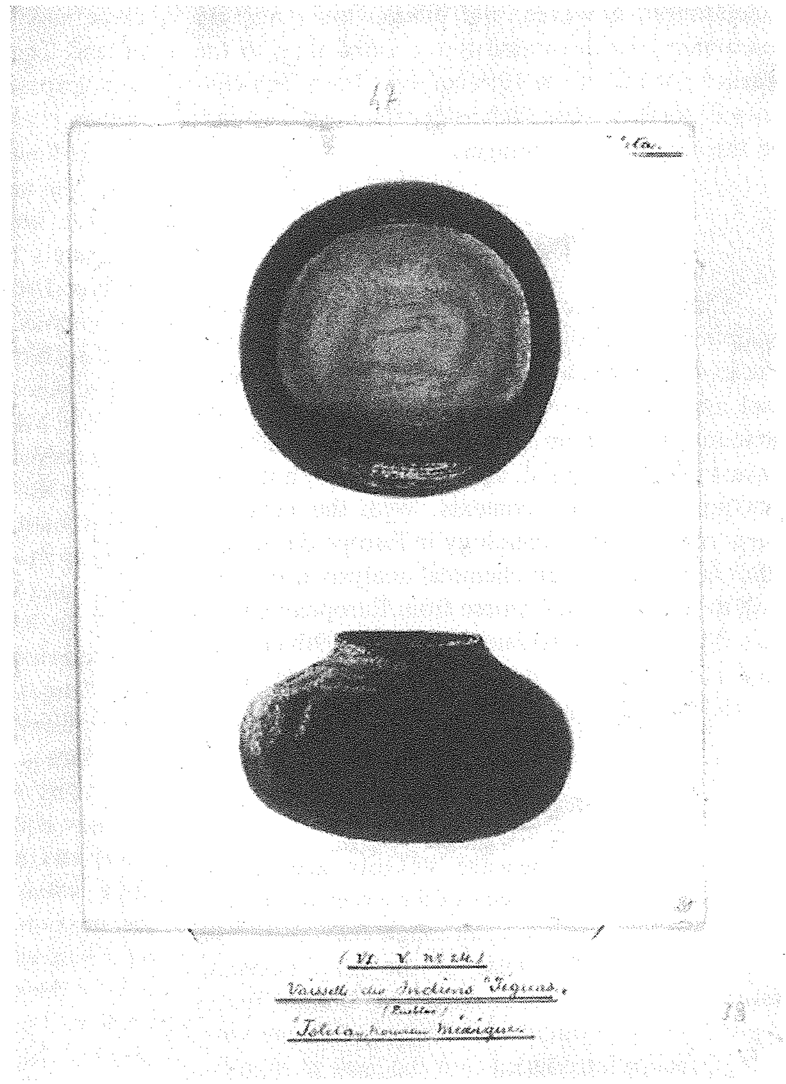

Figure 8. Watercolor rendering of Tigua vessels, Ysleta, New Mexico. Bandelier collection, Vatican Library.

Bandelier went on to describe the religious festivals and clans related to him by Nicomedes Lara, and the pottery which "looks very much like that of the Pimas. It has the same paint and color. Only it is a little lighter in here, but the designs are remarkably similar" (Lange and Riley 1970:161). After another visit, he remarked:

> Called on Nicomedes Lara and had a long conversation. It results from it that the pueblo of the Mansos was originally where the church is, because, there was the head of the acequia. At the "Réal," a pueblo of the Zumas existed, which is now abandoned, the Zumas having confounded themselves with the Spanish population. The Mansos originally lived in houses of branches and of straw or reeds, and only through the Spaniards were they brought to live in houses of adobe (Lange and Riley 1970:162).

Ethnic diversity clearly persisted at the Pass. Here, the people of Senecú, despite their knowledge of origins at the Pueblo of Abó in the middle Río Grande near present-day Socorro, New Mexico, had lost their native culture, then made the same pottery as the Mansos; where Piros and Tiguas and Mansos danced together; and where the Zumas "...hav[e] confounded themselves with the Spanish population" (Lange and Riley 1970:161-163).

Bandelier's images of red-on-brown and red-on-white ceramic vessels are unique representations of pottery styles that have been previously known only from excavations in the region (Figures 8-11). The assemblages from the later occupations at the Old Socorro mission and from 18th and 19th century sites in the lower valley include red-on-brown ceramics that appear to have roots in the prehistoric ceramics of the greater Southwest and Sierra Madre, ranging from Conchos red-on-brown to persistent red-on-brown ceramics known today in the Sierra

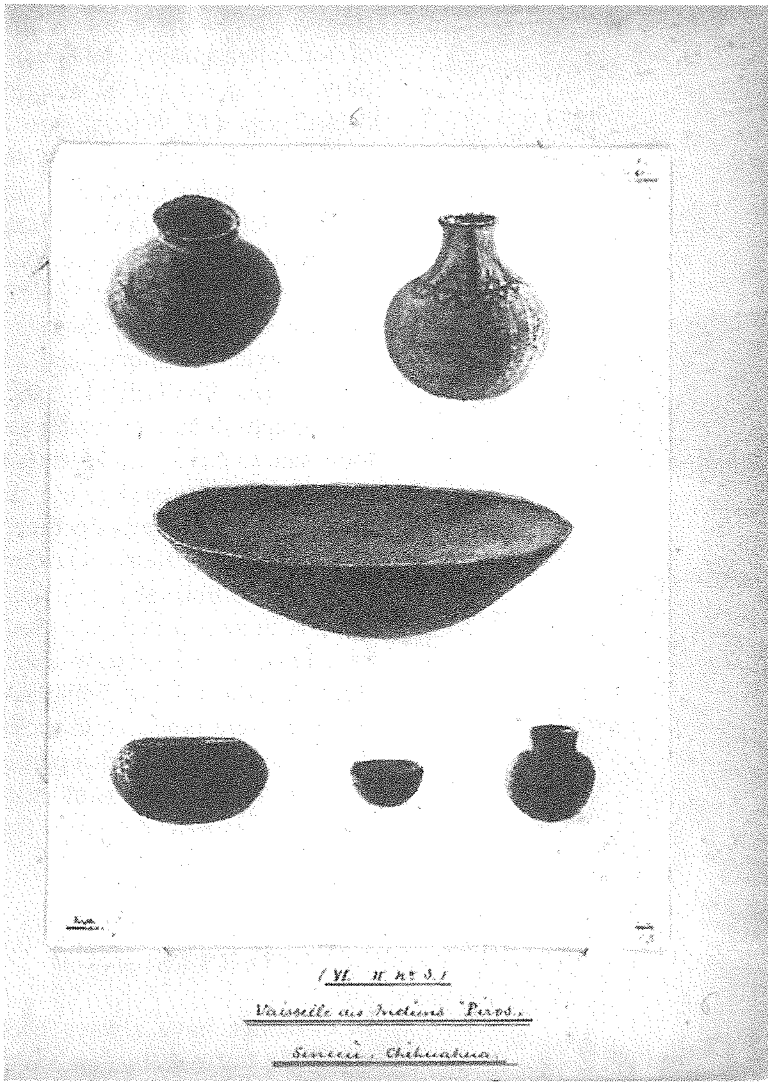

Figure 9. Watercolor rendering of Piro vessels, Senecú, Chihuahua. Bandelier collection, Vatican Library.

the clay and water. The black finish shown in the folio sheets reflects the common occurrence of smudged utility vessels found in archeological sites. Missing in Bandelier's material are the diversity of thickened rims and plates and jars with Spanish forms. Perhaps Bandelier was searching for origins so diligently that he overlooked the forms with carinated shoulders and newly colonial era functions such as *comales* and tortilla irons that appear in Houser's collection from Natividad Camargo (Figure 12). In any case, they are clearly distinct from the polychrome vessel and the plain black jar from Santa Clara Pueblo that Bandelier also documents.

## NICK HOUSER'S DISCOVERY

In the more recent past, Nicholas Houser revisited Bandelier's vision of the ethnic diversity and resilience that he depicted in the late 19th century. During the summer of 1966, Nick Houser spent many fruitless weekends attempting to locate Manso descendants. He queried numerous elderly people in the old *barrios* about the original Indians of Juarez and received laughter or polite denials of such knowledge. Then, one hot day in San Lorenzo, a Juarez neighborhood that was formerly a small town, he directed his inquiry to an old man seated in the shade of a large cottonwood tree. The old man told the shocked anthropologist that he was a Manso and proud of it! This man was Natividad Camargo, who lived near the Church of San Lorenzo. Houser interviewed Natividad, and eventually was able to document what appeared to be the last person in a long lineage of ethnic identity, if not in fact blood quantum, that had persisted in the region despite colonial incursions and multi-cultural intrusions since the earliest documented era of Spanish entradas in the 16th century.

Tarahumar of western Chihuahua. Bandelier also noted the red floral painted designs on the Manso and Piro vessels and the reflective quality on a Tigua bowl. The latter may have a locally produced glaze, similar to those found crudely effected on much of the green-glazed pottery found in El Paso area archeological sites.

The red-on-white vessel depicted in Bandelier's "Piro" vessels from Senecú, Chihuahua, may be representative of the red on white-slipped sherds found from a few early 19th century contexts in Socorro, Texas. Some of the thinner slips may represent deposits resulting from sodium or calcium in

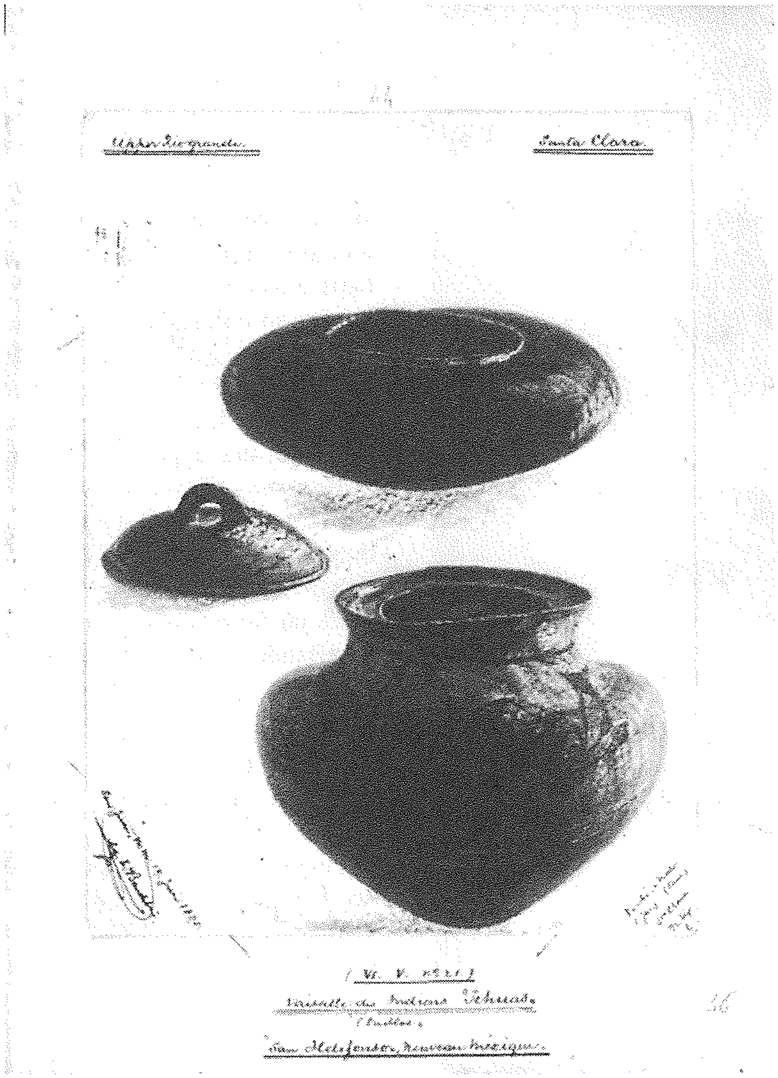

Figure 10. Watercolor rendering of Tewa vessels, San Ildefonso, New Mexico. Bandelier collection, Vatican Library.

From Camargo, Houser also collected a number of artifacts, including ceramic ollas and household tools.

A limited attempt to reestablish the pottery-making tradition at Ysleta Pueblo was undertaken in the late 1960s (Hedrick 1971). Women were asked where their mothers and grandmothers had collected clay and temper for making pottery and how the pottery was produced. Ceramic clay was collected from terraces of the Rio Grande sand for temper. Vessels were formed using the traditional Puebloan method of coiling.

The historic archeological record of Paso del Norte is made richer by these representational sources. Bandelier's watercolors of indigenous pottery and housing provide a record of the merging by still separate ethnic groups in the late 19th century. While the indigenous styles of pottery were clearly melding with each other and with Spanish traditions, Bandelier's images provide a baseline for evaluating the merging of style, technique, and ceramic form. Similarly, Houser's photographs depicting vessels and tools said to have been kept since the late 19th century by the Camargo family clearly document the persistence of Native traditions in the face of Spanish colonial hegemony in the region. The culture of ceramic production recorded by Hedrick indicates that while few ceramics were produced in the El Paso area during the earlier part of the 20th century, the memory of the craft was still alive in a few residents of the area.

## CONCLUSIONS

Ceramics have always been one of the key tools that archeologists have utilized to study past cultures. The ceramics recovered from the recent excavations in the lower valley of El Paso have great potential for understanding colonial life in a mixed ethnic community on the far frontier of the Spanish empire. Together with the representations of pottery from Bandelier and Houser, in the context of their accounts of complex and interactive ethnic communities, and in light of the continual invention and re-invention of ethnic identities, these sources in tandem provide provocative insights into the lifeways and the culture history of the area.

A number of questions arise from close study of the ceramic data from El Paso area archeological sites. The appearance of majolica and Chinese porcelain at sites in the region is clearly intrusive, and can provide excellent chronological data (Hill and

Peterson 1998a, 1998b). Miller and O'Leary (1992) see the origin of the brownwares in the Spanish-influenced ceramics of the middle and upper Rio Grande areas. While there are some similarities and some direct links, such as the Rio Grande Glazeware, between these areas and the Paso del Norte, there are fewer than expected. Did the transition in ceramic production require investigation of new clay and temper sources and did the discovery of these initiate new technological directions? Or did the Spanish in the Paso del Norte area exert a different and perhaps greater influence on the transplanted cultures? Is it possible that there was an admixture of Native brownware traditions from the Sumas or Manso (or even Apache) that may have guided the acculturation of Piro potters to their new home? Given the evidence for intermarriage between Native peoples, any ethnic epitaphs assigned to brownware assemblages from different localities in the Paso del Norte are likely to be misleading.

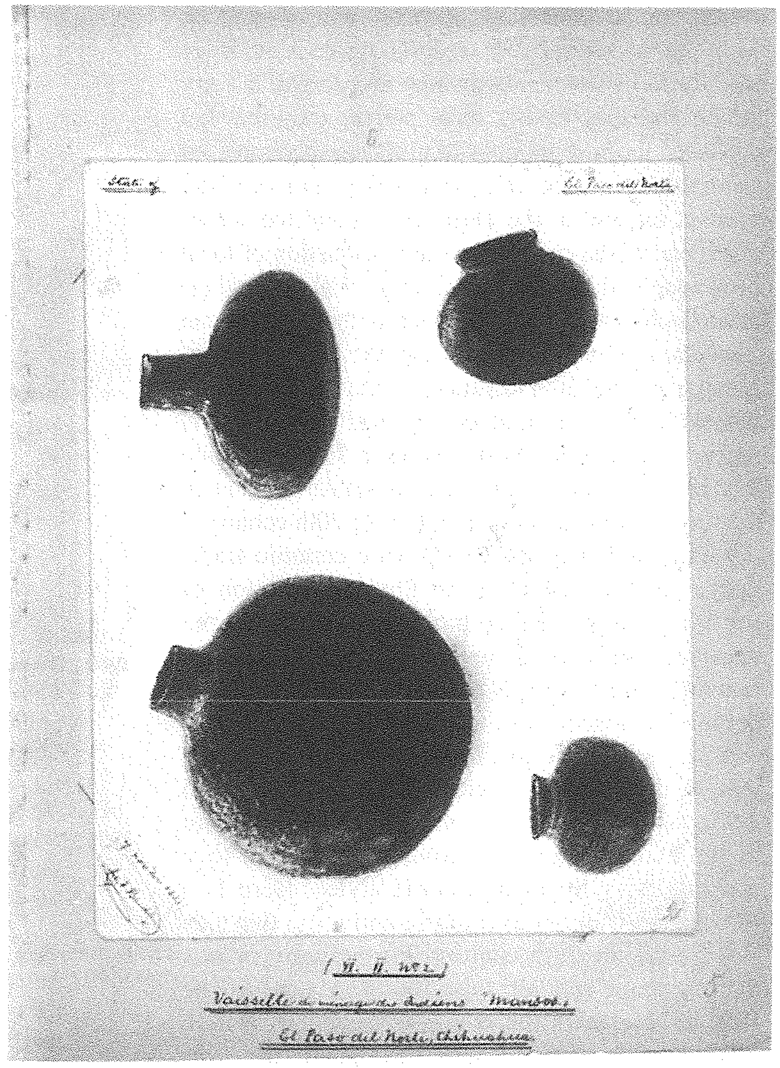

Figure 11. Watercolor rendering of Manso vessels, El Paso del Norte, Chihuahua. Bandelier collection, Vatican Library.

There are also questions regarding the extent and distribution of local ceramic production. How many potters were there and to what degree are individual differences or even micro-regional differences reflected in the simple technologies and even simpler decorative stylistic elements found? What was the range of wares produced? This historic pottery's paste, however, is quite different from the prehistoric brownwares and the genetic relationship between the two wares is not immediately apparent.

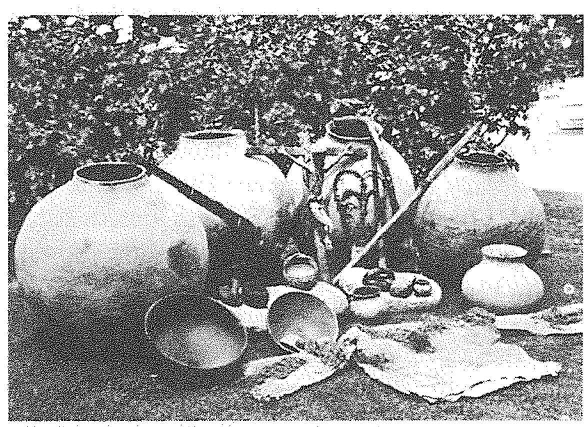

Figure 12. Natividad de Camargo vessels, San Lorenzo, Chihuahua.

A key aspect of the examination of the brownware tradition is the mode and locus of production. Gerald (1968) notes that brownware production may have been the purview of every presidial wife. While this is possible, it seems unlikely, nor does it explain the distribution of brownwares in the Paso del Norte. Despite the differences between the historic brownwares and the local prehistoric ceramic tradition, there is evidence that these historic brownwares are part of a very strong and long-lasting local pottery tradition that produced the vast majority of utilitarian ceramics for more than a century. Only with the opening of wider trade at the end of the 18th century and the subsequent end of the colonial era did production of local brownwares decline. Indeed, Jesse Walter Fewkes, an archeologist and ethnographer for the Smithsonian Institution, who traveled through the Pass at the beginning of the 20th century, found that no more vessels were being produced by Native peoples living in the Paso del Norte (Fewkes 1902). Despite this decline, they continued as a viable element in the total ceramic assemblage into the 20th century.

Through time, the brownware ceramic tradition comes to resemble the Spanish tradition of the border in the limited number of forms and the relative simplicity of techniques of elaboration, remembering that the Spanish ceramics of the border may represent a limited range of ceramic forms compared to those available closer to trade centers. While this can be viewed as acculturation to a Spanish lifestyle, we submit that it speaks more to the maintenance of Native identity than to a merging with Spanish ceramic styles. Here is a brownware tradition, forged in antiquity, that survived until the 20th century. Furthermore, it was the dominant ceramic type found in most of the Paso del Norte, in the homes of people of Native American descent, perhaps throughout the 19th century. Thus, the persistence of a Native brownware tradition is not about imitating Spanish ceramic styles, but about making a cultural statement through the use of a local tradition.

The distinctive architectural style of the Socorro Mission in the lower valley of El Paso provides some insight into this dilemma (Figure 13). In its construction details are implicit a merging of styles that are not quite Spanish, although perhaps not identifiably Native American. There is little question that acculturation to the Spanish lifestyle caused a simplification of previous aboriginal lifeways, but as in all such cases, it also served to strengthen those patterns that did survive. Overall, for the Native American descendants of the lower valley, it was not a question of learning to be Spanish in a previously Native American world, but of learning to be Indian in a Spanish-dominated world.

Figure 13. Socorro Mission, stepfret parapet design.

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# A Review Essay of "Spanish Expeditions into Texas," by William C. Foster (1995)

*A. Joachim McGraw and James E. Corbin*

## FOSTER'S PURPOSE

William Foster re-examined the routes of 11 Spanish Colonial expeditions that crossed the Rio Grande and entered early Texas from 1689 to the middle 18th century. He reviewed the exploration accounts of Alonso de Leon in 1689 and 1690, Teran de los Ríos (1691), Salinas Varona (1693), Espinosa (1709), Domingo Ramon (1716), Alarcon (1718), and Aguayo (1721). Foster also discussed the military inspections of Rivera (1727) and Rubí (1767), as well as an inspection of the missions by Fray Solís in 1768.

Foster stated that his work grew out of frustration from the decades of inconsistencies and the lack of agreement in previous research that attempted to describe these trails. His list of reprobate researchers who had contributed to his confusion include Herbert Bolton, Carlos Castañeda, Robert Weddle, and the Texas Department of Transportation.

Foster noted that the purpose of his study was to correct misinterpretations, and for the first time in the study of Texas history formulate a clear and authoritative picture of where early Spaniards traveled across Texas. To accomplish the formidable task of retracing the exact day-by-day location of four routes of exploration, three routes of settlement, two courses of military inspections, and a journey to inspect frontier missions (all of which occurred throughout a century of dynamic historical change), Foster set out across Texas with diaries and maps in hand. His exact intent was to track the former lines of march, to locate nightly campsites and to verify their locations by on-site inspection. In Foster's own words, his book did that. We think not.

## GOOD POINTS OF THE WORK

Foster's effort contributed several positive elements to the study of Spanish Colonial expeditions. First, his work offered the reader an introduction to frontier expeditions that were significant to the state's early history. Second, his book demonstrated that the study of early trails can lead to a substantial body of untapped information applicable to a wide body of multi-disciplinary studies. Finally, researchers may also use Foster's interpretations as a comparison to their own or other studies.

## SHORTCOMINGS

### The Lack of Historic Context

The volume purports to provide highly accurate maps of the 11 expeditions, review modern detailed topographic maps, aerial photos, and on-site inspections (Foster 1995:8-9) to locate and verify the routes and places of the expeditions. While it may appear to the uninitiated that this book accomplishes these tasks and utilizes these data to the extent indicated, it is patently obvious to some of those involved in Spanish Colonial research that this volume falls far short in those areas. Although he styles himself an historian, Foster seems to have little faith in the direct historical approach—starting with the known present and working backwards—used so well by ethnographers and archeologists. In addition, Foster fails to utilize the strong multi-disciplinary approach needed to conduct a study of this nature. The shortcomings of Foster's research involves two considerations that must be recalled while practicing objective historiography: (1) the importance of presenting information within a clearly formulated historic context, and (2) the immediate and subsequent consequences of employing an insular research strategy.

Foster's effort consisted of a descriptive narrative liberally interspersed with unverified subjective interpretations and the occasional gratuitous comment. Although he attempted to more clearly define historic trails by reviewing the journals of early travelers, Foster did not compare nor contrast the differing contexts of individual expeditions. His introduction did offer a brief (five-page) overview of the historical setting, a description of his methodology, and brief comments on Indian tribes.

Not being an anthropologist, Foster may be forgiven for not recognizing the distinction between Indian groups, chiefdoms and "tribes," but the implication of misused critical terminology is troubling, as is his inaccurate identification of inter-regional Indian trails as "Tejas trade routes" (Foster 1995:2-3 and Map I). The collective misuse of such terms results in the inadvertent genesis of a non-existent antecedent cultural universe.

Foster's work makes no distinction between routes of exploration, settlement, and commerce, although historically, Spaniards themselves distinguished between them. These routes varied greatly in historical significance; for example, a route of exploration or to create missions and settlements (*entrada*) would have a greater impact on the historical record than a route of inspection (*visitas*) by missionaries. Nor did he address the different purposes of travelers or the rationale that caused variations in their routes. For instance, an expedition intent on exploration or establishing settlements did not follow the same route as a military or ecclesiastical company intending to inspect outposts or missions. Furthermore, the circuitous journeys of the latter did not necessarily reflect unrecognized segments of a single previously established trail. Instead, military and religious travelers often followed segments of several different routes to reach their destinations.

Foster's lack of thematic and historic contexts for synchronic and diachronic route variations is troubling. It leaves the reader following the tracks of individual expeditions in an historic landscape barren of descriptions regarding dynamic cultural interactions or the influences of their inter-relationships. French, Spanish, Indian, European, military, political, and ecclesiastical influences motivated these expeditions. The lack of context in Foster's work precipitated two subsequent effects: (1) no clear discussion of the inter-relationship and evolution of differing routes throughout his research period, and (2) the general reader lacks information on other contemporary, related roads, significant route variations, or the importance of regional segments that collectively formed the larger routes that Foster examined.

## The Consequences of Insular Research

Foster's second critical shortcoming, the use of an insular research strategy, conjures up a host of methodological demons. The immediate and subsequent consequences of this approach plague both the veracity of his interpretations and the usefulness of his study as a technical resource. In short, Foster's methodological approach is dominated by unequivocal subjectivity. Invariably, this results in prejudicial conclusions that, despite his insistence otherwise, lack any physical evidence or archeological verification.

The imperfection of Foster's approach is illustrated in four areas of his study: (1) the questionable verification of many of his own findings; (2) misinterpretation of translations and simple factual errors; (3) the selective and subjective use of historical data; and (4) the casual and recurrent misuse of specialized terminology.

## Map Details Are Important

The questionable verification of Foster's own findings reside in the confidence level of his research methods. We are well aware of the time-consuming effort required to verify even one location along a single route (as we have done this successfully ourselves). We question Foster's lack of specificity in how he verified specific locations along multiple routes Which segments and locations did he actually verify by using maps, aerial photographs, and on-ground inspections? It is unclear how he used these data, what evidence resulted, and why he did not revisit or inspect locales previously identified by others. Foster's lack of specificity means that anyone needing precise locations (e.g., archeologists) will need to redo his work in much more detail. For example, Foster

(1995:119) states, "...Santa Clara, near present Centerville in Leon County..." Based on his maps and his conclusion that Santa Clara is half-way between the Navasota and Trinity rivers, "near" is about 15 miles south of Centerville.

Foster's "detailed" maps are in fact not detailed enough for anything except for presenting a very generalized picture of where routes were located. In several locations, such as the crossings of the Trinity and Neches Rivers and at the San Pedro Creek locality, the maps are very inaccurate or just plain wrong. Foster constantly refers to verifying locations of campsites and routes on modern geological maps. Unfortunately, the only modern maps he consistently references are large scale (1:250,000) USGS geological-topographic maps on which little or no geology (except to a trained geologist) is evident and almost none, if any, of the types of features mentioned by the diarists are visible, even though Foster claims that they are. Such maps do not show soils, geologic formations, or types of vegetation. Unfortunately, maps of this scale are only useful for initial planning purposes, but not as evidence for routes and places eventually identified during the study.

Most of the specific details observed on the various expeditions cannot, contrary to Foster's view, be identified on these maps because the scale is too large or the maps do not show the kinds of geologic, topographic, soil, or vegetative features recorded in the diaries. Stream features (such as direction) that seem evident on a 1:250,000 map appear very different on a map scaled at 1:24,000 since the latter is ten times more detailed.

While Foster relies heavily on the 1:250,000 scale maps and a vegetation map (at an even larger scale), he consistently ignores other kinds of contemporary maps or data presented via maps. For example, there is nothing that indicates what aerial photos (e.g., USDA photos from the early 1940s, contemporary infrared photos, etc.) were utilized or how these provided verification of localities or routes.

In addition to the 7.5' or 15' topographic maps alluded to above, there are detailed soils maps available (scale 1:24,000) that present the soils and associated topography and vegetation at a scale that is more comparable, in a sense, to what the Spanish diarists actually could have seen and often did report. Thus, if a diarist reports a small prairie in a location, it will not appear on the large scale vegetation maps (because the prairie is too small); it will not show on the 1:250,000 scale maps, nor even show on the 1:24,000 scale maps, because their primary function is not to show vegetation or soil. The soil will be illustrated on the soils map as a biologic regime, even if the prairie is not there physically, because the prairie soil (very distinctive and easily identified by soil scientists) is still there. In addition to not using recent topographic maps of a relevant scale, soils maps, and true geologic maps, Foster seems to studiously avoid later historical maps of the region in question. While he seems to rely heavily on known and hitherto unknown or unused Spanish maps, he almost never mentions later historic maps of the region, particularly mid-19th century county deed maps, or late 19th and early 20th century geologic maps and associated studies.

An 1891 geologic study of Houston County describes and illustrates a small prairie known as Murchison's Prairie (Dumble 1892:21 and Plate II). For example: (1) based on Dumble's map; (2) the Juan Pedro Walker map of 1806; (3) the description of a *paraje* referred by De Mezieres (Bolton 1914:309) as the "prairie called Castano" (which is referenced by the same name at the same place on earlier expeditions, including descriptions by Rivera and La Fora); (4) the calls for the Procella grant that reference the prairie as well as start in the northeast corner of the grant at the right side of the road to Bexar (Procella 1833); and (5) the contemporary soils map of the area that clearly identifies this small, but very important prairie, we can, with a high degree of confidence, locate one of the important *parajes* of this region. In addition, we can also verify the location of the normal route (Corbin 1991:197-199) for most of the expeditions into the San Pedro Creek valley. This location could never have been identified using USGS maps of any scale (certainly not maps at a 1:250,000 scale), geologic maps, or current large scale vegetation maps.

## Foster's Expeditions

The mistranslating and/or misinterpretation of text occurs in several critical points in Foster's work as he reviewed routes across East and South Texas. At the least, he does not furnish the reader with other references or sources that would question his view.

### *Foster's Trails in Central and East Texas*

In Central Texas, the dilemma of the Brazos River crossing(s) illustrates Foster's obvious antipathy towards differing views on that subject. Unfortunately, Foster appears so determined that his view prevails, that he may have manufactured data in at least one place to support his interpretation. Foster (1995:169) writes "...Rivera reached the paraje called Los Angeles near the crossing of the Brazos at the junction of the Little Brazos River '...a short distance above the junction of the two streams.'" Foster appears to indicate to us that he is quoting Rivera's diary. Perusal of the translation of Rivera's diary (Jackson and Foster 1995:33) does not reveal the passage "...a short distance above the junction of the two streams." The passage in that volume says, "...we crossed the Colorado (or Brazos de Dios) near the place where its two branches join to form one river." Indeed, Foster's note at the bottom of the page says, "The river crossing was a few miles north of the juncture of the Brazos and Little Brazos..." If Foster was not quoting Rivera, then he must have been quoting himself, but failed to reference it. Either that, or a passage was left out of the translation of Rivera's diary.

So strong is Foster's antipathy towards the Texas Department of Transportation's study of the routes of the various Spanish roads (McGraw et al. 1991), that he virtually glosses over the route between the Brazos and the Trinity rivers and between the Trinity River and Nacogdoches. He almost totally ignores any previous discussion of the crossing of the Trinity or Neches rivers, even though his charts always show a confidence level of "1" [high?] wherever his maps show the routes crossing the Trinity and the Neches. Foster never attempts to identify the crossing(s) of the Trinity or Neches rivers, nor does he reference the latest works that do indeed identify the main crossings. It is clear that de Leon crossed the Trinity River downstream from all of the later crossings.

It is also quite clear that every other recorded expedition to the Tejas, with the possible exception of Varona, crossed the Trinity River at virtually the same place: the Kickapoo Shoals/Hurricane Shoals locality proposed by Williams (1979). Corbin (1991) has demonstrated that Williams' conjecture was indeed correct in that the old crossing at Kickapoo Shoals or the adjacent Hurricane Shoals meets all of the descriptions of the crossing. While Foster makes no attempt to specifically identify the crossing(s) in his text, his maps (which can have only a very low level of accuracy at the scale illustrated) show all of the crossings, with the exception of Ramon's, crossing the Trinity River well below the shoals at a location not specifically discussed in the book. On the scale of Foster's maps, the crossings appear to be placed about two to three miles below the crossing Foster indicates was used by Ramon, the Kickapoo/Hurricane Shoals location. Yet in Table 6 and others following, Foster indicates a confidence level of "1" as to the certainty of the location of the crossing on the Trinity River.

It is not clear whether this confidence level indicates he is confident that the expedition crossed the Trinity River or if he is confident of the actual location of a crossing that was never described or discussed. Assuming that Level "1" indicates a high degree of confidence in the actual place of the crossing, Foster never discusses how he determined where the crossing was nor indicates that he had verified the location of the crossing using maps, aerial photographs, deed records, or from an on the ground inspection. In addition, he did not reference previous investigations that demonstrated rather convincingly that the crossing was the Kickapoo/Hurricane shoals locality.

All of Foster's maps indicate that the expeditions that crossed the Neches River crossed above its confluence with San Pedro Creek. Based on the scale of his maps, this crossing is approximately two miles upstream from the confluence. In actuality, the crossing is three miles below the mouth of San Pedro Creek. In addition, it is clear from several of the dairies that once the expedition reached the Caddo village, or the location of Mission San Francisco, or the *paraje* at the old location of San Francisco on San Pedro Creek (all in the valley), the route was down (downstream meant going northeast) the valley to the crossing. Foster's maps show the routes traversing the heavily wooded uplands well north of the San Pedro Creek valley. The traditional route down the valley is the same route indicated in the Juan Pedro Walker map of ca. 1806 (Walker 1806). Walker's map clearly follows the route described by Solís (Kress 1931:60-61) and La Fora (Kinnard 1958:165-66). Solís says, "We forded this river in shallow water and one league beyond we climbed a hill. On the summit is a mound which appears to be hand-made."

At the spot where Foster indicates a crossing of the Neches River on his maps, he indicates in his charts at the end of the chapter a confidence level of [1]. In reality, at least for some archeologists who retentatively look, nothing is apparent there; this is just an imaginary location created by Foster at least two to three leagues from Solís' mound at the George C. Davis archeological site (a known spot on the road mentioned at various times from 1767 to the 1850s). There is a shallow crossing (UTM Easting 293222.524 and Northing 4295826.857 taken from direct GPS readings at the crossing) approximately one league from the mound site (see Corbin 1991:210) that is in the same vicinity as the one shown on the Walker map and can be easily extrapolated from the 1848 and 1851 Cherokee County land grant maps (General Land Office 1848, 1851; see also the USGS 15' Alto map and Stenzel's [1944] detailed geologic map of the locality). There is nothing in any line of investigation that places or locates a crossing at the spot indicated on Foster's maps.

At the San Pedro/Neches locality, Foster (1995:74) indicates a confidence level of [1] for the location of Mission Santissima Nombre de Maria. As far as we are aware, no one knows where the location of this short-lived mission was located. Teran (Hatcher 1932:29) indicated that it was one league above the crossing of the Neches and 1.5 leagues northeast of Mission San Francisco (Hatcher 1932:38). If Foster's maps of the location of the crossing are accurate and we place Mission Nombre de Maria upstream one league, then the location of Mission San Francisco would be well out of the San Pedro Creek valley, contrary to where all other documents place it (see Corbin 1991, 1994).

The lack of historical context in Foster's interpretations often lead to singular conclusions without regard to other reasonable explanations. In some cases, his reading of documents appear to be limited to a specific passage that supports his interpretation, when in fact, the document in its entirety suggests no such thing. This is complicated further since Foster did not distinguish between routes of exploration, foundation, and settlement, the subsequent network of roads that resulted, and the later, individual routes of inspection by military and religious companies. We believe the importance of these types of routes varied greatly, given the magnitude of impact that a particular type of expedition route might have had in the historical record.

These shortcomings are illustrated in his conclusions (Foster 1995:188, 223) about the abandonment of an upper route of the "Camino Real" in the middle 18th century in favor of a lower "Camino Real." Foster noted that a religious company and several military expeditions used this route that led south from San Antonio toward La Bahía and then swung northward toward the Colorado and Brazos rivers. First, the reader should note that he references routes of inspection, and the expeditions associated with them were likely to switch from one road to another (see also our comments below on Fray Solís' route in South Texas). Second, his attempt to support the conclusion that an upper route was abandoned at that time included a reference to the trip of Athanase de Mezieres, who also traveled this lower route "Camino Real" in 1778.

The reason for de Mezieres' trip, not mentioned by Foster, was to locate and propose alliances with major Indian groups throughout the province via a trail that led to the newly founded settlement of Pilar de Bucareli on the Trinity River. The circuitous route of de Mezieres included trips to Spanish Fort at the Red River in modern Montague County and west along the Brazos River. The complete journey also included a return trip to San Antonio in the following year by de Mezieres, traveling on the upper route that Foster had proposed was abandoned and in disuse. This is clearly evident in de Mezieres' letter of the trip that described a well-known landmark along the upper route, namely the springs of the San Marcos River, about 30 miles south of modern Austin.

Foster also did not discuss the relevant comments of Carlos Castañeda (1939, Vol. IV:312). If Foster postulated that an upper route to San Antonio had been abandoned, hence a roundabout trail by way of La Bahía, why did Castañeda write 60 years ago that the future town site of Bucareli was placed near the *Paso Tomas* crossing of the Trinity River because in part:

> This seems to have been at the point where the two roads leading to Los Adaes and La Bahia from San Antonio joined to form a passage over this stream.

Castañeda (1939, Vol. IV:317) later noted that communication between Bucareli and San Antonio was claimed not as difficult as previously assumed, in part because:

> There was no other danger than attack from Comanches between the Guadalupe and San Antonio by the lower road, or from the Colorado by the upper road.

### *The Elusive Hondo of South Texas*

A major point of Foster's regional interpretation is the direction of routes from the vicinity of the modern Frio River northward. He noted that previous researchers have not recognized the historical transposition of place names of various streams. Foster suggests that the original name of the modern Leona River was the *Sarco*, named by Alonso de Leon in 1689, and that most later expedition leaders called it the *Frio*. According to Foster, the confusion was compounded by de Leon also giving the name of *Hondo* to the present-day Frio River (Foster 1995:225). Foster does not inform the reader that scholars have proposed this idea as early as 1901 and others more recently, such as Richard Santos (1981:116, endnote 86), continue to do so.

In Foster's case, this interpretive view was particularly important as he postulated that de Leon turned eastward from the *Hondo*, or in Foster's estimation, the modern Frio River. In addition, at that locale, de Leon described Indian rock carvings in the shape of crosses there and thus named the locale *Las Cruces*. Foster's discussion chided a State Department of Highways and Public Transportation (SDHPT) study for proposing the location of *Las Cruces* as being on the modern Hondo Creek, somewhat north of his projection. In 1990, the SDHPT had recently located an early 19th century historical site that contained graffiti carved on a massive rock outcropping near the remnant segment of a regional Spanish Colonial road. Foster noted that since de Leon's journal clearly indicated the *Hondo* flowed east and southeast from *Las Cruces*, this precluded any serious consideration of the SDHPT findings. Indeed, Foster's maps showed the modern Hondo Creek flowing north to south.

Whether Foster is correct (we think not) is not the point nor the issue. In any case, archeological work is required to clarify the location of the former crossing. More important in the presentation of his data and argument is why he did not offer a clear discussion of other primary sources, such as the journal entry of Fray Isidro de Espinosa who crossed the *Sarco* River in 1709 and wrote, "...the Indians call it the Rio Frio..." (Tous 1930:4). Espinosa then went on to cross the *Hondo*. While he noted Espinosa's comment in Chapter Six of his book, Foster did not clearly explain the apparent incongruity of how Espinosa's *Frio*, unequivocally identified as the *Sarco*, is also Foster's *Hondo*.

We also question why Foster did not review local maps of the area rather than those of regional scales. He would have found that while the modern Hondo Creek generally flows north to south, at the location he discounts, its channel turns almost 90 degrees. Certainly this locale warrants further study. While we will not lose any sleep over the final location of this specific *paraje*, we wonder in the interim if Foster had not inadvertently hoisted himself on his own *paraje* [cf. petard] by his unequivocal and somewhat forced march to the *Hondo*.

In addition, when the Teran-Mazanet expedition of 1691 reached the *Hondo* (wherever that was), Mazanet noted that they were diverging from the route of the two previous expeditions (our best guess, these being the de Leon expeditions of 1689 and 1690 [Hatcher 1932:54]). The 1691 expedition traveled about 16 leagues further (about 42 miles) from that point to their stop on the San Antonio River (in the vicinity of modern San Antonio). This correlates well with the actual distance from the locale on the modern Hondo Creek to the San Antonio River if moving in a generally northeasterly direction as the expedition described. On the other hand, the minimum distance from San Antonio southward to the modern Frio River or Foster's *Hondo*, ranges between 55-60 miles (21-23 leagues). The difference between these distances is unacceptably large, by Foster's own standards.

Perhaps more important in an objective discussion of the elusive *Hondo* is Foster's omission of supplementary information that both described and defined the location of commonly cited historical landmarks along the route leading to and from the *Hondo*, such as the *Charco de Pita* and the *Arroyo Payayas*. These landmarks and other features, including a Spanish Colonial route used in 1776, have been referenced by previous researchers (McGraw et al. 1991:144). The value of this reference is that the mentioned landmarks became embedded in 19th century land grant records and their locations can be accurately transferred to modern maps. Certainly, the information contained in this document and adjacent land grant records dating to the Spanish Colonial period are critically relevant to any interpretation of the region's historic landscape.

On a regional perspective, Foster's view of historic routes in southern Texas failed to include or address other contemporary routes that were employed by the travelers he discussed. This was illustrated in his Map 2 (Foster 1995:4) titled "Spanish Road Network in Northeastern New Spain according to Expedition Diaries, 1689-1768." Foster omitted the Lower Presidio Road, or *Camino de en Medio*, from San Antonio to the Rio Grande and even excluded the San Antonio-Laredo Road, although his Chapter 12 (Foster 1995:197-214) reviewed the route of Fray Gaspar Jose de Solís who apparently traveled segments of both on his return trip to the Rio Grande. Foster noted that Solís traveled the Laredo Road after leaving San Antonio but did not mention that Solís stopped at the mission ranch *El Atascoso* belonging to Mission San José y San Miguel de Aguayo, in San Antonio (Kress 1931). The historic alignments of both roads are reasonably well known in this area. Thus, Solís' visit to *El Atascoso* is curious since other accounts not referenced by Foster (e.g., the travels of Morfi in 1777-1778) state that the trail we know today as the Lower Presidio Road was the boundary of the lands claimed by Mission Espada (Mission San José's lands, including the ranch of *El Atascoso*, would have been west of the trail).

Curiously, the Laredo Road was east of all this and would have traversed the lands claimed by Mission Espada. Foster's simple statement that Fray Solís traveled the Laredo Road, while we know he visited the mission ranch belonging to Mission San José, is an incongruity that deserves explanation or at least discussion. Lacking that, it hints at the ordinary ease with which historical travelers casually moved from one route to another.

## CONCLUSIONS

William Foster's (1995) *Spanish Expeditions into Texas* set out to describe, explain, and prove much. Foster focused on defining the exact routes of travel associated with his selected Spanish Colonial expeditions. The result, it appears, falls short of his intended purpose. Because of Foster's subjective, selective, and often limited treatment of the subject, serious readers and researchers must still consult and compare the previous works that Foster himself found so frustrating.

The difference between Foster's intent and his accomplishment is in part due to the complexity of the subject. Retracing the patterns and landmarks of historic routes requires an integrated multidisciplinary methodology and a level of research detail sometimes beyond the scope of the individual researcher. As important, it may be the focus of Foster's effort—the attempt to clearly define each point of each obscure trail—that limit his success. Foster often places points along his trails without consulting local archival documents that describe pertinent elements of the cultural-historical setting. The recognition of significant elements within that cultural-historical setting often lead to serendipitous findings more important than relocating the probable locale of an obscure campsite. Perhaps that is what is lacking and most disturbing in Foster's self-described exhaustive study: any mention of serendipitous findings that are inherent in such work. The real contribution of historic trail studies is not to more clearly document the historical changes of these trails but more importantly, to permit a better understanding of the peoples and events that created these changes.

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# Response to a Review Essay of "Spanish Expeditions into Texas, 1689-1768"

*William C. Foster*

The purpose of this is to respond to a review essay by Al McGraw and Jim Corbin (this volume) on my 1995 book *Spanish Expeditions into Texas, 1689-1768*. First, I would like to express my appreciation to Timothy K. Perttula, Texas Archeological Society Publications Editor, for soliciting my response. His offer was gracious and is hereby accepted.

As noted by the reviewers, it is helpful to give readers the "historic context" or a brief background statement on the topic at hand. As background, it should be noted that the principal issues concerning expedition route projections raised by the reviewers are not new; the differences and criticisms arose over five years ago.

It started this way. In January 1991, the Highway Design Division of the Texas State Department of Highways and Public Transportation (today, TxDOT) released a study entitled *A Texas Legacy, The Old San Antonio Road and the Caminos Reales, A Tricentennial History, 1691-1991* (McGraw et al. 1991). In the report, Al McGraw is identified as the "Project Director," Elizabeth Robbins (who prepared articles on expedition routes) is named as a member of the project staff for "Historical Review and Report Production," and Jim Corbin is listed as one of nine "Contributors" (p. iii). The TxDOT study projects the day-by-day line of march of Alonso De Leon's Expedition of 1689 (pp. 63-65); Alonso De Leon's Expedition of 1690 (pp. 66-69); Domingo Teran's itinerary on his 1691 expedition (pp. 72-74) with accompanying maps; Fray Damian Massanet's 1691 itinerary (pp. 76-80); Salinas Varona's 1693 expedition with accompanying maps (pp. 82-88); Fray Isidro Felix de Espinosa's 1709 itinerary (pp. 354-357); Domingo Ramon's expedition of 1716 (pp. 90-95); Fray Isidro Felix de Espinosa's 1716 itinerary (pp. 96-103); Fray Francisco de Celiz' 1718 itinerary of the Martin de Alarcon expedition (pp. 358-363); and Antonio de la Pena's 1721 itinerary of the Marques de Aguayo expedition (pp. 105-113). Thus, the 1991 TxDOT study and my 1995 book cover the same expeditions, except my 1995 work also includes Pedro Rivera's 1727 military expedition, the Marques de Rubi's 1767 military expedition, and Fray Jose de Solis's 1768 mission inspection tour.

In October 1993, two years before my book *Spanish Expeditions into Texas, 1689-1768* was published, the *Southwestern Historical Quarterly* published an article Jack Jackson and I edited that included the first fully annotated English translation of the 1693 expedition of Governor Salinas Varona from Monclova to the East Texas mission field (Foster and Jackson 1993). In the annotations to the Salinas Varona diary account, we critically noted a number of mistakes in the projection of De Leon's 1689 route and Salinas Varona's route found in McGraw's TxDOT route study, differences that McGraw and Corbin raise again in their review. Moreover, my 1995 projection of De Leon's 1689 route is repeated in *Imaginary Kingdom, Texas as seen by the Rivera and Rubi Military Expeditions, 1727 and 1767*, a study of military expedition routes that Jack Jackson and I completed in late 1995.

The first area of difference centered on the specific question of whether Alonso De Leon (in 1689 and 1690) and Salinas Varona (in 1693) were referring to the present-day Leona River or the Frio River when they wrote that they crossed the "Rio Frio," and whether they were referring to the present-day Frio River or the Hondo when they wrote that they camped on the "Rio Hondo." This issue will be treated in more detail at the appropriate place later, but the 1993 comment made by

Jackson and I that kicked off the route dispute should be noted here as part of the background. We wrote in 1993 (Foster and Jackson 1993:286-287, fn. 59):

> The fact that the name Frio was used by expedition leaders to identify the Leona, and the Hondo was used for the modern Frio, has confused some historians. This confusion is reflected in the recent study *A Texas Legacy*, which assumes that Texas rivers in colonial times had their present names. This assumption has led to some serious problems with their route projections and analysis—particularly with those of early expeditions, including that of Salinas.

In the 1993 *Southwestern Historical Quarterly* article, Jackson and I were also critical of McGraw's TxDOT study of Salinas Varona's route to the San Antonio River (Foster and Jackson 1993:289, fn. 66), an area of dispute also revisited by the reviewers of my book. And when Salinas reached the Colorado, the route problem and the correct identification of the current names of Texas rivers arose again. At that point in the 1993 article, Jackson and I (Foster and Jackson 1993:293-294, fn. 77) noted:

> Despite the consistent use of the name San Marcos for the Colorado by the Spaniards, Elizabeth A. Robbins incorrectly postulates that the river that Salinas called San Marcos and crossed on May 28 was the present-day San Marcos... This type of error is likely to occur if route projections are made without an understanding of the names of rivers used during the historical period studied.

This summary of my 1993 critical comments on McGraw's 1991 study confirms my earlier observation that route issues now argued by the reviewers regarding my 1995 book on Spanish expeditions are not new questions but rather arose about five years ago. Now to McGraw's and Corbin's direct criticisms of my book.

The reviewers make two attempts to state the purpose of my book, both inaccurate. First they write, "The purpose of this study was to correct misinterpretations, and for the first time in the study of Texas history, formulate a clear and authoritative picture of where early Spaniards traveled across Texas." The second attempt, made in the same paragraph, states, "His exact intent was to track the former lines of march, to locate nightly campsites and to verify their location by on-site inspection." The reviewers omitted any reference to the specific narrow purpose of my book, which I stated directly in my introduction: "The central purpose of this study is to track as precisely as possible the route followed on each of the eleven expeditions" (Foster 1995:7). It was that; no less, no more.

My 1995 book is a geographical expedition route study that focuses on the number of leagues and the direction traveled daily (as recorded in the expedition diaries), on the correct modern names of the rivers and creeks crossed, and on the terrain, Indian tribes or bands, fauna, and flora encountered along the line of march. It did not focus on changes in Spanish colonial policies on the frontier, Spanish and French rivalry, or correcting misinterpretations of earlier authors. Nevertheless, it did compare my projections with those found in earlier Spanish expedition route studies. This analysis was appropriate and essential. It is true that on occasion my projections differed (and on other occasions aligned) with route projections of Herbert E. Bolton, Carlos E. Castañeda, and Robert S. Weddle, among others. It is also true that my route projections seldom coincided with those proposed in McGraw's 1991 study.

The reviewers address the "shortcomings" of my work by first discussing three general topics of concern and then identifying specific disputes with regard to my route projections. My response addresses the three general topics of concern in the order presented by the reviewers.

## GENERAL TOPICS OF CONCERN

The reviewers' first concern is entitled "The lack of historical context." Here the reviewers acknowledge that in the 15 page introduction I give an overview of the historical setting along with a description of my methodology and provide comments on Indian tribes, but the reviewers suggest that more is needed. They argue that descriptions are lacking regarding the "French, Spanish, Indian, European, military, political and ecclesiastical influences [that] motivated these expeditions." It is true; I did not focus on the multiple political and cultural influences that may have motivated the expeditions. That subject has been developed in detail by Bolton, Castañeda, Weddle, David J. Weber, Donald E. Chipman, and others. Instead, as I emphasized in my statement of the purpose of the study, I focused on where (not why) the expeditions moved across Texas. I found no serious lack of historical studies musing on conflicting European cultural influences and rivalries of the period; the limited need I saw was for improved geographical precision regarding where the expeditions went and their daily line of march.

It appears to me that my Introduction adequately meets the needs of the study and the general reader with regard to historical background. However, the reviewers may have a better perspective on this matter with regard to the use of my work by archeologists and their possible interest in a fuller political and ecclesiastical background piece.

The title to the second general area of concern is, "The consequences of insular research." The reviewers assert that this charge "conjures up a host of methodological demons," and that, "In short, Foster's methodological approach is dominated by unequivocal subjectivity." Not true.

In my Introduction, as noted by the reviewers, my methodology is expounded. As stated, it is based principally on information given in expedition diary accounts regarding the direction and number of leagues traveled each day. The direction was based on compass readings, and the number of leagues traveled daily (usually only four to seven) as estimated by experienced frontiersmen. These are reasonably objective measures and the daily route projection can often be verified using physical evidence. This objective evidence included the location, size, and direction of flow of creeks and rivers that frequently (every three to five days) intersected the line of march, as noted in the diaries; reports of heavily wooded areas such as the Post Oak Belt (called the Monte Grande) or of open prairies; and the identification of critical landforms such as the prominent bluff near La Grange named "Jesus, Maria y Joseph Buena Vista" by De Leon in 1690 and called Monument Hill today. My methodology is not dominated by "unequivocal subjectivity."

Another methodological "demon" raised by the reviewers is that I employed "insular research" in that my research was conducted in isolation, without the benefit of review and comment by recognized archeologists, anthropologists, or historians. That false impression should also be corrected.

My manuscript was submitted to the University of Texas Press, which subjected it to vigorous review. Frankie Westbrook, a distinguished and highly experienced acquisitions editor, first carefully reviewed the project and discussed with me the methodology used and the qualifications of the translators. Satisfied, she then presented it for in-house review to the entire editorial staff, including Theresa May, who was then Senior Editor and is now the Assistant Director of the Press, and Jack Kyle, then Director of the Press. Shannon Davies, the science and natural history editor, made important suggestions for expansion of the information on the flora and fauna found along the routes. Westbrook determined that the work merited submission to the customary peer review process required of all University of Texas Press books, and she submitted my manuscript to three highly competent readers for their comments and recommendations. Professors Thomas N. Campbell, David J. Weber, and Donald E. Chipman—all top-ranked scholars in this field—read my manuscript for the Press, and each of them offered helpful comments.

Professor Campbell, perhaps the most distinguished authority on Texas Indians and expedition routes, strongly urged the Press to publish my manuscript. In closing his comments on the manuscript, David Weber concluded (for attribution) "To have a single authoritative source for these early expeditions [is] enormously helpful... Foster's work [is] the most authoritative on the subject." Weber, Campbell, and Chipman notified the Press that their identity as readers could be disclosed.

After receiving the comments and recommendations of the readers, Westbrook and May advanced my revised manuscript to the Faculty Advisory Committee for approval of its publication by the Press. After full consideration, the Committee voted unanimously to publish the manuscript. McGraw and Corbin appear unfamiliar with the depth and scope of the peer review process imposed on prospective authors and their manuscripts by university presses generally and particularly by the University of Texas Press. In summary, there was no "insular" research.

The third area of general concern expressed by the reviewers relates to my use of United States Geological Survey (USGS) topographic maps

(1:250,000) that include detailed information on elevations, heavily wooded areas, and open prairies. The reviewers suggest that more detailed maps were required and their criticism is capsuled in their following comment: "Foster's lack of specificity means that anyone needing precise locations (e.g., archeologists) will need to redo his work in much more detail... Foster's 'detailed' maps are in fact not detailed enough for anything except for presenting a very generalized picture of where the routes were located."

First, to avoid reader confusion, it might be helpful in discussing large- and small-scale maps, to define the terms. According to Webster's Third New International Dictionary, "large-scale map" means having a scale that permits plotting of much detail with comparatively great exactness (Gove 1986:1273), and "small-scale map" means having a scale that permits plotting of comparatively little detail (Gove 1986:2149). These are the meanings I intend when I use the terms; I am not sure of the meanings of the terms intended by the reviewers. For example, the reviewers correctly note that I use "large scale (1:250,000) USGS geological topographic maps," but then are critical because "the specific details observed on the various expeditions cannot, contrary to Foster's view, be identified on these maps because the scale is too large." Obviously, if the scale had been smaller, there would have been even less detail. I fear that the confusion resulted from the failure of the reviewers to understand the correct technical meaning of the standard cartographic term they used.

My response to this basic criticism is that the detail of my route projections is determined by the route information regarding the direction and distance traveled daily found in the expedition diaries, and not by the scale of the map I used to reflect the information. In fact, a more detailed larger-scale map could be misleading, suggesting to the reader a degree of specificity beyond that found in the diary.

The USGS 1:250,000 Series maps cover with each individual map (size ca. 1.5 feet by 2.5 feet) the area within one degree latitude (ca. 70 miles) and two degrees longitude (ca. 120 miles). Thus, for example, De Leon's 1689 expedition route into Texas was plotted from the Rio Grande to the Guadalupe during the two-week march of about 200 miles using four USGS maps (Seguin NH 14-9; San Antonio NH 14-8; Crystal City 14-11; and Eagle Pass NH 14-10). The detail in the maps was sufficient that creek and river crossing areas could be identified, allowing the general route to be plotted as precisely as possible from the diary accounts. The distance of the daily march was given by the diarist in Spanish leagues (each is the equivalent of 2.6 miles), which by definition limits specificity. But the specificity is nevertheless sufficient to help ethnogeographers locate where De Leon and other diarists encountered named Indian tribes during the daily march, to aid botanists and zoologists interested in the range and distribution of Texas plants and animals in the 17th and 18th centuries, and to help archeologists focus on areas of possible interest.

In addition, the reviewers note that I relied on "the 1:250,000 scale maps and a vegetation map (at an even larger scale)." The "vegetation map (at an even larger scale)" referred to by the reviewers is the 1986 Texas General Land Office map entitled "Natural Heritage of Texas," which proved very helpful in depicting the larger areas of dense woods and vegetation such as the Post Oak Belt, and in locating the narrow tongue of prairie land that runs within the Post Oak Belt that expeditions followed beginning in 1716. This "vegetation map (at an even larger scale)" is in fact at a much smaller scale, not a larger scale map, than the USGS 1:250,000 scale map.

Although the reviewers are confused in their use of some standard cartographic terms, there appears to be no confusion about the charge that I relied heavily "on known and hitherto unknown or unused Spanish maps." The most frequently cited "unknown or unused Spanish map" referenced in my book was the ca. 1807 Puelles map reported by Jack Jackson in the January 1988 issue of the *Southwestern Historical Quarterly* (Jackson 1988:317-347). The Puelles map provides very detailed information on the relative location and names of over 20 crossings on the Guadalupe and San Antonio rivers used by Spaniards during the 1700s. It was extremely helpful to compare the names and locations of stream crossings used and named in expedition diary accounts with those found on this and other early Spanish maps. I believe my reliance was well-placed and the criticism trivial.

The next and final general area of criticism offered by the reviewers related primarily to questions regarding specific expedition routes. However, before identifying specific route issues the reviewers make a general observation that "he does not furnish the reader with other references or sources that would question his view." Not true. All along the expedition routes, I call the reader's attention where appropriate to earlier studies by Herbert E. Bolton, Carlos Castañeda, Thomas N. Campbell, Don Chipman, A. Joachim McGraw, Timothy K. Perttula, Richard Santos, Robert Thonhoff, Robert Weddle, J. W. Williams and others, citing the documents and page references in which concurring or dissenting opinions had been expressed. A typical example of the comparative analysis found in my book is given regarding De Leon's 1689 crossing of the San Antonio River. A careful review of this issue raised by the reviewers is warranted.

In my descriptive account of De Leon's initial crossing of the San Antonio River, I note that I project the river crossing area to be near the famous "Conquista Crossing" in northwestern Karnes County, whereas Bolton, Castañeda, and Weddle place the fording area about eight to ten miles downriver in central Karnes County. I also note in my study that the 1991 TxDOT study projected the San Antonio River crossing by De Leon to be about 45 miles upstream in Bexar County "below the confluence of the modern Medina and San Antonio rivers (McGraw et al. 1991: 62)"—far out of line with that made in any earlier expedition route studies. The TxDOT study gives no comparative information of any kind. It does not mention where Bolton, Castañeda, and Weddle projected the 1689 San Antonio River crossing to be or hint that the TxDOT route projection is about 45 miles out of line with earlier projections (see discussion in Foster 1995:22).

## SPECIFIC ROUTE ISSUES

The specific issues raised by the reviewers regarding expedition routes and river crossings now will be addressed in geographical sequence as the expeditions marched from the Rio Grande north and northeast to the present-day Nueces and Frio rivers (and the Hondo-Frio mixup), to the San Antonio River (and the San Antonio-Medina name change), along the Camino Real from San Antonio to the Brazos, and lastly to the Trinity and Angelina river crossings.

Most authorities agree that the four late 17th century Spanish expeditions into Texas (in 1689, 1690, 1691, and 1693) crossed the Rio Grande at or near the crossing that was later called Paso de Francia, located about five miles below the present-day Mexican community of Guerrero. From the Rio Grande the expeditions marched along the same general route to cross present-day Comanche Creek and soon thereafter to ford the Nueces River a short distance upstream from Crystal City. From the Nueces crossing, De Leon in 1689 traveled about 18 miles (seven leagues) northeast to camp on the present-day Leona River, which De Leon named the Sarco and Massanet later called the Frio, thus initiating the name mixup (see comments in Foster 1995:55-56). The following day (April 6th), De Leon marched about 13 miles (five leagues) northeast to the modern-day Frio River, which he named "Rio Hondo" because of its steep banks. That day, De Leon's party found some large white rocks into which crosses and other skillfully made figures had been cut many years earlier.

The following day (April 7th), De Leon did not cross the "Rio Hondo" (the Frio River), but rather turned downstream and "went more than 4 leagues down the river without crossing it, sometimes east, sometimes southeast" (Bolton 1916:392). The present controversy arose because McGraw argues that on April 6th, when De Leon spotted the crosses carved into large white rocks, the Governor's party was not on the present-day Frio River but rather on the present-day Hondo, mistakenly equating present-day river names and locations for those used in 1689. McGraw (McGraw et al. 1991:131) writes,

> The route [De Leon's 1689 route] then crossed the Frio River...in the immediate vicinity of Old Frio Town in northwestern Frio County...Approximately six leagues northward, it forded the steep Hondo Creek within a few hundred yards of modern FM 2200 in southern Medina County. This locale is believed to be De Leon's *Las Cruces*. He observed that Indian petroglyphs in the shape of crosses were carved on white rocks there. SDHPT [now TxDOT] archeologists located a massive outcrop of grayish-white sandstone in the vicinity of the old road that was covered with weathered graffiti dating to the 19th century.

In my 1995 book, I noted what I considered to be a mistake in McGraw's projection of De Leon's

1689 route with regard to "Rio Hondo" and the location of the large white rocks with crosses carved or cut into them (Foster 1995:21, fn. 15). The conflict between my projection of De Leon's 1689 route and McGraw's projection persists as indicated in the reviewers' critical comment that "Whether Foster is correct (*we think not*) is not the point nor the issue" (emphasis added). I strongly differ with the reviewers. I think that whether I am correct or the reviewers are correct is a significant issue; it was raised by them. A determination of the location of the crosses cut into large white rocks on the Frio River or Hondo would help confirm the earliest Spanish expedition routes into Central Texas. The following comments summarize my position regarding this question.

First, in projecting De Leon's 1689 line of march from the Nueces northeastward for the first two days, there is no difference between the general projection made in the 1991 TxDOT study and my 1995 study. The difference is in the destination. I have General De Leon crossing the Leona River on the first day (April 5th) and then stopping on the present-day Frio near Old Frio Town at the close of the second day (Foster 1995:20-21). The TxDOT study has the General crossing the Leona (called the Frio), then on the second day crossing the present-day Frio near Old Frio Town and continuing north-northeastward another 16 miles or six leagues (a distance substantially beyond that recorded in the diary) to an area on the present-day Hondo where the creek is intersected by FM 2200 (McGraw et al. 1991:131).

One problem with the TxDOT-McGraw projection is that to march northeast from the Nueces crossing to the present-day Hondo, one must obviously cross two large rivers—the present-day Leona and the Frio. De Leon mentions only crossing one river after leaving the Nueces and arriving at the "Hondo." De Leon only recorded crossing the present-day Leona (which he named the "Sarco" and Massanet later called the "Frio") before reaching the "Hondo."

As I mentioned at some length in my book, Spanish expeditions into Texas in the late 1600s were conducted during the climax of the Little Ice Age (ca. 1350-1850), a global climatic period during which the weather was unusually cool and precipitation was exceptionally high in Texas, North America, and Europe generally. This means that the present-day Leona, Frio, and Hondo in the 1680s and 1690s generally carried much larger volumes of water than they do today, and therefore it is extremely unlikely that the present-day Frio could have been crossed without it being mentioned by De Leon. It is very dangerous for writers to project expedition routes assuming that the diarist whose work is being followed will omit references to a major river crossing.

A second problem with McGraw's projection that I mentioned in my book concerns the direction that Governor De Leon said the "Rio Hondo" was flowing. The Governor said that the day after finding the crosses cut in the white stone on "the Hondo," his party followed the river downstream "sometimes east, sometimes southeast" for about four leagues (10.4 miles) (Bolton 1916:392), and marched on eastward after crossing the river at that point. De Leon's description fits perfectly with my projection, as the Frio from the vicinity of Old Frio Town flows east and sometimes southeastward about 10 miles, to join present-day Hondo Creek (see USGS San Antonio NH 14-8 and Crystal City NH 14-11). General De Leon's description does not fit the TxDOT projection because the present-day Hondo Creek from its intersection with FM 2200 flows downstream southward, not eastward. De Leon, an experienced frontiersman, had with him a compass, and his compass directions are very reliable. In fact, at the time, Spanish regulations required that the official expedition diary include the direction traveled each day and the number of leagues marched (Hatcher 1932: 8). The latter was to be recorded twice—once in the text and again in the margin of the diary.

Had McGraw consulted other route studies and noted the comparisons as I did (see Foster 1995:295, fn. 13-14 and 296, fn. 15), his mistaken projection would have been apparent. In 1979, J. W. Williams, the noted Texas historian of trails and expeditions, wrote that in 1689 De Leon left the Nueces crossing north of Crystal City, traveled seven leagues to the Leona River (which Massanet named the Frio), and the following day continued another five leagues to the Frio, which Williams says De Leon named the Hondo.

Williams (1979:114) explains the Frio-Hondo mixup this way:

> Some way the names of several rivers in this area seem to have been moved one space to the east. The Leona, a stream of

> cold spring water, was long known to the Indians as the Frio (cold). The name now applies to the next river to the east.... Also, the name Hondo has moved east to the next river... [which] flows southward into the Frio... [and] is now known as the Hondo.

Robert Weddle agreed with Williams' assessment and writes, "Crossing the Rio Grande at Leon's Paso de Francia, Teran followed the same trail as far as the Rio Hondo (the Frio River), encountering various Coahuiltecan bands along the streams" (Weddle 1991:88). My projection of De Leon's 1689 route to the Frio and the location of "Las Cruces" is in line with similar projections made much earlier by highly regarded Texas historians, experts in the field of expedition route projections. My projection stands despite the criticisms submitted by the reviewers.

Not willing to give up on the issue, McGraw adds, as further evidence in support of his Hondo projection, that TxDOT has located a massive outcrop of grayish-white sandstone that is covered with weathered graffiti. I certainly agree that the identification of a location where there is a cross cut with skill deeply into a large white rock on either the Hondo or the Frio would help resolve the question at hand. Recently, the Texas Archeological Research Laboratory at The University of Texas at Austin was notified of such a find on the Frio River (41UV401), a short distance upriver from my projected location of "Las Cruces." The cross is very skilfully and deeply cut into a massive white smooth rock; the large cross measures approximately three feet in height and two feet in width. Further field work is planned for 1999 to determine if other crosses or figures can be found in similar large white rock outcrops downstream on the Frio. This recently found prospect on the Frio seems eminently more promising than McGraw's reported sandstone outcrops covered with 19th century graffiti on the Hondo.

Geographically moving eastward from the San Antonio area, the next question raised by the reviewers is the route of the "Camino Real" from San Antonio to the Spanish capitol of Texas at Los Adaes in present-day Louisiana. As mentioned by the reviewers, I conclude that the upper route of the "Camino Real" that ran from San Antonio northeast to a crossing of the Colorado above Onion Creek in Travis County, and on to the crossing of the Brazos near its junction with the Little Brazos, switched, probably in the 1730s or 1740s, to the lower "Camino Real." The more southern or lower route ran southeast from San Antonio along the east bank of the San Antonio River to a point near the mouth of Cibolo Creek in Karnes County, where the royal road turned northeast to cross the Guadalupe near Cuero (at or near Vado del Gobernador), crossed the Colorado near La Grange, and the Brazos near its junction with the Little Brazos (Foster 1995:223). From the Brazos crossing, the Camino Real followed generally the route eastward to the Trinity. Contrary to the statement made by the reviewers, the lower Camino Real was not "a roundabout trail by way of La Bahia." First, the Lower Route was not a roundabout trail; it was selected as the official government route or Camino Real because it ran below the dense Post Oak Belt which served as protection to travelers from the mounted Apache in the north. Secondly, the Lower Route did not go by way of the presidio and mission of La Bahia; the Camino Real turned east from the San Antonio River over 30 miles upriver from La Bahia.

The decision to shift the Camino Real southward to the lower route was not a casual or uninformed decision made by Spanish officials. As mentioned, it was a very informed official decision to avoid exposure to Spanish movements from Apache attacks that had repeatedly occurred along the upper road, particularly in the exposed open prairie areas near and east of the Colorado River crossing in eastern Travis and Williamson counties. A recent study of this question directed by Congress and prepared by the National Park Service (NPS) concluded that the Spaniards had been unable to keep open an identifiable and marked trail along the Upper Route (see Section 3 of the NPS map "El Camino Real de los Tejas" in National Park Service [1998:17-18]). Thus, the NPS rejected the upper Camino Real route described as the Camino Real in the McGraw-TxDOT study, as I had rejected it in my 1995 study. The upper route was simply not a viable, safe, dependable, and protected route for use by government officials, troops, sponsored visitors, or those moving government cargo and supplies.

The lower route, although longer, was more secure because it ran south of the dense Post Oak Belt across present-day DeWitt, Lavaca, and Fayette counties. Moreover, the lower route picked up the more open and elevated geological formation called the Oakville Escarpment that runs between the San Antonio River in Karnes County and the Colorado River in eastern Fayette County. The switch in the route of the Camino Real to the lower road, of course, does not imply that the older upper route was never used again by anyone; it was. But in the 1730s or 1740s, the official government route or "Camino Real" became the Lower Route and official documents in the 1740s and later refer to the lower road as the Camino Real. In the 1991 TxDOT Camino Real study, this Lower Route was basically ignored in favor of the Upper Route, but in the 1998 NPS study, the lower Camino Real was proposed to Congress to be designated as the official "Camino Real de Los Tejas" and be added to the federal government's system of National Historic Trails (National Park Service 1998:iii-iv).

The reviewers also questioned my projection of the location of the crossing on the Trinity and Angelina rivers. In my book, I indicate that the Trinity crossing was near the fording area identified by the reviewers as the Kickapoo-Hurricane Shoals location (see expedition maps in Foster [1995:111, 129, 147, 163, 180]). The reviewers seem to agree with my projection, but complain that "On the scale of Foster's maps, the crossings appear to be placed about two to three miles below...the Kickapoo-Hurricane Shoals location." John Cotter, the cartographer who prepared the maps in my book, drew the line of march at my direction as precisely as the space on the page permitted. In my view, the map correctly identifies the crossing area, and I find no need to adjust by about one league the route reflected on the map as suggested by the reviewers.

With regard to the location of the crossing of the Neches River, I indicate that the crossing was above the mouth of San Pedro Creek. The reviewers differ. They argue that it was below the mouth of the creek. In presenting their case, the reviewers cite the 1767-1768 diary of Fray Gaspar Jose de Solis. I admit at this point to some frustration and nervousness at the reviewers' casual mistakes in citing the documentary record. The reviewers write, "Solis says, 'We forded this river in shallow water and one league beyond we climbed a hill. On the summit is a mound which appears to be hand-made.'" This is not accurate. There are two translated versions of the Solis diary—one by Peter P. Forrestal (1931) and a second by Mattie Austin Hatcher (Kress 1931; the one inaccurately cited by the reviewers). Neither version includes material even remotely similar to that quoted by the reviewers.

The two sentences quoted can be found not in the 1768 Solis diary but in the 1767 diary kept by Marques de Rubi's engineer Nicolas de Lafora (Kinnaird 1958:165). The TxDOT study does not include an itinerary or map for either expedition, although in my book a chapter is devoted to each. Neither Solis nor Lafora, nor any earlier expedition journalist, specifically states whether the crossing used was above or below the mouth of San Pedro Creek. Diary accounts suggest that the parties approached the San Pedro Creek area in open terrain north of the stream before reaching the Caddo villages. My interpretation is that the parties crossed the Neches River above the mouth of San Pedro Creek as no mention was made that a creek was crossed immediately before reaching the Neches. Moving eastward from the Neches crossing location that I project, a party would travel eastward toward the hilly area mentioned by La Fora. I understand the position of the reviewers, but I stand by my projection.

In summary, Corbin's projection and my projection of the location of the crossings on the Trinity and Neches rivers in East Texas differ by only about one league. In contrast, the McGraw-TxDOT projections and my projections of expedition routes in South and Central Texas differ substantially. Historians and archeologists need to know whether De Leon in 1689 found "Las Cruces" on Hondo Creek (according to McGraw-TxDOT) or on the Frio River as I project; whether on the same expedition De Leon crossed the present-day San Antonio River in Bexar County (McGraw-TxDOT) or about 40 miles downstream in Karnes County; and finally, whether the Camino Real from San Antonio ran northeast to cross the Colorado River in Travis County (McGraw-TxDOT) or southeast to cross the Colorado about 40 miles downstream in Fayette County as the 1998 National Park Service study and I project. The differences in these route projections in South and Central Texas are very important and substantial.

The reviewers conclude with the observation that "The real contribution of historic trail studies is not to more clearly document the historic changes of these trails but more importantly, to permit a better understanding of the people and events that created these changes." In conclusion, I could not more fully disagree with the reviewers. Texas historians, including Bolton, Castañeda, Williams, Weddle, Chipman, and others, have repeatedly sought to document the specific routes of expeditions and to project their line of march. Only by tracking as precisely as possible the line of march followed on each expedition can we accurately identify where Texas Native people, animals, and plants encountered along the route were geographically located. This geographic information is of value to numerous specialists interested in early historic and prehistoric Texas, including archeologists, anthropologists, ethnohistorians, and also biogeographers, who have recently contributed significantly to clarifying the route of Cabeza de Vaca (Olson et al. 1997:175). Whereas some of our differences in documentary route interpretation and route projections may be minor or involve only a few leagues, my difference with the reviewers as to the purpose and contribution of historic trail studies is immense and fundamental.

The reviewers, both practicing archeologists who have been associated with TxDOT, seem to be unaware that traditional historical route studies can assist in the design of archeological projects and contribute to the interpretation of the physical record (see Hester et al. 1997:52). For example, Michael B. Collins and Grant D. Hall, two highly regarded archeologists, cite my 1995 work on Spanish expedition routes in recent articles in the *Bulletin of the Texas Archeological Society* (Collins 1995:386; Hall 1998:5). Moreover, in the introduction and notes to the recently published book *The La Salle Expedition to Texas*, I referenced over 20 archeological studies and reports that helped interpret and enrich Henri Joutel's journal (Foster 1998). Rather than restricting the field of inquiry for historians, as proposed by the reviewers, other scholars and specialists that are interested in the field should be encouraged to commingle more frequently and share the results of their studies of the early historic and prehistoric periods.

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# Radiocarbon Dating of *Rangia cuneata*: Correction Factors and Calibrations for the Galveston Bay Area

*Karl W. Kibler*


## ABSTRACT

In the past, a variety of correction and calibration methods have been used by archeologists to bring radiocarbon assays from *Rangia cuneata* in line with dated samples from the atmospheric radiocarbon reservoir. Many of these methods, some of them used incorrectly, have tried to force or fit components and assemblages into Aten's (1983) absolute chronology for the Galveston Bay area, which itself is questioned in this paper. Suggested methods of correction and calibration are given and are utilized on a sample of extant radiocarbon assays from the Galveston Bay area.


## INTRODUCTION

The lack of appropriate materials from indisputable contexts for radiocarbon dating presents a major obstacle for archeological investigations in the Galveston Bay area. Commonly, charcoal is not found in discrete hearths but instead is scattered and dispersed throughout the site and/or shell midden (Aten et al. 1976:12; Gadus and Howard 1990:201). Due to the paucity and sometimes questionable provenience of charcoal, archeologists working in the Galveston Bay area primarily have resorted to obtaining radiocarbon assays from shells, particularly those of the ubiquitous brackish water bivalve, *Rangia cuneata*. However radiocarbon assays on shells, including *R. cuneata*, are inherently problematic because shells grow and develop outside the atmospheric carbon reservoir (Molto et al. 1997:495; Stuiver and Braziunas 1993:137; Stuiver and Polach 1977; Taylor 1987:49–52) and tend to render radiocarbon ages that are too old. In the Galveston Bay area, several factors may account for this. Valastro and Davis (1970:265–266) estimated that *R. cuneata* shells from the Trinity delta area are diluted with 1–3 percent dead carbon, most likely from ancient terrestrial carbonates delivered by the Trinity River. It is also probable that the influx of marine waters from the Gulf, particularly during periods of drought and/or prior to the development of Galveston Island and Bolivar Peninsula, might contribute to the age anomaly in shell. This age anomaly phenomenon is known as the reservoir effect (Stuiver et al. 1986; Stuiver and Polach 1977). A reservoir correction factor has to be applied to these radiocarbon ages in order to bring them in line with contemporaneous samples grown in the atmosphere (Molto et al. 1997:495; Taylor 1987:49). The difference between conventional radiocarbon ages of samples grown simultaneously in the atmosphere and another carbon reservoir is known as the reservoir age, *R(t)*. Differences between reservoir and atmosphere radiocarbon activity are apt to vary with changes in reservoir parameters, changes in atmospheric $^{14}C$ values, and exchanges or interaction between reservoirs; therefore, *R(t)* is not constant (t = cal age) (Stuiver et al. 1986:980).

Aten (1983:329–341) tried to compensate for reservoir effect in the Galveston Bay area by deriving a reservoir correction factor (225 ± 103 years) based on dated pairs of shell and charcoal. The pairs, exhumed from common proveniences or stratigraphic positions within shell middens, were assumed to be coeval. With a number of radiocarbon assays from paired charcoal and shells, Aten (1983:332) provided a regression equation in order to predict charcoal (atmospheric) radiocarbon ages for contemporaneous *R. cuneata* shells. With this regression equation and its standard error, the shell radiocarbon ages were transformed into a charcoal radiocarbon scale or brought in line with the atmospheric carbon reservoir. The correction factor was then applied to the raw radiocarbon ages obtained from unpaired *R. cuneata* shells. A correction for stable carbon isotope fractionation (delta $^{13}C$) was not applied to the shell radiocarbon ages prior to the reservoir correction and subsequent calibration.

Based on this work, Aten (1983:282–290) developed a Ceramic period chronology for Galveston Bay based on a seriation of ceramics from a number of sites, and radiocarbon assays from the various ceramic-bearing components. Six periods were defined using the relative percentages of two major ceramic wares: untempered sandy paste wares (e.g., Goose Creek Plain) and grog-tempered wares (e.g., Baytown Plain). The stratigraphic distribution of more than 60 radiocarbon dates was then used to estimate the time range for each of the six periods (Aten 1983:285). Even though Aten's (1983:283) ceramic seriation is somewhat problematic given its heavy reliance on the presence and absence of Goose Creek Plain, which has a bimodal distribution, it has on a general level held up since its inception (cf. Ellis and Ellis 1995). However, the absolute chronology of this sequence has been questioned (e.g., Howard et al. 1991:13; Kibler et al. 1992:21; Weinstein 1986:119–120).

Recent archeological investigations have suggested that the absolute chronology of the Ceramic period may be inaccurate (see Ricklis 1994). Aten's radiocarbon dates may be too recent by 150 years (Kibler et al. 1992:21) to 200–300 years (Howard et al. 1991:13). At 41GV10 and 41GV53 along Clear Creek, the radiocarbon dates for the ceramic-bearing levels appeared to be several hundred years older than the ages implied by the associated ceramic assemblages, even after applying Aten's correction factor (Bailey et al. 1987:16, 20). Weinstein (1986:119–120) has argued that an increase in age of approximately 200 years would bring Tchefuncte ceramic-bearing components of the Galveston Bay area (i.e., Clear Lake period) more in line with dated Tchefuncte components in the lower Mississippi River valley to the east that date to ca. 2450–1950 B.P. Some suggest a time lag between the introduction of certain early ceramic types into the Galveston Bay area and their introduction (and in some cases their disappearance in the archeological record) to neighboring Louisiana (e.g., Aten 1983). This explanation is not a strong argument and may have been bolstered by inappropriate methods of correction and calibration of radiocarbon ages of *R. cuneata*.

Unfortunately, the varying results and interpretations of shell radiocarbon ages have led many archeologists to use a barrage of varying correction factors and calibration curves to force their radiocarbon ages into Aten's (1983) absolute chronology. Weinstein et al. (1988:210) applied Aten's correction factor to delta $^{13}C$-corrected assays and then calibrated the dates using the dendrochronological curve of Klein et al. (1982). Later, Weinstein (1991) calibrated delta $^{13}C$-corrected radiocarbon ages using the Klein et al. (1982) curve, but made no attempt to correct for reservoir effect in his final interpretation. Gadus and Howard (1990) applied Aten's correction factor to uncorrected radiocarbon ages and then calibrated the assays utilizing the atmospheric record of Stuiver and Pearson (1986) and Pearson and Stuiver (1986), while Ensor (1995) applied Aten's correction factor in conjunction with the marine calibration curve of Stuiver and Braziunas (1993), or a mixed atmospheric and marine calibration curve to delta $^{13}C$-corrected assays. Howard et al. (1991:26–27) applied a reservoir correction factor ($\Delta R = -5 \pm 15$) derived from the world ocean model of Stuiver et al. (1986) for Carribean samples to conventional radiocarbon ages, then calibrated them with the marine calibration curve of Stuiver et al. (1986). In addition, Howard et al. (1991) calibrated the same conventional radiocarbon ages using the atmospheric curve of Stuiver and Pearson (1986) and Pearson and Stuiver (1986), comparing the results with the marine calibrations. In all cases the atmospheric curve yielded dates 300–500 years older than the marine curve (Howard et al. 1991:44, 71–72).

There may be various explanations for discrepancies between Aten's absolute chronology and more recently obtained radiocarbon ages from shells, and why there are so many contrasting shell radiocarbon ages for the various ceramic-bearing components. First, Aten's original dates were not corrected for stable carbon isotope fractionation. Second, the greater accuracy and precision of today's radiocarbon dating techniques and calibration curves, respectively, should produce more reliable dates than those used for Aten's materials. Third, intra-bay variability in reservoir ages from terrestrial carbonate enrichment and marine water intrusion across Galveston Bay may be responsible for some discrepancies (Howard et al. 1991:13). Aten's reservoir correction factor, which is directly applicable for the Trinity River delta area, may not be applicable for other areas of Galveston Bay. For example, although the Trinity River basin includes carbonate-rich, Cretaceous-age lithological units, the Clear Creek drainage basin does not (Aronow et al. 1982).

The establishment of a more-accurate absolute chronology is critical for several reasons, from extra-regional comparisons and interactions to diachronic changes (be they technological, environmental, or social) within the Galveston Bay area itself. This is particularly important for temporally establishing the beginning of the Clear Lake period, which marks the first appearance of ceramics (albeit in low frequencies, although the exception to this is the Eagle's Ridge site, 41CH252 [see Ensor 1997]) in the Galveston Bay area. Under such low-density conditions, the ability to differentiate Clear Lake components from preceding Late Archaic components at some sites based on the presence or absence of ceramics may be problematic. Radiocarbon dates for the positive occurrence of ceramics must be emphasized as the basis for estimating the initial appearance of ceramics in the Galveston Bay area (Aten 1983:286).

## METHODS OF CORRECTION AND CALIBRATION

The selection of appropriate radiocarbon correction methods and calibration curves for shell samples remains a major research issue (Ensor 1997:30; Gadus and Howard 1990:224; Ricklis and Cox 1991:23–24). Methods of correction for stable carbon isotope fractionation, reservoir age, and calibration for radiocarbon assays from *R. cuneata* are presented below. These methods follow those used by Howard et al. (1991), although I have attempted to calculate and use a more appropriate and more local reservoir correction factor than that used by Howard et al. (1991).

First, the radiocarbon assay should be corrected for stable carbon isotope fractionation, which until recently was rarely performed. In some archeological studies of Galveston Bay and other Texas bays, earlier-obtained radiocarbon assays without accompanying delta $^{13}C$ values were corrected by applying an average value (e.g., Howard et al. 1991; Ricklis and Cox 1991; Ricklis 1993). Often this cannot be avoided since the original sample is usually no longer available for obtaining such measurements. However, delta $^{13}C$ values tend to vary from specimen to specimen. A sample of 71 *R. cuneata* shells from the Galveston Bay area have yielded delta $^{13}C$ values ranging from –1.6 ‰ to –10.8 ‰ (mean=–6.4 ± 1.8 ‰), which increase the ages of the samples by 230 to 375 years (mean=300 years) (see Ensor 1995; Gadus and Howard 1990; Howard et al. 1991; Kibler et al. 1992; Weinstein 1991; Weinstein et al. 1988; Weinstein and Whelan 1987). All future investigations need to obtain delta $^{13}C$ values for each assay in order to correct the raw radiocarbon age, and while events separated by less than 200 to 300 years are indistinguishable for normal precision dating (Taylor 1987:141), corrections for stable carbon isotope fractionation should still be carried out since the effect of no correction may multiple once the radiocarbon age is subsequently corrected for reservoir effect and calibrated. This is particularly important given the great range (9.2 ‰ or greater) of delta $^{13}C$ values for *R. cuneata* in the Galveston Bay area.

Second, a reservoir correction factor needs to be applied to the delta $^{13}C$ corrected assay to bring the shell's conventional radiocarbon age in line with the atmospheric carbon reservoir. To handle reservoir effect and calculate a correction factor, I follow the method developed by Stuiver et al. (1986) and Stuiver and Braziunas (1993).

A reservoir correction factor for the *R. cuneata* of Galveston Bay may be obtained two ways. The first way is through the acquisition and radiocarbon dating of shell/charcoal pairs from common proveniences (e.g., Aten 1983). However, the assumption that shell/charcoal pairs are contemporaneous can be problematic due to our incomplete understanding of shell midden formation processes. Theoretically, charcoal from a particular stratum may be more recent than the adjacent shells, since charcoal from a fire built on top of the inherently coarse matrix of a shell midden may work down into an earlier stratum (Ambler 1973:47–49; Aten 1983:332). Shell midden surfaces may also have been exposed for very long periods of time prior to burial (Aten 1983:332), and therefore subjected to contact with the material remains (e.g., charcoal) of much later occupations. While these are potential problems, strong correlation coefficients for Aten's (1983) pairs (Pearson's r=0.985) and a data set of pairs (Pearson's r=0.996) presented later in this paper lend support to the assumption of the contemporaneity of the individual pairs.

The second method is to obtain a sample of conventional radiocarbon ages from shells of known historic age (Molto et al. 1997:496). One important factor to consider when procuring such a sample is the introduction of vast amounts of hydrocarbons into the Galveston Bay environment during the last 80–90 years from the development of the petrochemical, oil, and gas industries. Because of this, it would be best to obtain samples of *R. cuneata* that are known to have been collected prior to the turn of the century. Samples may have been collected by naturalists traveling through the Galveston Bay area in the 19th century. The *R. cuneata* specimens must have been collected alive. Such samples currently may be curated at various museums and/or universities across Texas and the country.

Calculating the reservoir correction factor for both methods consists of plotting the calibrated intercept(s) of the radiocarbon-dated charcoal of the shell/charcoal pair or the collection date of the modern shell against the $^{14}C$ content of the mixed layer (top 75 m) of the model ocean formulated by Stuiver et al. (1986:Figure 11-11S; Stuiver and Braziunas [1993:Figures 17A–17X]). The model's $^{14}C$ content was calculated through observations of the atmospheric $\Delta^{14}C$ record. The model's mixed layer reservoir age, *R(t)*, averages 373 years over the last 9,000 years and is the result of specific model parameters; it does not reflect local variations in the ocean reservoir ages (Stuiver et al. 1986:982). Stuiver and Braziunas (1993:139–140) have extended the model ocean to ca. 12,000 B.P. based on Bard et al's. (1993) data set of $^{234}U/^{230}Th$ ages on corals. This has resulted in minor, but negligible corrections to the model. Local variations are accounted for by ΔR.

Simply put, ΔR is the difference between the reservoir age of local reservoirs (e.g., Galveston Bay) and the reservoir age of the model ocean. There are two components to ΔR that account for the difference. The first is the differences between the global and local atmospheric $^{14}C$ ages, and the second is the differences between the world model ocean and local processes, such as fluvial discharge. By assuming a parallel $\Delta^{14}C$ response between the model ocean and regional parts of the world ocean, local variations or effects can be taken into account and corrected for in the calibration process. In other words, it is assumed as a first approximation that the regional (Galveston Bay) and world ocean have identical time-dependent responses to atmospheric forcing (Stuiver et al. 1986:982). Thus, although the difference between radiocarbon ages of samples formed contemporaneously in the mixed layer of the ocean and the atmosphere (i.e., the reservoir age) is time dependent—because the oceanic $\Delta^{14}C$ response to atmospheric $\Delta^{14}C$ changes—an approximately parallel response to atmospheric forcing of a regional part of the ocean and the world ocean results in a constant difference (ΔR) in the reservoir age of the two. Therefore, although *R(t)* is not constant, ΔR, as a first approximation, is constant (Stuiver et al. 1986:982; Stuiver and Braziunas 1993:139).

The difference (ΔR) in the reservoir age of Galveston Bay and the reservoir age of Stuiver et al. (1986) or Stuiver and Braziunas (1993) model oceans can be derived through the formula, $\Delta R = P - Q$, where P represents the delta $^{13}C$-corrected radiocarbon age of the prehistoric shell of the shell/charcoal pair or the modern shell. The values for Q are derived, as described above, from the mixed layer of the model ocean of Stuiver et al. (1986:Figures 10A and 11–11S) or Stuiver and Braziunas (1993:Figures 17A–17X) and presented as radiocarbon years B.P. (Figure 1). Standard deviations for ΔR can be calculated from the errors reported with the radiocarbon ages of the dated sample.

A group of radiocarbon ages also can be viewed as a data set from which the standard deviation in the unweighted mean can be calculated (Stuiver et al. 1986:982). After ΔR and its standard deviation are determined, it can be used in conjunction with the computer calibration program of Stuiver and Reimer (1986, 1993), and the marine calibration curve of Stuiver and Braziunas (1993:137), to acquire a calibrated date range for any conventional radiocarbon age on *R. cuneata* from the Galveston Bay area. The marine calibration curve is used because only it can account for the time dependency of *R(t)* (Stuiver and Braziunas 1993:137). The computer program and calibration curve have the ability to incorporate any given reservoir correction factor. Little (1993) found the method and calibration curve appropriate for calibrating the conventional radiocarbon ages of marine shells obtained from archeological sites along

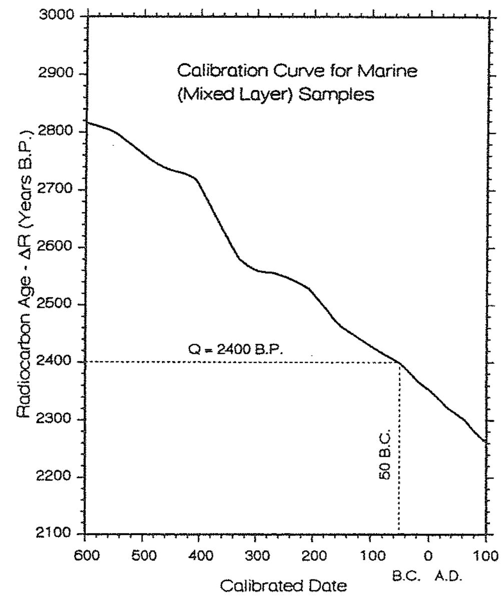


Figure 1. Calculating ΔR, where ΔR =P–Q. The charcoal member of the pair has a calibrated intercept of 50 B.C. This intercept is used to find Q. Here Q=2400 B.P. P is the conventional radiocarbon age of the shell partner. Here P=2480 ± 60 B.P. Therefore, ΔR=2480–2400, or 80 ± 60. Figure 1 is modified from Stuiver and Braziunas (1993:Figure 17E).

the coast of New England. Little's (1993) investigations revealed a close correlation between the marine curve–calibrated dates from shell, radiocarbon-dated organic materials of terrestrial origin, and associated temporally diagnostic artifacts. While *R. cuneata* is not a true marine species, it is clearly not a freshwater species either, tolerating salinities from 1–15 ‰ and surviving in salinities as high as 25 ‰ and as low as 0 ‰ at times (Hopkins et al. 1973). It should be noted that I "manually" applied the derived ΔR value to the conventional radiocarbon ages of the shells (of the data set presented below) prior to calibration. These "reservoir-corrected" ages were then calibrated using the atmospheric curve of Stuiver and Pearson (1993) and Pearson and Stuiver (1993). The resultant dates did not overlap at one-sigma with the dates of their charcoal pairs, and most did not overlap even at two-sigmas. The best correlation was found using the marine calibration curve of Stuiver and Braziunas (1993).

## A CASE STUDY OF THESE METHODS

A small number of conventional radiocarbon ages from paired *R. cuneata* shells and charcoal have been reported from the Peggy Lake sites along the lower San Jacinto River (Gadus and Howard 1990), and from sites in the Trinity River delta (Ensor 1995, 1997). From this small extant database, ΔR values were derived from each charcoal/shell pair (Table 1).

Howard et al. (1991:13) believed that variabilities in terrestrial carbonate enrichment across Galveston Bay may result in intra-bay reservoir age variability. To test this hypothesis, mean Δ R values from the Peggy Lake sites (average Δ R=140 ± 34) and the Trinity River sites (average Δ R=94 ± 25) were compared. The results suggest that statistically there is no significant difference between Δ R values from the lower San Jacinto River area and the Trinity River delta area ($t$=2.527, df=4, $p > 0.05$). Simply put, the same reservoir correction factor can be used to correct conventional shell (*R. cuneata*) radiocarbon ages from both areas, and possibly all of Galveston Bay. It is also probable that reservoir correction factors may vary through time, particularly for shells that predate (>ca. 4000 B.P.) and postdate (<ca. 4000 B.P.) the development of the barrier complex of the Gulf entrance to Galveston Bay. To test this hypothesis, the mean Δ R value derived from the two oldest charcoal/shell pairs (average Δ R=238 ± 42) was compared to the mean Δ R value derived from the remaining nine pairs (average Δ R=88 ± 23). Again the results suggest there is no significant difference or variation through time ($t$=4.835, df=1, $p > 0.10$). Based on these results, an average Δ R value of 115 ± 20 was calculated for the data set, and used in conjunction with the marine calibration curve of Stuiver and Braziunas (1993) to calibrate the conventional radiocarbon ages of the shell partners in the data set (see Table 1). The corrected and calibrated two-sigma date ranges of the shells closely correlate and overlap with the two-sigma calibrated dates of their charcoal mates.

In order to test and evaluate the Δ R value (115 ± 20) and Aten's (1983) absolute chronology, select conventional radiocarbon assays on *R. cuneata* in association with Clear Lake period (A.D. 100–425) ceramic assemblages were corrected for reservoir effect and calibrated as above. The Clear Lake

**Table 1 . Conventional Radiocarbon Ages on Paired Shell and Charcoal, Calculated ΔR Values, and Calibrated Dates from the Galveston Bay Area**

| Site | Lab No. | Material | delta $^{13}C$ ‰ | delta $^{13}C$ -corrected Age B.P. | R(t) | ΔR | Calibrated 2-Sigma Date Range and Intercepts for Terrestrial Member[1] | Calibrated 2-Sigma Date Range and Intercepts for *R. cuneata* Member[2] |
|---|---|---|---|---|---|---|---|---|
| Trinity River Delta sites and reported conventional radiocarbon ages (Ensor 1995 and 1997) | | | | | | | | |
| 41CH357 | Beta-72723 | Charcoal | –27.2 | 890 ± 80 | | | A.D. 1003 (1170) 1287 | |
| | Beta-72726 | *R. cuneata* | –8.0 | 1200 ± 50 | 310 ± 94 | –60 ± 50 | | A.D. 1234 (1308) 1407 |
| 41CH16 | Beta-73037[3] | Charcoal | –27.4 | 1930 ± 60 | | | 41 B.C. (A.D. 80) 236 | |
| | CAMS-13810 | | | | | | | |
| | Beta-73038[3] | *R. cuneata* | –7.6 | 2390 ± 70 | 460 ± 92 | 110 ± 70 | | 90 B.C. (A.D. 84) 253 |
| 41CH16 | Beta-73039[3] | Charcoal | –28.3 | 2060 ± 60 | | | 196 B.C. (50) A.D. 76 | |
| | CAMS-13817 | | | | | | | |
| | Beta-73040[3] | *R. cuneata* | –8.2 | 2480 ± 60 | 420 ± 85 | 80 ± 60 | | 177 B.C. (16) A.D. 125 |
| 41CH16 | Beta-73043[3] | Charcoal | –26.4 | 2270 ± 60 | | | 405 B.C. (370) 180 | |
| | CAMS-13819 | | | | | | | |
| | Beta-73044[3] | *R. cuneata* | –7.6 | 2600 ± 60 | 330 ± 85 | –40 ± 60 | | 352 B.C. (170) 7 |
| 41CH252 | Beta-72718 | Charcoal | –26.6 | 3480 ± 60 | | | 1937 B.C. (1760) 1631 | |
| | CAMS-13354 | | | | | | | |
| | Beta-72711 | *R. cuneata* | –5.6 | 4100 ± 60 | 620 ± 85 | 300 ± 60 | | 2191 B.C. (2015) 1862 |
| 41CH252 | Beta-94322 | Charcoal | –27.6 | 3640 ± 5 | | | 2138 B.C. (2011, 2009, 1977) 1880 | |
| | Beta-94323 | *R. cuneata* | –5.7 | 4150 ± 60 | 510 ± 78 | 175 ± 60 | | 2277 B.C. (2104) 1907 |

**Table 1** . *(Continued)*

| Site | Lab No. | Material | delta $^{13}C$ ‰ | delta $^{13}C$ -corrected Age B.P. | R(t) | ΔR | Calibrated 2-Sigma Date Range and Intercepts for Terrestrial Member[1] | Calibrated 2-Sigma Date Range and Intercepts for *R. cuneata* Member[2] |
|---|---|---|---|---|---|---|---|---|
| Peggy Lake sites and reported conventional radiocarbon ages (Gadus and Howard 1990) | | | | | | | | |
| 41HR124 | Beta-29967 | Charcoal | –25.7 | 540 ± 70 | | | A.D. 1297 (1410) 1474 | |
| | Beta-29968 | *R. cuneata* | –5.9 | 1090 ± 60 | 550 ± 92 | 120 ± 60 | | A.D. 1300 (1406) 1475 |
| 41HR124 | Beta-29971 | Charcoal | –24.9 | 1010 ± 100 | | | A.D. 819 (1020) 1249 | |
| | Beta-29972 | *R. cuneata* | –4.6 | 1510 ± 60 | 500 ± 117 | 110 ± 60 | | A.D. 893 (1023) 1162 |
| 41HR581 | Beta-30593 | Charcoal | –24.7 | 1700 ± 100 | | | A.D. 118 (380) 597 | |
| | Beta-30594 | *R. cuneata* | –7.6 | 2180 ± 70 | 480 ± 122 | 150 ± 70 | | A.D. 145 (337) 498 |
| | Beta-29980 | *R. cuneata* | –5.3 | 2260 ± 80 | 560 ± 128 | 230 ± 80 | | A.D. 47 (239) 431 |
| 41HR581 | Beta-30597 | Charcoal | –26.7 | 1470 ± 180 | 430 ± 20 | | A.D. 221 (610) 967 | |
| | Beta-29985 | *R. cuneata* | –4.4 | 1900 ± 100 | | 90 ± 100 | | A.D. 421 (645) 820 |

[1] 20-year atmospheric record of Stuiver and Pearson (1993) and Pearson and Stuiver (1993).
[2] Marine curve of Stuiver and Braziunas (1993); with ΔR = 115 ± 20 for all assays.
[3] Samples obtained from TARL; originally dated by The University of Texas Radiocarbon Laboratory and reported by Aten (1983).

period is viewed as a good test case because Tchefuncte wares, which are well dated in Louisiana to ca. 2450–1950 B.P., are included in the period's ceramic assemblage.

From 41CH63, along Lake Charlotte, Weinstein et al. (1989:87) report Tchefuncte Plain ceramics within a stratified shell midden. At 41HR581 in the Peggy Lake disposal area, Gadus and Howard (1990:152, 172) report on the excavation of a small discrete shell pile (Feature 7, which they interpret as an early Clear Lake feature) associated with five Goose Creek body sherds. Conventional radiocarbon assays of 2732 ± 67 B.P. (UGa-5844) and 2510 ± 90 B.P. (Beta-29979), respectively, were obtained on associated *R. cuneata* shells. Corrected for reservoir effect and calibrated, the radiocarbon ages produce two-sigma date ranges of 497 (354) 161 B.C. and 331 (48 B.C.) A.D. 149, respectively. The resultant two-sigma date ranges from this exercise lend support to the idea that Aten's (1983) absolute chronology may be 200–400 years too recent. More significantly, the dates are in line chronologically with Tchefuncte ceramic-bearing components further to the east.

## CONCLUSIONS

The difficulties of radiocarbon dating materials not originating in the atmospheric carbon reservoir are well known (Gillespie and Polach 1979; Stuiver and Polach 1977; Taylor 1987:49–52). Molto et al. (1997) provide an excellent account of the difficulties of dating materials subjected to reservoir effects (in their case, skeletal remains of humans whose diet consisted of an unknown portion of marine resources). They clearly demonstrate how a conventional radiocarbon age can render multiple date ranges of great variability when calibrated with an atmospheric and a mixed atmospheric/marine curve and when such parameters as Δ R and the amount of marine carbon in the paleodiet are unknown (Ensor [1997] provides a similar discussion on *R. cuneata* radiocarbon ages). In demonstrating this variability, Molto et al. (1997) did not come to any firm conclusions regarding correction factors (for reservoir effect) for their materials, nor does this article claim to be the last word on the correction for reservoir effect for radiocarbon ages of *R. cuneata* from the Galveston Bay area. The Δ R value (115 ± 20) presented here is considered preliminary and it may not be applicable for all areas of Galveston Bay (e.g., Clear Lake). It is statistical in nature and is bound to be slightly adjusted as more appropriate data are acquired. Obviously, more pairs must be dated from various areas across Galveston Bay in order to calculate a more-robust reservoir correction factor(s). Such a factor(s) should be supported by additional Δ R values derived through the radiocarbon dating of modern or historically collected *R. cuneata* specimens. Similar steps should be taken for the other bays and estuaries along the Texas Coast, since there may be some interbay variability. If possible, more of the materials originally dated by Aten (1983) should be obtained, dated again by radiocarbon assay, corrected for stable carbon isotope fractionation, and then calibrated with the reservoir correction factor so that comparisons can be made with the calculations made by Aten (1983). It is believed that these steps will result in more reliable radiocarbon dates from unpaired *R. cuneata*, which are more common archeologically and more often in less-questionable contexts than charcoal. Accurately dating archeological *R. cuneata* remains will thus strengthen and create a more rigorous absolute chronology for the Galveston Bay area, and comparisons can be more readily made with similar components and assemblages throughout and outside of the Galveston Bay area.

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# Comparative Review and Discussion of *Rangia cuneata* Dating Methods on the Upper Texas Coast

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**ABSTRACT**

A summary of *Rangia cuneata* dating methods is presented based on recent research in the Wallisville Lake project area and Galveston/Trinity Bay system. After presenting a general history of *Rangia cuneata* dating, three *Rangia* dating methods are presented that have been recently used by various researchers at sites in the Galveston/Trinity Bay system. It is concluded that a terrestrial or atmospheric model using a reservoir correction factor seems most appropriate with regard to dating brackish water clams on the upper Texas Coast.

## INTRODUCTION

The issue of accurately dating shell on the upper Texas coast is an important one because of the dearth of reliable charcoal samples from archeological sites in the Galveston Bay and upper Texas coast region. This discussion presents current views on how dating of *Rangia cuneata* and other shells from archeological sites in the vicinity of Galveston Bay and the upper Texas coast should be handled, given the current state of knowledge. The following discussion attempts to draw divergent approaches together for comparative purposes and to illustrate apparent strengths and weaknesses of each method. In the end, no one approach is likely to be a "cure all" for dating shell in the area due to problems inherent in dating shell in general.

What follows is an attempt to present the current evidence on dating shell in the area, to compare the competing methodologies, and to arrive at an unbiased set of conclusions that may benefit future researchers who must deal with this issue. While it may not be possible to eliminate all bias from the discussion, the reader is assured that a fair and reasoned approach has been taken which displays similarities and differences in the methods, including supporting arguments with actual data presented as clearly as possible. The reader is left to judge the success or failure of this endeavor.

## *RANGIA CUNEATA* DATING ON THE UPPER TEXAS COAST

Radiocarbon dating of the marsh clam, *Rangia cuneata*, on the upper Texas coast and in the Galveston Bay area was first given serious discourse by J. Richard Ambler, working in conjunction with Sam Valastro of The University of Texas at Austin Radiocarbon Laboratory in the early 1970s (cf. Aten 1983:330). At that time, a discrepancy was detected between the age of *Rangia cuneata* and charcoal found in apparent association. A series of "paired" charcoal/shell samples was run on samples from the Trinity River delta. These assays revealed that the shell ranged from 100 years to 400 years older than the charcoal from the same context. The difference in age was attributed to the 1-3 percent "dead" carbon that had somehow managed to find its way into the shell calcium carbonate structure.

As part of his dissertation research, Lawrence Aten conducted a lengthy review of the problems of shell dating on the upper Texas coast. Since Ambler and Valastro had made a plausible case for a consistent difference between the ages of the shell and charcoal components in the paired samples, Aten felt compelled to explore the matter further as part of his dissertation research. As stated by Aten (1983:329):

> It is reasonable to estimate that at least 90% of the archaeological shell middens on the upper Texas coast are composed entirely...of the brackish water clam, *Rangia cuneata.* To develop understanding of *Rangia cuneata* as a practical radiocarbon dating tool would constitute an important technical improvement supporting archaeological research in this area. But the practical use of any medium for radiocarbon age determinations depends on an understanding of carbon isotope behavior in that medium and the field conditions in which these materials occur.

Aten, like Ambler, recognized the potential problems associated with dating shell from the Galveston Bay area, since various carbon reservoirs could significantly alter shell carbonate material through carbonate exchange in an aqueous medium (Aten 1983:330). Aten decided to continue the work of Ambler by collecting paired samples from sites in the Galveston Bay area whenever possible. These samples formed the empirical basis for his regression equation which predicted the shell age from the charcoal age. A Pearson correlation coefficient of R=.985 was obtained between the ages of the 13 paired charcoal and *Rangia cuneata* samples (Aten 1983:333-334; Howard 1991:12). A regression equation was developed that allowed for the conversion of *Rangia cuneata* dates to the charcoal radiocarbon scale (Aten 1983:334). Aten's (1983:334) formula was based on the results of the regression analysis:

$$y = 0.995x - 225.2441, \quad SEE_y = 103 \text{ years}$$

where y = the predicted shell radiocarbon age after transformation to a charcoal scale, in radiocarbon years B.P.; x = the apparent or assayed age of *Rangia cuneata* shell, in radiocarbon years B.P.; and $SEE_y$ = standard error of the estimate of the regression equation, in radiocarbon years. This estimate is based on the sampling distribution of the individual radiocarbon sample means and replaced the use of sample standard deviations for corrected age estimates.

At the time that Aten's shell dates were run at The University of Texas at Austin Radiocarbon Laboratory, correction for isotopic fractionation was generally not conducted, so all of Aten's work was performed using the "raw" or, in today's terminology, measured $^{14}C$ age. The dates were further tree-ring calibrated according to Seuss (1970), since it was recognized that the amount of $^{14}C$ in the atmosphere had varied over time.

In addition to developing the 225-year correction factor for archeological shells in the Galveston Bay area, Aten also gathered information on dating shells along the entirety of the upper Texas coast into southwestern Louisiana. Aten noted that while paired charcoal/shell samples are not common from southwestern Louisiana to the lower Lavaca River area, water chemistry data indicate that bicarbonate concentrations range from a low of 37.5 mg/liter in the Sabine River drainage to a high of 269 mg/liter in the lower Lavaca River area. The Trinity River had a concentration of 113.6 mg/liter while the Brazos River delta had a concentration of 139 mg/liter. Aten noted a correlation between the bicarbonate level and estimated differences between shell/charcoal pairs from these areas, suggesting that bicarbonates from interior limestone rock formations have played a role in determining $^{13}C/^{12}C$ ratios of shell dates on the upper Texas coast (Aten 1983:338-339).

Radiocarbon dating since Aten's work in the Galveston Bay area and along the upper Texas coast has acknowledged Aten's work to a greater or lesser degree (Ensor 1995; Gadus and Howard 1990; Howard et al. 1991; Kibler 1996; Ricklis 1994, 1995; Weinstein and Whelan 1987; Weinstein 1991, 1994), yet a general feeling of uneasiness with the results of radiocarbon dating shell and the general lack of charcoal samples from secure contexts have been worrisome (Ensor 1995; Gadus and Howard 1990; Howard et al. 1991; Kibler 1996). Howard (Howard et al. 1991:12-13) conducted a review of $^{14}C$ dating prior to dating samples in the Clear Creek area of Galveston Bay. Howard discusses many of the potential pitfalls associated with dating *Rangia cuneata* on the upper Texas coast, including the fractionation or $^{13}C/^{12}C$ ratio. As explained by Howard (Howard et al. 1991:12-13):

> Fractionation is the variation in the ratios of the carbon isotopes between organisms, as a function of the isotopes' differing atomic masses. The amount of enrichment or depletion of the "heavier" $^{14}C$ isotope in a sample may be compensated for by normalizing its activity to

> the ratio of the stable carbon isotopes $^{13}C/^{12}C$. Conventional $^{14}C$ assays assume a given concentration of $^{12}C$ in the sample. If this concentration, as measured by the delta $^{13}C$ value, varies from the standard delta $^{13}C$ value of charcoal (-25.0 ‰) the radiocarbon age calculations must be adjusted accordingly.

To illustrate the significant variation in the $^{13}C/^{12}C$ ratios of charcoal and shell samples from the Galveston Bay area, Howard noted that 10 charcoal dates from sites at Peggy Lake yielded only a slight variation from the standard delta $^{13}C$ value of -25.0 ‰, with $^{13}C/^{12}C$ values ranging from -22.8 to -27.7 ‰; this results in corrections of only 40 years or less (Howard et al. 1991:13). On the other hand, assays of 23 shells from Peggy Lake sites indicated that $^{13}C/^{12}C$ ratios ranged from -1.6 to -8.4 ‰, which adds anywhere from 270 to 390 years (average of 317 $\pm$ 31) to their age when normalized to the standard $^{13}C/^{12}C$ value. Further, dates from shells at Clear Creek sites yielded similar increases in age since $^{13}C/^{12}C$ values ranged from -2.7 to -6.8 ‰. This indicated that the shells, when corrected for fractionation, yielded dates some 290 to 370 years older (average of 326 $\pm$ 24). Howard also noted that these age differences compared favorably to results obtained from dating similar material from other places in the world (Howard et al.1991:13).

In her review, Howard also discussed the impact of carbonates that originate in the deep oceans and in freshwater reservoirs. Translocation of carbonates from limestone or calcium-rich ocean bottoms or the influx of carbonate-rich water into Galveston Bay have been considered the primary sources of a local "reservoir effect" that causes the differences between shell and charcoal ages in the Galveston Bay area. However, the degree of magnitude and source (freshwater or marine, or a combination of the two) are unknown since it is difficult to measure this phenomena (Howard et al. 1991:13). Howard further stated that the correction factor derived by Aten (1983) is probably correct. However, she qualified this with the statement that the dates are probably too young by 200-300 years since $^{13}C/^{12}C$ correction for fractionation was not conducted for Aten's samples and the context of the charcoal portion of the paired sample was less than certain. She indicated that because of all the uncertainties involving reservoir effects and fractionation, the dates that she obtained that had been corrected for fractionation were not directly comparable to Aten's assays. Howard et al. (1991:70-73) corrected the measured or "raw" $^{14}C$ ages of the Clear Lake samples for fractionation and then calibrated them using the conventional ages with both the terrestrial and marine models in CALIB (Stuiver and Reimer 1986). The marine-calibrated conventional ages ranged from 200-500 years younger than those calibrated with the terrestrial model. A delta R value of -5 $\pm$ 15 was used in the marine calibration, which approximates values derived from the world ocean model of Stuiver and Reimer (1986) for the Caribbean, the closest ocean with available delta R values. It was noted that any reservoir variability related to freshwater carbonate was not taken into account using the marine model (Bailey et al. 1991:26-27).

With this background, the various methods that have been proposed for adjusting or calibrating shell ages to bring them in line with conventional charcoal ages are discussed below. It should be noted that all calibrations presented have been produced using CALIB (version 3.0 or higher) or the Pretoria-Beta program currently in use by Beta Analytic, Inc. The results produced by both programs are statistically the same with the Beta-Pretoria program employing a cubic spline fit of the calibration data that smooths the correlation curve, effectively averaging the data and making it more representative of individual samples (Darden Hood, 1997 personal communication). In all instances, the program used is identified and the derivation of calculations or methods made explicit.

In summary, the uncertainties involved with dating shell in the Galveston Bay area and along the upper Texas coast are reinforced by the diverse range of opinions, each apparently supported by somewhat independent lines of data, and involving the use of three different calibration methods. Prior to delving into calendar calibrations, conventional versus measured $^{14}C$ ages, and delta R reservoir correction factors, a word to the wise is presented regarding the inherent limitations of radiocarbon dating and calendar calibrations. The following cautionary note has been provided by Darden Hood (1997 personal communication) of Beta Analytic, Inc., and it behooves all with an interest in radiocarbon dating on the upper Texas coast to take careful note:

> ...calendar calibration is full of indeterminate errors and all correlation results should be interpreted loosely and critically...they are not a panacea. What works at one site may be completely different for another site...or material. Don't overemphasize the accuracy of calendar calibrations.

## TERRESTRIAL OR ATMOSPHERIC MODEL WITHOUT A RESERVOIR CORRECTION

The first model discussed is a simple calibration of shell ages using the terrestrial or atmospheric model (Stuiver and Reimer 1993), also used for calibrating all charcoal samples. Once corrected for isotopic fractionation, the age of the shell is calibrated using Stuiver and Reimer's (1993) atmospheric model with no reservoir correction. Ricklis (1994, 1995, this volume) indicates that results of dating paired samples from the Corpus Christ area site 41SP120 (Ricklis 1993; Ricklis and Cox 1991) and at the Mitchell's Ridge site (41GV66) on Galveston Island "produced statistically identical results" and "the same ages as samples of hearth charcoal," respectively. Ricklis (1995:163) further explains his rationale for use of the atmospheric model when dating shells from the upper Texas coast:

> Judging from the recently acquired empirical evidence, a marine correction factor should not be used on shallow-water estuarine shells from the Texas coast, presumably because the relevant molluscan species live in very shallow water in an essentially atmospheric carbon reservoir, and are not exposed to upwelling of old organic carbons from the ocean floor, as occurs in true marine environments.

Additionally, apparent close agreement between shell ages and cultural components (diagnostic artifacts) at the Lido Harbor site (Weinstein 1991) were obtained by calibrating the shells using the atmospheric model and no correction factor. Ricklis (1995:163) also states that the dating of paired charcoal/shell samples has inherent pitfalls since charcoal is usually found only in small pieces and the potential for these pieces to "migrate" downward in a shell midden is always present. Ricklis notes that the discrepancy in age between Aten's, and for that matter any, paired samples may be the product of such downward migration, the result of a hearth being built on previously deposited shell and gradually working its way into the underlying shell layer, where it is found and collected as a paired sample. The potential liabilities involved with dating such samples were noted very early in the history of *Rangia cuneata* dating in the Galveston Bay area by Ambler (1973), Aten (1983), and more recently by Howard et al. (1991), Ensor (1995), and Kibler (1996). However, the consistent divergence in age between shell/charcoal pairs has prompted several recent researchers to re-evaluate and build on Aten's concept of a reservoir correction factor (Ensor 1995, 1998; Howard 1991; Kibler 1996).

The results of calibrating nine paired samples from sites in the Trinity River delta and Galveston Bay area using the atmospheric model with no reservoir correction are presented below. The results will be directly compared to the other two methods, also discussed in detail below. Unlike the samples calibrated using a reservoir correction factor with either the atmospheric or marine curve, samples that were not reservoir-corrected did not overlap with the charcoal intercepts.

## TERRESTRIAL OR ATMOSPHERIC MODEL USING A RESERVOIR CORRECTION

The majority of archeological shells in the Galveston Bay area appear to come from a lacustrine or mixed marine/freshwater environment (hence the preponderance of the mixed [brackish water] species *Rangia cuneata*). A consistent divergence in age ranges for paired charcoal/shell samples from four sites in the Trinity River delta has been noticed, and Stuiver et al.'s (1986) atmospheric model has been used recently in conjunction with an updated version of Aten's (1983) 225-year reservoir correction factor (Ensor 1995) to derive a new delta R correction factor. This new factor is based on re-dating three paired samples from 41CH16 in the Trinity River delta (which had been originally dated by Aten) along with a paired sample from another Trinity delta site, 41CH357. Three additional paired samples from the Eagle's Ridge site (41CH252), which overlooks the Trinity River delta (Ensor 1995, 1998), have also been dated. An updated delta R value of 540 ± 110 years was obtained from 10 of Aten's 13 original paired samples (see Aten 1983:333). These samples all came from sites in the Trinity River delta and from general excavation levels where charcoal was found intermixed with *Rangia cuneata*; none came from direct association within closed or sealed contexts such as pits or hearths. The value of 540 ± 110 is subtracted from the conventional radiocarbon age rather than subtracting Aten's 225 years, which was applied to the measured or "raw" age of shell (see discussion above). It is important to note that the local reservoir effect or delta R is equal to the error in $^{14}C$ age due to its disequilibrium between the $^{14}C$ uptake reservoir and the contemporaneous environment. It is applied only after $^{13}C/^{12}C$ correction and is discussed relative to the conventional age (Darden Hood, 1995 personal communication).

The dating of these paired samples has been discussed in detail by Ensor (1995). Since Aten's correction factor had been based on shells uncorrected for fractionation, a method was devised to essentially leave Aten's correction factor intact, but to make it usable on samples that have been corrected for fractionation. This was done to avoid the possibility that someone would use Aten's 225-year correction factor (based on measured ages) on conventional ages. This concept is very simple: it simply adjusts Aten's 225-year reservoir correction factor systematically so that it can be used on conventional ages. Regardless of whether one uses Aten's original 225 years on a measured (raw) age or the 540 years on a conventional age (corrected for fractionation), the results are the same as illustrated by Hood (1997 personal communication):

> If measured age=4000 B.P., then the Measured Age-Aten's 225 years=3775 B.P. (reservoir-corrected $^{14}C$ age);
>
> If measured age=4000 B.P. and if $^{13}C/^{12}C$ ratio=-6 ‰, then the Conventional age=4310 B.P.;
>
> New reservoir correction for use with the conventional $^{14}C$ age=Aten's 225 years (the difference between the measured and conventional $^{14}C$ ages) + 310 years= 535 (rounded to 540);
>
> Conventional $^{14}C$ age corrected for reservoir effect=4310-540=3770 B.P. (same as reservoir-corrected age).

The outcome is the same in both instances.

The derivation of the 540 ± 110 year delta R correction factor involves adding 300 years (which is equivalent to a $^{13}C/^{12}C$ ratio of -6.7 ‰) to each of Aten's 10 shell dates (to correct for fractionation) and then subtracting the associated (paired) charcoal dates. The 300-year correction factor for Aten's measured ages was obtained by using an arbitrary average of -6.7 ‰, since no sample-specific $^{13}C/^{12}C$ ratios were computed (Darden Hood, 1997 personal communication). The average delta R for the 41CH16 and 41CH357 samples was -7.4 ‰ or 290 years. When corrected for $^{13}C/^{12}C$ fractionation and the charcoal dates are subtracted, an average of 540 years was obtained for Aten's 10 pairs. When the average 300 year correction for fractionation is subtracted from the average difference, the result is 315 years, very close to the 300 years assumed for Aten's uncorrected dates. Aten's charcoal/shell pairs came from general stratigraphic associations (none were from discrete hearth areas) and are subject to the vagaries of post-depositional mixing to one degree or another. Although the difference between the charcoal and shell dates ranges from 400 to 710 years, or some 310 years, they may be the same statistically.

As noted by Darden Hood (1997 personal communication) regarding the derivation of an assumed delta R of 540 years for Aten's paired samples:

> ...with regards to using an assumed $^{13}C$ ratio or -6. The error generated by using an estimated $^{13}C/^{12}C$ ratio of -6 on a sample which really had a ratio of -1 would introduce an 80 year offset. The standard deviation on a typical radiocarbon date is going to be 60-90 years. So, although systematically wrong, the precision limitations of radiocarbon dating itself would not allow you to see this. AND...trying to interpret radiocarbon dates as differentiated within this small time segment would be incorrect. The method is just not that good. Now, when you take all the uncertainties associated with reservoir correction into account the offset is even less significant. This is not a point of debate...it is just the way it

> is...However, if it is felt that this is an important point, I would simply increase the error on the 540. I think ± 110 was used...make it ± 180 or ± 200. This would certainly take it into account.

Keeping this in mind, the three charcoal/shell pairs dated from 41CH16 show a slightly lower reservoir effect than that obtained from Aten's 10 pairs (400 years versus 540 years) (Table 1). Likewise, the paired sample from 41CH357 also shows a lower reservoir effect (320 years) than Aten's 540 years. These differences may be due to site location and varying concentrations of carbonates. These slightly lower effects were used below in the calibration of the 41CH16 shell samples using the atmospheric model (see Table 1).

All of the samples dated by Ensor (1995) from 41CH16 came from general matrix samples from individual levels. No tight associations such as would be expected in a feature context were noted. The paired sample from 41CH357 came from a well-defined, relatively thin, organic lens or stratum in the lower portion of the shell midden. The samples from Peggy Lake (sites 41HR581 and 41HR124) (see Table 1) were from individual strata within shell middens but none were from discrete hearth areas or pits. The shell member of the paired sample from Eagle's Ridge (see Table 1) came directly from Feature 2, a diffuse hearth, while the charcoal member consisted of small charcoal fragments dispersed in the general vicinity of the hearth. In general, the context of paired samples consisted of shell/charcoal found intermixed in general excavation levels of shell middens, with a few exceptions.

This updated reservoir correction factor, modified slightly at times to accommodate small differences in reservoir effect as described above, has been used in calibrating shell/charcoal pairs from sites 41CH16, 41CH252, and 41CH357 in the Trinity River delta (Ensor 1995) and from Peggy Lake sites 41HR124 and 41HR581 (Gadus and Howard 1990; Kibler 1996). Examination of Table 1 indicates close correspondence between the calibrated one-sigma shell intercepts and the charcoal intercept using the atmospheric model and a delta R correction. All pairs overlap at one-sigma, with many of the ages being virtually identical.

The logic of using the atmospheric model in calibrating shells from the Trinity River delta has been summarized by Darden Hood (1997 personal communication):

> ...regarding reservoir correction of shells using atmospheric data and a local reservoir effect. If there is no reservoir effect, using the atmospheric calibration curve is going to give the best estimate of a calendar equivalent age (since the $CO_2$ in the water is derived directly from the atmosphere). The best case scenario is shallow water shells in agitated environments. If a local reservoir is present, simply applying it to the atmospheric data is the only option since modeling would be unique to each environment and probably end up with statistically similar numbers as that straight comparison.

## MARINE MODEL USING A RESERVOIR CORRECTION

In a recent study and review of shell dating methods in the Galveston Bay area, Kibler (this volume) presents an argument for the use of Stuiver and Braziunas' (1993) marine model in calibrating shell samples. By dating paired charcoal/shell samples from the same context or by obtaining dates on shells of known historic age, Kibler (1997 personal communication) indicates that a reservoir correction factor may be obtained in conjunction with Stuiver et al.'s (1986) mixed layer ocean model (Figure 1):

> To calculate Delta R take the calibrated intercept (or if there are multiple intercepts average them) of the charcoal at the point where the calibrated intercept of the charcoal meets the curve, locate the corresponding radiocarbon age (in years BP) along the y-axis of the table. Then subtract the radiocarbon age that you derived from the table from the conventional radiocarbon age of the shell of the same pair, this is Delta R, i.e., Delta R=conventional shell age (BP)-radiocarbon age (BP) derived from its charcoal mate and model ocean table.

What Kibler's method actually represents is best explained by Darden Hood (1997 personal communication):

## Table 1. Recalibration of Selected Paired Samples from the Galvestion Bay/Trinity Bay System (adapted in part from Kibler 1996)

| Site # | Lab # | Material | $^{13}C$ ‰ | $^{13}C$-Corrected Age B.P. | Calibrated one-sigma date range and intercepts for terrestrial member | [1] Atmospheric—No Reservoir Correction | [2] Marine—delta R Correction | [3] Atmospheric with Fresh-water Correction |
|---|---|---|---|---|---|---|---|---|
| Peggy Lake Sites and Reported Conventional Radiocarbon Ages (Gadus and Howard 1990) | | | | | | | | |
| 41HR124 | Beta-29968 | *R. cuneata* | -5.9 | 1090 ± 60 | A.D. 1321 (1410) 1439 | cal A.D. 893 (984) 1018 | cal A.D. 1359 (1421) 1456 | cal A.D. 1299 (1410) 1443 |
| 41HR124 | Beta-29972 | *R. cuneata* | -4.6 | 1510 ± 60 | A.D. 966 (1020) 1162 | cal A.D. 434 (559, 573, 576) 639 | cal A.D. 990 (1037) 1106 | cal A.D. 985 (1031, 1144, 1146) 1211 |
| 41HR581 | Beta-30594 | *R. cuneata* | -7.6 | 2180 ± 70 | A.D. 239 (380) 439 | cal B.C. 357 (202) 95 | cal A.D. 259 (368) 443 | cal A.D. 260 (420) 542 |
| 41HR581 | Beta-29980 | *R. cuneata* | -5.3 | 2260 ± 80 | A.D. 239 (380) 439 | cal B.C. 395 (359, 270, 260) 174 | cal A.D. 149 (258) 379 | cal A.D. 181 (264, 269, 342, 374, 376) 428 |
| 41HR581 | Beta-29985 | *R. cuneata* | -4.4 | 1900 ± 100 | A.D. 415 (610) 755 | cal A.D. 4 (88, 99, 127) 241 | cal A.D. 563 (661) 738 | cal A.D. 603 (662) 777 |
| Trinity River Delta Sites and Reported Conventional Radiocarbon Ages (Ensor 1995) | | | | | | | | |
| 41CH357 | Beta-72726 | *R. cuneata* | -8 | 890 ± 110 | A.D. 1031 (1170) 1247 | cal A.D. 774 (781, 789, 806, 848, 863) 939 | cal A.D. 1183 (1242) 1288 | cal A.D. 1022 (1160, 1173, 1188) 1276 |
| 41CH16 | Beta-73038 | *R. cuneata* | -7.6 | 2380 ± 70 | A.D. 18 (80) 136 | cal B.C. 682 (403) 387 | cal B.C. 106 (6) cal A.D. 80 | cal B.C. 90 (cal A.D. 28, 41, 51) cal A.D. 132 |
| 41CH16 | Beta-73040 | *R. cuneata* | -8.2 | 2480 ± 60 | 157 B.C. (50) A.D. 13 | cal B.C. 768 (755, 657, 587, 582, 540, 529, 523, 460, 448) 410 | cal B.C. 204 (141) 43 | cal B.C. 345 (86, 83, 53) cal A.D. 54 |
| 41CH16 | Beta-73044 | *R. cuneata* | -7.6 | 2600 ± 60 | 393 B.C. (370) 204 | cal B.C. 808 (791) 766 | cal B.C. 370 (327) 189 | cal B.C. 389 (347, 319, 226, 223, 206) 56 |
| 41CH252 | Beta-72711 | *R. cuneata* | -5.6 | 4100 ± 60 | 1881 B.C. (1760) 1689 | cal B.C. 2843 (2825, 2825, 2623, 2610, 2600, 2587, 2583) 2490 | cal B.C. 1885 (1758) 1668 | cal B.C. 1921 (1768, 1761, 1743) 1626 |

[1] Atmospheric model with no reservoir correction; 10 paired *Rangia* samples; one-sigma results, CALIB Method A, decadal data set with 10-point curve smoothing

[2] Marine calibration of paired samples using Delta R of 23 ± 30 for Trinity River samples and Delta R of 300 ± 60 for 41CH252 Middle Archaic sample; one-sigma results, CALIB Method A, Marine Data Set, with 10-point curve smoothing.

[3] Atmospheric model; 10 paired samples using freshwater reservoir correction factor of 320 ± 110 years for 41CH357, 400 ± 110 years for 41CH16, and 540 ± 110 years for 41CH252 and Peggy Lake sites; one-sigma results using CALIB Method A, atmospheric decadal data set, 10-point curve smoothing.

When you use the marine calibration scenario and enter in a local reservoir effect, you are first adjusting the Conventional $^{14}C$ age by the amount of the reservoir correction and then comparing this adjusted age to the marine correlation curve...this curve is much smoother than the atmospheric curve. This is because the curve is mathematically derived from the atmospheric curve allowing for delay-and-dampening of $^{14}C$ concentration caused by equilibration factors. The marine curve also has a built in global reservoir factor which ranges between about 200 to 500 years dependent on where you are in the time scale and which has been mathematically derived through modeling marine ocean circulation and $^{14}C$ distribution. Therefore, when you use this marine curve, you are adding your local reservoir factor to a global marine estimate. This is really 2 reservoir effects being added together. It's my impression that these sites aren't associated closely enough with the marine environment to justify this. If they are, then some of the effects included in the marine calibration model are present and unfortunately non-quantifiable. If they are not, the marine calculation scenario is inappropriate.

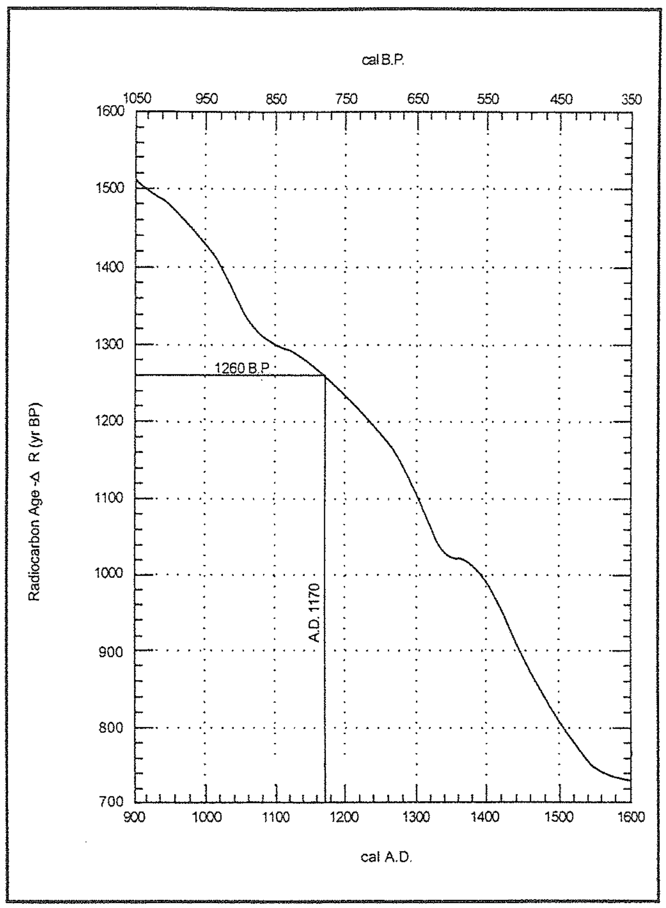


Figure 1. 41CH257: Beta-72723 charcoal intercept=A.D. 1170; delta R for Beta-72726=-60 $\pm$ 50; conventional shell age=1200 $\pm$ 50; 1200-1260=delta R (adapted from Stuiver and Braziunas 1993; Kibler, 1997 personal communication)

Kibler applies this method to the same paired samples listed above (see Table 1). Kibler arrived at an average delta R based on the conventional age (not corrected for reservoir effect), which resulted in a substantial difference at $23 \pm 30$ years. He also arrived at a delta R correction factor of 300 years for the one *Rangia* sample (Beta-72711) from the lower portion of the shell midden at 41CH252 (Kibler, 1997 personal communication).

Each shell sample from the Galveston Bay/Trinity River delta sites in Table 1 has been recalibrated (original calibrations were presented in Kibler [1996:60-61]) using the marine model curve in CALIB 3.0.3c. Sample-specific delta R correction factors were averaged for different geographic areas within the Trinity delta/Galveston Bay system. The averages were then used to calibrate the conventional shell ages of the pairs following Kibler's method and delta R factors. Regardless of which delta R factor was used in his calibrations, the calibrated one-sigma results overlap with those from the respective charcoal members in all cases (Kibler 1996:62, 1997 personal communication). Although the results are consistent, it is felt that Kibler's method unnecessarily uses the marine model to arrive at a number (his delta R factor) that will always produce the same results for any charcoal/shell pair; that is, the conventional charcoal date will always match the conventional shell date, with the only variance being the actual measured ages of the charcoal/shell members.

## SUMMARY AND CONCLUSIONS

The preceding discussion has attempted to provide a critical review and comparison of the different approaches to shell dating in the Galveston

Bay and upper Texas coast region. By focusing on methodology and presenting a wide range of viewpoints, in conjunction with using paired charcoal/shell samples to illustrate similarities and differences in the various approaches, it is hoped that a clearer understanding of the issues involved has been achieved.

It appears that both the atmospheric model using a delta R reservoir correction factor and the marine model using a reservoir correction factor yield good results when evaluating the shell/charcoal pairs (Table 2). However, the reason why they yield good results is very different. The atmospheric model using no reservoir correction yields significantly different ages between the shell/charcoal pairs (see Table 2). Discounting the possibility that these differences are due to mixing or displacement of the charcoal member of the pair, using the atmospheric model without a delta R correction factor on archeological shell in the Trinity delta would appear to give erroneous results. On the other hand, if significant displacement and translocation of charcoal has occurred at a site, the significant overlap obtained by dating the paired samples may be spurious and unrelated to any systematic difference in the actual age between the shell and charcoal. This is the only plausible explanation for the discrepancy in age. The apparently consistent results obtained using the atmospheric model with no reservoir correction factor at certain sites along the upper Texas coast may have more to do with their geographical/environmental location than with factors contributing to site mixing. Reservoir effects may vary widely, requiring that each site and locality be evaluated on an individual basis. It cannot be assumed that what works at one site will also work at another.

The main difference between the methods advocated by Ensor and Hood (atmospheric model with reservoir correction) and Kibler (marine model with delta R correction) is that the former is empirically derived (i.e., by direct comparison of dates from shell/charcoal pairs) and calibrated using the atmospheric model, while the latter is derived, in part, from a theoretical computer model devised to calibrate marine samples (see Table 2 and Figure 1). Since the Ensor/Hood model is based strictly on "empirical" data (original method proposed by Aten), it appears to be correcting for old carbonates that most likely have a terrestrial or freshwater origin (i.e., dependent upon a clam bed's location relative to the source of freshwater carbonates) as originally envisioned by Aten.

When Kibler uses his marine model on paired samples he always gets a close correspondence between the shell/charcoal members of a pair because the same two variables (conventional shell age and conventional charcoal age of the paired sample) are used to calculate the delta R vis-a-vis Stuiver and Braziunas' (1993) marine curve (see Figure 1). Any delta R calculated from shell/charcoal pairs in this manner (i.e., conventional shell age minus the corresponding value from the mixed layer of the model ocean of Stuiver et al. [1986] of the charcoal intercept) will always give identical results. That is to say, the calibrated charcoal intercept will always match the marine model calibration for a given pair since the two are intrinsically linked by the same variables. It is not possible to derive a true delta R factor using this approach since the relationship between the charcoal/shell ages and the delta R are predetermined and mathematically defined. The only things that vary are the values for the variables. Since nature is not that predictable, the number derived by Kibler (his delta R) does not convey an empirical relationship between the charcoal and shell pairs. Certainly the variability in radiocarbon isotopes contained within a charcoal sample, or the amount of "old carbon" in a shell, will vary enough in nature to preclude use of this number as a true delta R factor. Further, any standard deviation associated with a delta R factor must be taken into account before applying the derived number in a meaningful manner. A standard deviation of $\pm$ 50 computed using Kibler's method would yield a delta R of 0 since the difference in true age between the charcoal sample and shell sample is statistically insignificant (Darden Hood, 1997 personal communication).

The main problem with the method, beyond its use as a predetermined, rigid number that substitutes for a delta R factor, is that it mistakenly accounts for the difference in age of charcoal and shell pairs by attributing them primarily to marine origin (hence use of the marine curve). If Kibler (this volume) is not attributing the differences between the charcoal and shell ages to marine factors, then it would seem to make better sense to use the atmospheric model since calculation of his delta R factor for paired samples is more cumbersome than the Ensor/Hood method. Kibler's method requires

**Table 2. Calibrated One Sigma Results from Comparison of Paired Sample Calibrations Using the Three Methods Discussed in Text**

| Sample # | Atmospheric —No Reservoir[1] Correction | Atmospheric with delta R[2] Reservoir Correction | Marine with delta R[3] Reservoir Correction | Charcoal Intercept[4] |
|---|---|---|---|---|
| Beta 29968 | AD 984<br>cal AD 893(984)1018 | AD 1410<br>AD 1299(1410)1443 | AD 1421<br>AD 1359(1421)1456 | Beta 29967<br>AD 1410 |
| Beta 29972 | AD 559, 573, 576<br>AD 43(559, 573, 576) | AD 985(1031, 1144, 1146)1211 | AD 1037<br>AD 990(1037)1106 | Beta 29971<br>AD 1020 |
| Beta 30594 | BC 202<br>BC 357(202)95 | AD 420<br>AD 260(420)542 | AD 368<br>AD 259(368)443) | Beta 30593<br>AD 380 |
| Beta 29980 | BC 359, 270, 260<br>BC 395(359, 270, 260)174 | AD 264, 269, 342<br>AD 181(264, 269, 342, 374, 376)428 | AD 258<br>AD 149(258)379 | Beta 30593<br>AD 380 |
| Beta 29985 | AD 88, 99, 127<br>AD 4(88, 99, 127)241 | AD 662<br>AD 603(662)777 | AD 661<br>AD 563(661)738 | Beta 30597<br>AD 610 |
| Beta 72726 | AD 781, 789, 806, 848, 863<br>AD 774(781, 78, 806, 848, 863)939 | AD 1160, 1173, 1188<br>AD 1022 (1160, 1173, 1188)1276 | AD 1242<br>AD 1183(1242)1288 | Beta 72723<br>AD 1170 |
| Beta 73038 | BC 403<br>BC 682(403)387 | AD 28, 41, 51<br>BC 90(AD 28, 41, 51)AD 132 | BC 6<br>BC 106(6)AD 80 | Beta 73037<br>AD 80 |
| Beta 73040 | BC 755, 657, 587<br>BC 768(755, 657, 587, 582, 540, 529, 523, 460, 448)410 | BC 86, 83, 53<br>BC 345(86, 83, 53)AD 54 | BC 141<br>BC 204(141)43 | Beta 73039<br>BC 50 |
| Beta 73044 | BC 791<br>BC 808(791)766 | BC 347, 319, 226<br>BC 389(347, 319, 226, 223, 206) 56 | BC 327<br>BC 370(327)189 | Beta 73043<br>BC 370 |
| Beta 72711 | BC 2825, 2623<br>BC 2843(2825, 2623, 2610, 2600, 2587, 2583)2490 | BC 1921 (1768, 1761, 1743) 1626 | BC 1758<br>BC 1885(1758)1668 | Beta 72718<br>BC 1760 |

[1] Stuiver and Pearson 1993; Stuiver and Reimer 1993. Calibrated using conventional age (one-sigma results) using CALIB 3.0.3c; decadal atmospheric data set with Method A (curve intercepts), curve smoothed with 10 points.

[2] Stuiver and Pearson 1993; Stuiver and Reimer 1993. Calibrated using conventional age (one-sigma results) adjusted for local reservcir effect of 320 ± 110 years (41CH357), 400 ± 110 years (41CH16), and 540 ± 110 years (41CH252 and Peggy Lake sites) using CALIB 3.0.3c; decadal atmospheric data set with Method A (curve intercepts), curve smoothing with 10 points.

[3] Stuiver and Braziunas 1993, Stuiver and Reimer 1993; calibrated using conventional age (one-sigma results) CALIB 3.0.3C and marine curve; delta R of 23 ± 30 for Trinity delta sites, 140 ± 34 for Peggy Lake sites, and 300 ± 60 for site 41CH252 (after Kibler 1996; 1997 personal communication), Method A with curve smoothing of 10 points.

[4] Stuiver and Pearson 1993, Pearson and Stuiver 1993; calibrated using conventional age (one-sigma results) and 20-year atmospheric curve; CALIB 3.0 (from Kibler 1996).

careful manual calculation of intercepts on Stuiver and Braziunas' charts and additional steps in arithmetic to arrive at his delta R factor prior to entering it into the marine model of CALIB.

The Ensor/Hood method (derived from Aten's method) requires only subtracting the 540 years (or a locally derived correction factor based on shell/charcoal pairs) from the conventional charcoal age prior to calibration using the atmospheric model (where no paired samples are present). In samples where a slightly lesser or greater reservoir effect is apparent (for paired samples), such as that noted at 41CH357 and 41CH16, one needs to only subtract the charcoal age from the conventional shell age of a pair prior to subtracting that result from the conventional shell age. In either case, the appropriate reservoir correction factor is subtracted from the conventional shell age to arrive at the reservoir-corrected $^{13}C/^{12}C$ age, which is used as input into the atmospheric model of the CALIB program. This method provides a means of arriving at delta R correction factors for particular areas within the Trinity delta-Galveston Bay system by dating paired samples from specific sites or by dating paired samples from different cultural components at a site. Once enough paired samples have been dated for a particular area or time period, it may be possible, as the data warrants, to date shells reliably without a charcoal mate for different areas of the upper Texas coast or for particular cultural components.

The evidence reviewed above indicates that although the marine model yields predictably good (yet artificial) results when used with shell/charcoal pairs, and provides a method for assigning conventional shell ages to the marine-adjusted charcoal scale, it probably should not be used. Since the shallow waters of Galveston Bay and other estuaries on the upper Texas coast are subject to strong agitation and mixing of atmospheric, freshwater, and perhaps some marine carbon, the atmospheric method should be used in calibrations. Since the Ensor/Hood method uses a model that most closely approximates the environment where *Rangia cuneata* grow on the upper Texas coast, and provides an accurate means of transforming shell dates into the charcoal scale using a more appropriate model, it would seem preferable to the marine model.

Future studies should focus on obtaining additional charcoal/shell "pairs" from discrete contexts in the Galveston Bay and upper Texas coast region that can be used to "fine-tune" the existing data. The limitations of radiocarbon dating must be studied and recognized and a concerted effort made to "date within our means." As much as we would like to have narrow, tight chronologies, it is always safer to err on the side of reason and interpret the age of material remains carefully and conservatively. In conclusion, in searching for the most appropriate calibration method and accurate shell date possible on the upper Texas coast, researchers must always be cognizant of the inherent limitation of calibration methods as they exist. An open mind should be maintained, and revision, addition, or correction to established methods implemented as new data become available. All methods of calibration and derivation of correction factors (with specific examples provided) should be included for each analysis. In this manner, confusion and uncertainty related to shell dating can be minimized and the archeological results achieved more meaningful.

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# Atmospheric Calibration of Radiocarbon Ages on Shallow-Water Estuarine Shells from Texas Coast Sites and the Problem of Questionable Shell-Charcoal Pairing

*Robert A. Ricklis*

## ABSTRACT

The use of a marine-reservoir calibration or a so-called freshwater correction factor on conventional radiocarbon ages of archeological shell samples from the Texas coast may produce misleading results. Given the arithmetical inevitability that the delta-R factor in marine calibration will automatically bring any shell age into alignment with that on terrestrial wood charcoal, it is essential to show clear association of paired shell-charcoal samples on the basis of co-occurrence within discrete depositional units in which the contemporaneity of shell and charcoal can be confidently demonstrated. Only in this way can it be determined that divergences in conventional radiocarbon ages are the result of the influence of a marine carbon reservoir, rather than a reflection of actual age differences between shell and charcoal samples. Where paired samples have been extracted from discrete depositional units at Texas coast sites, the conventional or uncalibrated ages on paired shell and charcoal samples are similar or virtually identical, strongly suggesting that shallow-water mollusks in protected estuaries grew in an essentially atmospheric, rather than a marine, environment. In these cases, an atmospheric, rather than marine, calibration is appropriate. In light of these findings, the assumption that either a marine calibration or a "freshwater" correction factor (which rests on untested assumptions) should be employed on conventional shell dates from Texas coast sites is questionable. Future research should, therefore, seek to expand the relevant data base through acquisition of additional, clearly paired shell-charcoal samples.

## MARINE CALIBRATION AND FRESHWATER CORRECTIONS OF CONVENTIONAL SHELL AGES

It has been recognized for some time that radiocarbon ages on marine shells from archeological sites are often several hundred years older than ages on apparently associated charcoal. Additionally, it has been noted that marine shells of known historic ages also tend to be produce radiocarbon ages somewhat older than the recorded date of gathering (Stuiver et al. 1986; Taylor 1987; Stuiver and Braziunas 1993). Theoretically, the divergent ages have been explained as due to the reduced intake of atmospheric $^{14}C$ by marine organisms, and also perhaps due to the presence of "old" carbon introduced into the subaqueous environment through oceanic upwelling of organic materials. In order to compensate for age differences between dated materials of terrestrial vs. marine origins, a marine calibration curve was developed for adjusting conventional radiocarbon ages on shell samples (Stuiver et al. 1986; Stuiver and Braziunas 1993).

To employ the marine calibration curve, the following procedures are required:

1. The delta-R must be calculated. The delta-R is obtained by the formula delta-R=P-Q, where P is the conventional radiocarbon age on shell (raw radiocarbon age corrected for $^{13}C$) and Q is the actual age of the sample (as measured by the atmospherically calibrated age of associated charcoal or the known age of a historically collected shell sample) as adjusted by reference to a mixed marine layer calibration

curve (Stuiver et al. 1986; Stuiver and Braziunas 1993; see also Kibler et al. 1996 and Kibler, this volume).

2. The conventional age of the shell sample (raw radiocarbon age plus correction for $^{13}C$ fractionation) is entered into the marine calibration program along with the delta-R, to obtain a calibrated age range that can be expressed either in years B.P. or in Calendar (B.C./A.D.) years.

This procedure will *inevitably* produce a calibrated age on shell that aligns with that on charcoal believed to be the same age (i.e., a sample within the same context/provenience and thus "paired" with the shell sample). This inevitability derives from the fact that the delta-R value is inherently compensatory, in that it is a positive or negative value arithmetically calculated to make up the difference in ages between the supposedly paired shell-charcoal samples. While this procedure is valid if the shell and charcoal are indeed of the same historical age (although of differing uncalibrated radiocarbon ages), it can be misleading if in fact the two samples are actually of different ages, since, using the marine calibration, *the age of any shell sample will automatically align with the atmospherically calibrated age of a given charcoal sample* simply because the calculation of the delta-R is designed to bring the divergent ages into alignment.

The use of the marine calibration is thus valid only when dating *true* paired samples with significantly divergent ages. Therefore, the fact that a series of marine-calibrated shell ages align with ages on charcoal samples does not, in itself, demonstrate the reliability of the approach in the absence of demonstrably paired shell-charcoal samples (i.e., shell and charcoal from clearly discrete depositional units in which contemporaneity is certain or highly probable). For example, if for some reason one were to hypothetically posit that a calibrated charcoal age intercept of, say, 1450 ± 60 B.P. was paired with a conventional (uncalibrated) shell age of 5000 ± 60 B.P., the procedures used in the marine calibration would bring the ages into alignment, even though the age differences are obviously too great to reasonably infer contemporaneity. In this case, the delta-R is 3090, which, when entered into the marine calibration program (Stuiver and Braziunas 1993), yields a calibrated age range on the shell of 1530-1340 B.P., with a single intercept at 1440 B.P. This is virtually identical to the calibrated age intercept for the charcoal.

The idea that conventional radiocarbon ages on archeological shell samples from the Upper Texas coast require an adjustment toward the present is deeply entrenched. Aten (1979, 1983; see also Valastro and Davis 1970) estimated that *Rangia* shell dates should be corrected toward the present by 225 years, based on an average discrepancy between "paired" charcoal ages. He speculated that such a correction might be required due to the exchange of "dead" carbon ions introduced into the estuarine environment, through riverine discharge, as dissolved carbonates originating in the limestone bedrock of inland Texas. It is noteworthy, however, that Aten stated that this was only one possible explanation (not testable with existing information), and he emphasized that the interpretation was preliminary and hypothetical.

Basically following Aten's work, Ensor (1995, 1998; see also Ensor, this volume) has employed a "freshwater reservoir" correction of 540 years for *Rangia* samples from the Eagle's Ridge site (41CH252). This essentially mimics Aten's correction factor, since 540 years is subtracted from the age *after* approximately 300 years are added for the $^{13}C$ correction (which was not done when Aten developed his correction factor). Ensor based this correction factor on "paired" samples that were believed to be contemporaneous by virtue of their apparent association within arbitrary levels and/or stratigraphic units. As such, the pairs do not meet the more rigorous contextual requirement of coming from a demonstrably discrete depositional unit, and have all the potential problems of samples from shell midden strata. Furthermore, as Ensor (1995:L-1) acknowledges, "the 'reservoir effect' is of indeterminate magnitude since no studies have been conducted on samples of the water which carried the carbonates."

## THE PROBLEM OF QUESTIONABLE PAIRED SAMPLES

When shells of known historic age from a given coastal area are not available for radiocarbon dating, the archeologist must rely on paired samples of shell and wood charcoal to determine if shell samples yield uncalibrated ages that are older than terrestrial charcoal believed to be of the same age (thus indicating that the shell ages do in fact require a marine-reservoir calibration). Unfortunately, many, probably the great majority, of so-called paired samples used in chronology building on the upper Texas coast are not demonstrably associated within discrete depositional units that indicate contemporaneous deposition of shell and charcoal. Rather, almost all "paired" samples from the area consist only of shells and scattered charcoal bits (often collected from screens rather than from their primary contexts in features) from arbitrary vertical levels or more or less thick stratigraphic units that may have accumulated over centuries (e.g., Ambler 1967; Aten 1983; Gadus and Howard 1990). Such samples cannot be considered reliably paired, since contemporaneity of deposition of shell and charcoal is based on possibly flawed assumptions.

The potential unreliability of "pairs" from such contexts should be considered, *a priori*, for the following reasons:

1. As pointed out by Kibler (this volume), small bits of charcoal may derive from hearths built on top of existing (older) shell midden deposits, as suggested long ago by Ambler (1967), the excavator of many of the Trinity River delta deposits later discussed by Aten (1979, 1983). That hearths were commonly built on existing shell deposits is well demonstrated by the many small burned-shell patches within shell-midden matrices recently documented at the Eagle's Ridge site (Ensor and Ricklis 1998).

2. Charcoal particles are usually of small size, and may have been vertically translocated by: (a) settling of materials and (b) agencies of bioturbation.

3. Discrete depositional units within shell middens (especially *Rangia* middens, where shell species diversity is minimal and deposits tend to appear homogeneous) are difficult to discern, and mixing of materials is hard, if not impossible, to detect.

## RESULTS ON TRUE PAIRED SAMPLES FROM THE TEXAS COAST

Identification of true paired samples is basically a geoarcheological task, insofar as contemporaneity must be shown on the basis of association of shells and charcoal within primary natural or cultural depositional units that can be confidently considered to represent discrete events or relatively short periods of time. To reiterate a key point, association within arbitrary levels is inherently questionable, since it relies on the potentially fallacious assumption that such vertical provenience units do not cross-cut the temporal sequence of midden formation. Likewise, "pairing" of samples from more-or-less thick stratigraphic units is also potentially unreliable, since anything more than a very thin lens of deposited shell midden may contain materials spanning a time equal to, or greater than, any possible difference in the conventional or uncalibrated shell and charcoal radiocarbon ages. Thus, true paired samples will inevitably be difficult to locate, and will be relatively rare.

I review examples of true paired charcoal-shell samples from the Texas coast. In all such cases, the conventional radiocarbon age for shell samples (corrected for $^{13}C$) is not significantly older than, but very similar, if not virtually identical to, that for associated charcoal.

First, 41SP120 on Corpus Christi Bay had a terminal Archaic deposit that was interpreted as a discrete depositional unit (Ricklis 1993). The deposit consisted of a particularly dense lens of shell debris, some 10 cm thick (Figure 1), that contrasted

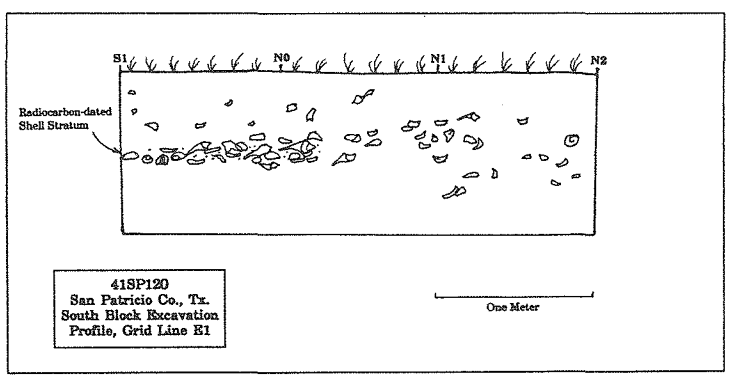


Figure 1. Excavation profile, South Block excavation, 41SP120, Corpus Christi Bay, showing vertically discrete Terminal Archaic deposit of dense shell, charcoal, and artifacts from which three charcoal and four shell samples were radiocarbon-dated.

with the surrounding matrix by virtue of: (a) a markedly higher density of shells and the less fragmented condition of the shells; (b) an unusually large quantity of wood charcoal within and among the shells, in contrast to all surrounding matrix, wherein only sporadic and tiny bits/flecks of charcoal were present; and (c) a greater density of artifacts than in the surrounding matrix. Moreover, the artifacts consistently conformed to expectations for a terminal Archaic assemblage; that is, no mixing with the Late Prehistoric materials overlying the shell lens was in evidence, indicating that materials had not been significantly translocated to become mixed into the dense shell lens. Three samples of wood charcoal and four samples of shell constitute a set that can be assumed on the physical bases of context and associations to represent essentially contemporaneous deposition. The corrected shell ages are similar, and most of the atmospherically calibrated age ranges overlap at one-sigma, while all overlap at two-sigma (Table 1).

Second, the Mitchell Ridge site (41GV66) on Galveston Island produced a thin (10-15 cm) and stratigraphically discrete deposit of Late Prehistoric debris (Ricklis 1994). A single time period is indicated for this deposit on the basis of a late ceramic assemblage as well as an overwhelming dominance of the projectile point sample by Perdiz arrowpoints (dated to A.D. 1300-1700; see Prewitt [1981] and Turner and Hester [1993]). Several discrete hearth features were contained within this zone. Two charcoal samples were recovered from two of the hearths, and two oyster shell samples were extracted from two other hearths. The shell radiocarbon ages, corrected for $^{13}C$ and uncalibrated, are essentially the same as the ages for the charcoal (see Table 1).

Third, the Redtail site (41HR581), on San Jacinto Bay on the upper Texas coast, produced a series of radiocarbon dates on shell and charcoal, some of which have been treated as paired charcoal-shell samples because they came from the same stratum of shell midden (Gadus and Howard 1990; Kibler et al. 1996). However, the authors of the site report in fact state that the shell and charcoal samples were "not directly paired," and that much of the charcoal was collected as small bits on screens (Gadus and Howard 1990:170). They do note, however, that "the single case of a true pair (Beta-29092 and Beta-29093) yielded highly divergent dates." The true pairing in this case is based on the fact that both the shell and charcoal were within an apparently discrete depositional context, at the base of the site, sealed under an overlying feature (Feature 18).

Actually, the radiocarbon ages on the true paired samples are not divergent at all, but are virtually identical: When the shell is corrected for $^{13}C$ (307 years added to the age, based on the average correction factor for *Rangia* shells at this site), an uncalibrated age of 2397 $\pm$ 80 B.P. is obtained, while the uncalibrated age of the paired charcoal sample is 2400 $\pm$ 140 B.P. The "divergence" in conventional ages in the case of this true pair is, therefore, merely the result of subsequent manipulations using what is apparently an inappropriate marine calibration (see Gadus and Howard 1990:Table 48).

Toward the earlier end of the chronological continuum, clearly paired shell-charcoal samples were also recovered from 41KL71 on Grullo Bay, part of the Baffin Bay system (Ricklis 1998). Archeological deposits here were stratigraphically superimposed within naturally cumulic clay dune sediments of eolian origin (Figure 2). The lowest cultural deposit consisted of a very thin (approximately 5 cm) lens of

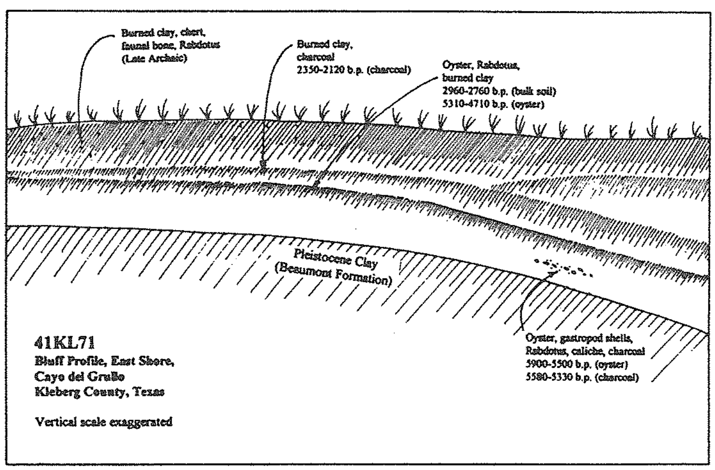


Figure 2. Profile of 41KL71, a multicomponent stratified site in eolian clay dune sediments, Cayo del Grullo, Baffin Bay area. Note paired shell-charcoal sample in lowest zone. Date on bulk soil is too recent, presumably due to introduction of relatively young organics into soil development on a stable but subsequently buried surface. All calibrations are atmospheric (Stuiver and Reimer 1993).

**Table 1. Data on True Paired Charcoal-Shell Samples, Texas Coastal Sites, showing Uncorrected Radiocarbon Ages, Ages Corrected for $^{13}C$ Fraction, and One- and Two-Sigma Age Ranges using Atmospheric Calibration (Stuiver and Reimer 1993)**

| Site/ Reference | Criteria for Acceptance as Valid Paired Sample(s) | Material | Laboratory No. | Uncorrected Age | Age corrected for $^{13}C$ | Atmospherically Calibrated Age Ranges, one- and two-sigma |
|---|---|---|---|---|---|---|
| 41SP120 (Ricklis and Cox 1991; Ricklis 1995) | All samples from within a discrete stratigraphic unit 10–15 cm thick | Charcoal | Tx-6387 | 950 ± 110 | – | 960-740 B.P.<br>1060-670 B.P. |
| | | Charcoal | Tx-6920 | 950 ± 80 | – | 950-740 B.P.<br>1050-690 B.P. |
| | | Charcoal | Tx-6639 | 1030 ± 130 | – | 1060-770 B.P.<br>1260-670 B.P. |
| | | Whelk | Tx-6925 | 580 ± 70 | 980 ± 70 | 950-790 B.P.<br>1050-730 B.P. |
| | | Scallop | Tx-6919 | 630 ± 70 | 1020 ± 70 | 970-800 B.P.<br>1060-740 B.P. |
| | | Quahog | Tx-6926 | 610 ± 70 | 1030 ± 70 | 1050-800 B.P.<br>1070-750 B.P. |
| | | Oyster | Tx-6924 | 760 ± 50 | 1160 ± 50 | 1170-970 B.P.<br>1250-950 B.P. |

**Table 1.** *(Continued)*

| Site/ Reference | Criteria for Acceptance as Valid Paired Sample(s) | Material | Laboratory No. | Uncorrected Age | Age corrected for $^{13}C$ | Atmospherically Calibrated Age Ranges, one- and two-sigma |
|---|---|---|---|---|---|---|
| 41KL71 (Ricklis 1998) | Discrete lens of cultural material, 5 cm thick, in cumulic clay dune sediment | Charcoal | Beta-100288 | 4650 $\pm$ 60 | 4730 $\pm$ 60 | 5590-5330 B.P.<br>5600-5300 B.P. |
| | | Oyster | Beta-106807 | 4730 $\pm$ 60 | 4960 $\pm$ 60 | 5840-5620 B.P.<br>5900-5500 B.P. |
| 41GV66 (Ricklis 1994) | All samples from within 10-15 cm thick zone with associated Late Prehistoric assemblage | Charcoal | Beta-55862 | 650 $\pm$ 170 | 590 $\pm$ 170 | 670-500 B.P.<br>900-300 B.P. |
| | | Charcoal | Beta-53673 | 610 $\pm$ 80 | 570 $\pm$ 80 | 650-520 B.P.<br>670-490 B.P. |
| | | Oyster | Beta-55867 | 280 $\pm$ 50 | 650 $\pm$ 50 | 660-650 B.P.<br>660-550 B.P. |
| | | Oyster | Beta-55866 | 140 $\pm$ 50 | 510 $\pm$ 50 | 550-510 B.P.<br>630-480 B.P. |
| 41HR581 (Gadus and Howard 1990) | Samples from within discrete deposit sealed by overlying strata | Charcoal | Beta-29092 | 2400 $\pm$ 140 | - | 2720-2210 B.P.<br>2760-2070 B.P. |
| | | *Rangia* | Beta-29093 | 2090 $\pm$ 80 | 2397 $\pm$ 80* | 2705-2340 B.P.<br>2720-2160 B.P. |

* Correction factor of 307 years based on average for *Rangia* shell samples from this site where $^{13}C$ assay was reported.

Note: Absence of correction for $^{13}C$ means $^{13}C$ assay was not reported by radiocarbon laboratory; in these cases, calibration is made directly from uncorrected age, since correction factor on wood charcoal is generally on the order of only a few decades.

burned clay/caliche nodules, charcoal, and oyster and gastropod shells sealed within an otherwise culturally sterile eolian clay-silt sediments. The corrected ages obtained on charcoal and oyster shells are similar (4730 ± 60 B.P. and 4960 ± 60 B.P., respectively), and overlap at two-sigma when atmospherically calibrated.

In these several cases, true paired samples have yielded $^{13}C$-corrected ages on shell and charcoal that are in close agreement. The use of a marine calibration is unnecessary and inappropriate, since the need for such a calibration exists when shell dates are substantially too old relative to charcoal. The similar conventional ages for paired shell and charcoal indicate that the molluskan organisms lived in essentially an atmospheric, rather than a marine, environment, and the conventional ages of both the charcoal and shell should, therefore, be adjusted using an atmospheric calibration.

In light of shoreline environmental conditions in Texas coast estuaries, the latter point is not surprising, since in general shellfish were gathered from shallow bays and lagoons protected by barrier islands, where, judging from modern environmental analogs, depths were probably on the order of approximately 1-4 feet. Conditions were, apparently, analogous to those found in small lakes, in which "the exchange rate with the atmosphere is dominant...[and] the change in specific $^{14}C$ content may well parallel the observed change in atmospheric $^{14}C$ content" (Stuiver et al. 1986:980).

## ADDITIONAL STRATIGRAPHIC/ TYPOLOGICAL SUPPORT FOR THE USE OF ATMOSPHERIC CALIBRATION OF SHELL AGES

An atmospheric calibration (Stuiver and Reimer 1993) has been employed on samples from other sites on the Texas coast, with satisfactory results. This has proven useful, insofar as shell samples thus calibrated produce age ranges in line with expectations based on the estimated ages of associated time-diagnostic artifact types and their stratigraphic contexts.

At 41SP120 on Corpus Christi Bay, atmospheric calibrations of radiocarbon ages on two shell samples (scallop and quahog, respectively) yielded identical one-sigma ranges of 930-740 B.P. These

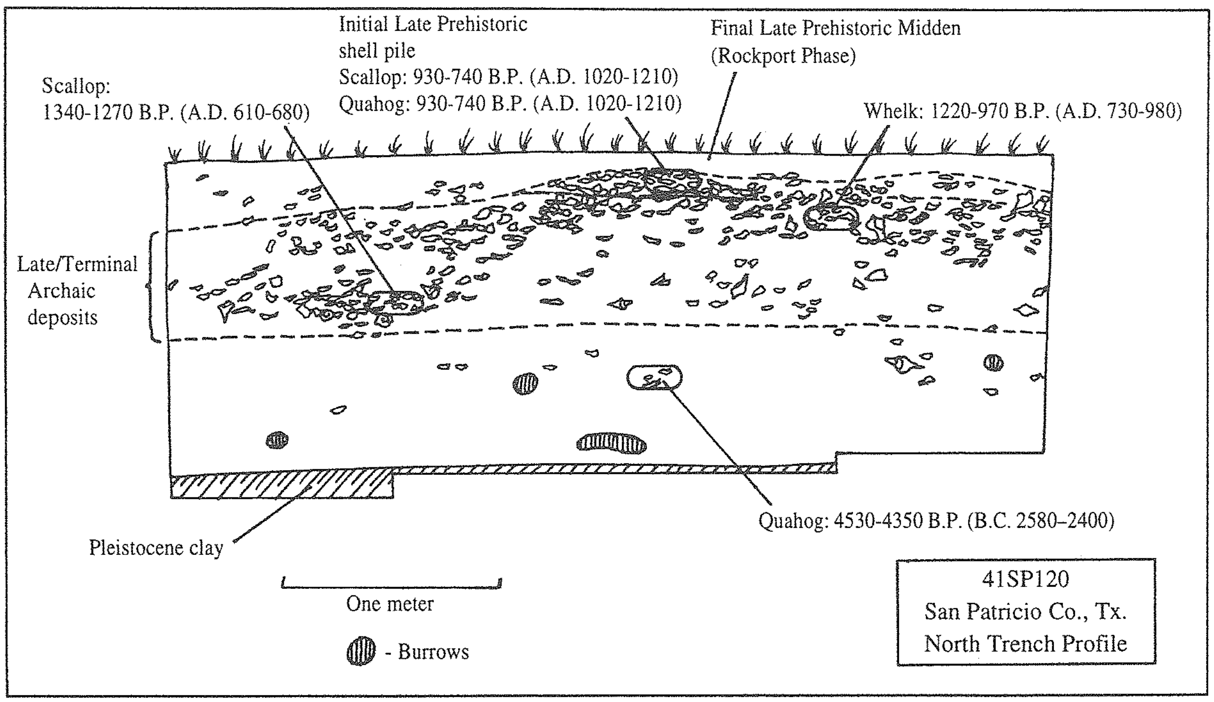


Figure 3. Profile of North Trench excavation, 41SP120, Corpus Christi Bay, showing location of dated shell pile associated with unstemmed triangular arrow points. All calibrations are atmospheric (Stuiver and Reimer 1993). Note that calibrated age ranges for this feature place deposition immediately prior to the overlying Rockport phase midden, dated on typological grounds to ca. A.D. 1250/1300-1700.

samples were extracted from a cleaned wall profile (Figure 3), in which it was clear that both samples came from a discrete depositional unit (a small shell pile) resting on a Late Archaic shell midden and immediately beneath a Late Prehistoric Rockport phase component that produced, among other temporal diagnostics, Perdiz arrowpoints and asphaltum-coated/decorated Rockport ware ceramics (Ricklis 1993). The dated shell pile, on the other hand, was marked by a dearth of ceramics and associated unstemmed triangular arrowpoints, shown to pre-date Perdiz in the southern part of the central coast (cf. Corbin 1974; Ricklis 1995). The atmospheric calibration thus placed these shells precisely in line with cultural-historical expectations, that is, between ca. A.D. 1000 and 1200, between the terminal Archaic component at the site, dated to ca. A.D. 1000, and the Rockport phase, which on typological grounds can be dated to ca. A.D. 1250/1300-1700 (Ricklis 1992, 1995, 1996).

At the earlier end of the temporal range, three atmospherically calibrated ages on *Rangia flexuosa* shells from the McKinzie site (41NU221) on the shore of Nueces Bay fell into a rather tight cluster with age ranges between ca. 5300 and 5900 B.P. (Ricklis 1988, 1995). The shells came from a thin, discrete stratum that also produced dart points of the Bell type, generally placed in the Texas chronology between 5000 and 6000 B.P. (e.g., Prewitt 1981; Collins 1994; Johnson 1994).

At the Lido Harbor Site (41GV82) on the upper Texas coast, Weinstein (1991) identified a series of Late Prehistoric features consisting of discrete pockets of *Rangia* shell. Although the features did not produce charcoal for pairing with the shell, Weinstein found that atmospheric calibration of the conventional radiocarbon ages on *Rangia* samples yielded age ranges in line with expectations based on the artifact assemblage. He noted that if the corrected ages were adjusted toward the present (e.g., through use of a "freshwater" reservoir correction), they would have been significantly too young for the kind of time-diagnostic artifacts with which they were associated.

## SUMMARY

Both the correction for the "freshwater" reservoir and the marine calibration rest on untested or questionable assumptions. The use of a freshwater correction factor for *Rangia* shells from the upper Texas coast rests on the assumption that estuarine mollusks absorbed "old" dissolved carbon ions derived from limestone bedrock located several hundred kilometers upstream. While this may ultimately prove to be so, it should be noted that this does not apply in the case of shell samples from the Nueces-Corpus Christi Bay estuary, which receives freshwater input from the Nueces River, the headwaters of which drain the limestone-rich region of the southern Edwards Plateau. Although it has been found that shells growing within a few kilometers of carbonate sources do absorb "old" carbon (Darden Hood, 1997 personal communication), it is as yet unclear if this applies to mollusks in aquatic environments at considerable distances downstream.

The use of a marine calibration is predicated upon the questionable assumption that the shallow, protected estuaries of the upper coast constitute a marine reservoir rather than an atmospheric $^{14}C$ environment. Given the current absence of historically collected shells of known age, the valid calibration of corrected ages of archeological shell samples must rest on the empirical association of shell with essentially contemporaneous wood charcoal. As presented herein, confidently paired samples have, to date, produced similar or virtually identical uncalibrated ages on shell and charcoal, indicating that an atmospheric calibration is appropriate.

Still, the fact that most upper coast shell samples are older than charcoal from the same stratigraphic/arbitrary levels will require explanation. At this point, it is possible only to suggest two alternative hypotheses to explain this tendency:

1. Some, perhaps many, shell samples from the upper coast do in fact produce ages older than those of truly contemporaneous charcoal, thus requiring a non-atmospheric correction or calibration; or

2. Charcoal particles are commonly younger than shells within a given vertical provenience because: (a) small charcoal bits tend to be translocated downward within the context of larger, more stationary shells; (b) prehistoric site occupants tended to rather consistently build fires on the surfaces of pre-existing, older shell deposits; (c) or a combination of these factors.

While the data generated by true shell-charcoal pairs suggest that an atmospheric calibration is appropriate, there are presently too few true paired shell-charcoal samples from the upper Texas coast for a final resolution of this problem. Given the abundant availability of shell in regional shoreline sites and the general scarcity of charcoal in clearly primary contexts, the need for a consensus on how to reliably adjust radiocarbon ages on shell is obvious. Until a larger series of true paired samples are available from the upper Texas coast area, however, it seems ill-advised to assume that a marine or freshwater calibration on conventional shell dates is generally appropriate. Ongoing research in the upper coast area should, therefore, place strong emphasis upon finding additional, clearly paired samples that are extracted from within demonstrably discrete depositional units.

## ACKNOWLEDGMENTS

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# Lake Jackson State Archeological Landmark (41BO172): Report of the 1994 and 1995 Texas Archeological Society Field Schools and Additional 1996-1998 Excavations

*Joan Few*

## ABSTRACT

The Lake Jackson State Archeological Landmark (41BO172), the Lake Jackson Plantation, in Lake Jackson, Texas, was a sugar and cotton plantation that operated in the 19th century. Abner Jackson was one of the largest sugar producers in Texas. Following the Civil War, convict labor was used to tend the sugar plants and refine the sugar. The hurricane of 1900 severely damaged the sugar mill and the mill was closed.

This 2.719 acre site contains the ruins of 12 structures, including the main house and sugar mill area of the plantation. Historic records document the evolution of sugar technology between the 1840s and 1900. Archeological evidence was found to support and clarify those changes at the Lake Jackson sugar mill.

The 1994 and 1995 Texas Archeological Society (TAS) field schools excavated portions of the ruins of the main house; the sugar mill; and structures A-D and I. These two field school are responsible for 90 percent of the excavations at the site. Field classes by the University of Houston Clear Lake in 1996-1998 completed excavation units at the sugar mill begun by the TAS.

## INTRODUCTION

The 1994 and 1995 Texas Archeological Society (TAS) field schools excavated portions of the 19th century main house, the sugar mill, and structures A-D and I at the Lake Jackson State Archeological Landmark site (41BO172) in Brazoria County, Texas (Figures 1 and 2). The two field schools are responsible for 90 percent of the excavations at the site. Without the excellent and dedicated work of the field school participants, this part of Texas history would have taken years to uncover. Field classes by the University of Houston Clear Lake between 1996 and 1998, completed excavation units at the sugar mill begun by the TAS field schools. This paper includes the results of all field work at the site through 1998.

History documents where plantations were located (Platter 1961), who their owners were (Strobel 1926), and how much sugar they made (Champomier 1852-1858). Records have not been located, however, that describe the size, layout, and processual orientation of the sugar mills along the lower Brazos River valley. Archeological research at sites like Lake Jackson has provided this missing information on the first industry in Texas, that of refining sugar. The Lake Jackson sugar mill is of great importance because the mill was first constructed using the fire heat method of sugar reduction. After the Civil War, the mill underwent alterations—to adapt to new technologies—that have been documented archeologically. The archeological contributions made by the Texas Archeological Society during the 1994 and 1995 Field Schools have greatly enhanced our ability to better understand a new chapter in Texas history.

### Plantation Archeology in Texas and Research Objectives

The "sugar bowl" of Texas includes Brazoria, Fort Bend, Matagorda, and Wharton counties. It was dominated by large sugar and cotton plantations (Creighton 1975:204). The historic documents available about plantation history in Brazoria County include public records (i.e., censuses, tax records, probate records), plantation journals and records, agricultural journals, diaries and letters,

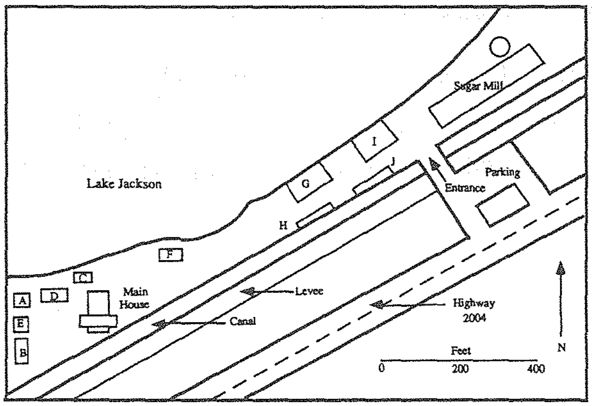


Figure 1. Lake Jackson State Archeological Landmark Site Map

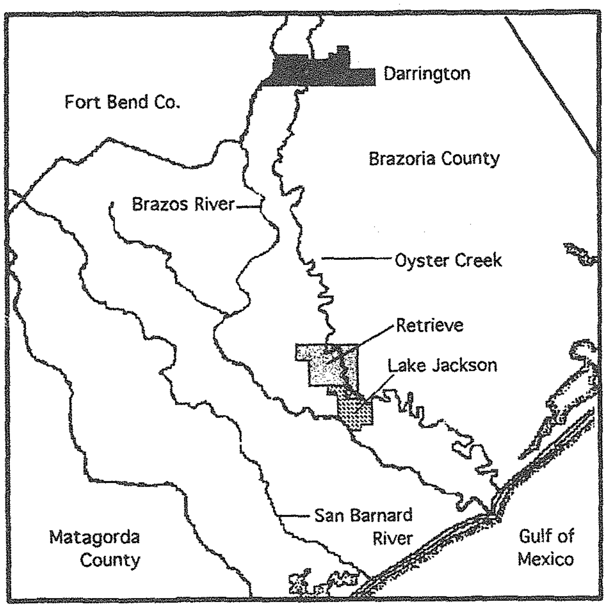


Figure 2. Brazoria County and Abner Jackson's Three Plantations

travel journals, and newspapers. From these documents and the archeological deposits we are seeking answers to the questions:

1. How did the plantation system work? How did they produce sugar? What changes in the sugar process are documented in the archeological record?
2. How self-sufficient was each plantation system? How many artifacts were imported and how many appear to have been hand-made on the plantation?
3. How did life on a plantation relate to the economic and social worlds of its owners and slaves? and,
4. How was space used? What economic and social behavior is reflected in the allocation of space?

Research also included the following excavation objectives:

1. find the plantation period exterior ground living surface;
2. find the original sugar mill built by Jackson;
3. find material evidence of how sugar was made at the original mill and identify the structural alterations made as the sugar process changed during the Jackson period;
4. find material evidence for the way sugar was made after the Civil War (Convict period) and identify the alterations made to the sugar mill during the Convict period; and
5. expose structures to determine the size of the structure, the type of foundation, and structure function.

### Basic Recording Data and Excavation Procedures

The site was laid out in one foot squares. Excavation units in all areas were 3 x 3 feet except for the sugar mill, where units were 9 x 9 feet. Units are labeled by their southwest corner coordinates. The site datum for vertical measurement was the top of the historical marker located east of the main house. The equator/prime meridian intersection for horizontal measurement was an arbitrary point north of the historical marker set in concrete with a brass pin. When matrix was screened, 1/4-inch mesh was used. Excavation levels were 0.5 feet in thickness. In each area, the number and placement of excavation units were determined by the research objectives. In some excavation units, the objective was to expose architectural features without removing the features. In excavation units not obstructed by architectural features, excavations proceeded until sterile soil was reached.

## Recognizing Patterns in Historical Archeology

A pattern is the arrangement and configuration of artifacts (including structures, land alteration, deposits, etc.) by type and quantity that reflect cultural activities, cultural time periods, and cultural change. The assumption is that every social system has identifiable survival strategies; that every survival strategy has a measurable amount of energy and resources; that every household and business reflects the whole system through objects used; that all systems are reflected in patterns; and that meaningful patterns can be identified in the archeological record by: (1) artifact numbers (how many), (2) artifact association (with what), and (3) artifact distribution (where).

At Lake Jackson, we used Stanley South's (1977) quantitative pattern by artifact type. South's artifact grouping system is used because it applies to all historic sites. The artifact groupings quantitatively identify the specific patterns of cultural function, whether the site is a plantation, farm, factory, fort, or urban or rural site. South classifies and groups artifacts according to specific functions: kitchen artifacts include all storage, cooking and eating utensils, and all bottles including pharmaceuticals; bone (food); architecture includes window glass, nails, bolts, and all construction hardware, including door locks; furniture includes hinges, knobs, drawer pulls and locks, curtain pulleys, mirrors, chimney lamps, and glass; arms includes bullets, shot, gun flints, gun parts, and bullet molds; clothing includes buttons, buckles, thimbles, scissors, pins, and beads; personal includes coins, keys, and personal items (combs, jewelry, watches, pencils, pens); activities includes construction tools, farm tools, toys, fishing gear, stable and barn objects, miscellaneous hardware (unidentified metal); miscellaneous includes everything that does not fit into any other group as well as 20th century garbage (South 1977:95). For this study we eliminated South's smoking pipe group because so few pipes were found, and then added a prehistoric category because of the presence of prehistoric materials (see Few et al., this volume).

All artifacts were counted and grouped: (1) by level to reflect a level pattern to determine what activities may have taken place in the same place at approximately the same time; (2) by excavation unit to reflect the unit pattern to determine if similar or different activities took place in the same place over time; (3) by structure to reflect a structure pattern to determine how the structure was used; (4) by room to reflect a room pattern to determine how a room was used; (5) and for the entire site to reflect the site pattern of a 19th century cotton-sugar plantation.

These quantitative patterns will help to identify activity areas and the function of different structures. Looking at particular artifact types can be helpful in identifying the function of a structure. Artifact types must be examined both as a percentage of the total number of artifacts and the actual count of specific artifact types. For example, we would expect that furniture-related artifacts would be found in higher concentrations within domestic dwellings, as well as arms artifacts. Guns and ammunition would not have been unattended but would have been kept in domestic areas for defense and for security of the weapon. The highest numbers (count, not percentage) of arms and furniture artifacts were found in the structures where people lived, the main house and Structure B. The arms artifacts found around Structures A, C, D, and I were close to the surface, however, and relate to gun use during the Dow Chemical Company Park period. Clothing artifacts, personal artifacts, and ceramics were concentrated at the main house and structures B and D where people lived. Structure B was constructed during the Jackson period, and structure D after the Civil War. The site pattern as reflected in the count and percentage of provenienced artifacts is provided in Table 1. Table

**Table 1. Artifact Types at Lake Jackson**

| Artifact Type | Number | Percent |
|---|---|---|
| Kitchen* | 15952 | 20.2 |
| Bone | 12550 | 15.9 |
| Architecture | 41834 | 53.1 |
| Furniture | 89 | 0.1 |
| Arms | 183 | 0.2 |
| Clothing | 724 | 0.9 |
| Personal | 200 | 0.3 |
| Activities | 5664 | 7.2 |
| Prehistoric | 285 | 0.4 |
| Miscellaneous | 1301 | 1.6 |
| Total | 78782 | |

* 99 percent bottle glass

**Table 2. Patterns in Artifact Types by Structure**

| Artifact Type | Main House Complex | | | | | Industrial Structures | |
|---|---|---|---|---|---|---|---|
| | MH* | A | B | C | D | SM | I |
| Kitchen | 18.5** | 25.1 | 12.6 | 51.5 | 24.2 | 24.6 | 18.9 |
| Bone | 7.1 | 37.5 | 43.7 | 7.7 | 44.3 | 3.7 | 12.0 |
| Architecture | 69.7 | 17.4 | 32.0 | 26.1 | 24.4 | 47.3 | 22.9 |
| Furniture | 0.1 | 0.1 | 0.3 | 0.2 | <0.1 | 0.1 | 0.2 |
| Arms | 0.2 | 0.3 | 0.4 | 0.7 | 0.3 | 0.1 | 0.2 |
| Clothing | 0.8 | 0.3 | 2.3 | 0.8 | 1.5 | 0.3 | 0.4 |
| Personal | 0.2 | 0.1 | 0.5 | 0.6 | 0.2 | 0.2 | 0.3 |
| Activity | 3.1 | 15.0 | 2.9 | 5.7 | 1.6 | 21.8 | 35.3 |
| Prehistoric | <0.1 | 0.7 | 0.8 | 0.2 | 2.4 | <0.1 | 0.2 |
| Miscellaneous | 0.3 | 3.3 | 4.5 | 6.3 | 5.8 | 1.6 | 9.9 |
| Total Artifacts | 44935 | 5364 | 8829 | 1333 | 5526 | 8388 | 1159 |

* MH = Main House; SM = Sugar Mill
** Percent

2 shows the percentage of artifact types by the different structures.

## HISTORY OF JACKSON PLANTATION

When Abner and Margaret Jackson brought their children and slaves to Brazoria County, Texas, in the early 1840s, they joined the many immigrants to the new Republic who were drawn by the richness and availability of the land. In Brazoria County, the annual growing season is over 270 days with an average annual rainfall of 47 inches (Platter 1961:4-5). The alluvial soils of this Gulf Coast Plain, which produced both sugar and cotton in abundance, were a source of great wealth for the planters. The early settlers found hardwood forest teeming with game. The Brazos and San Bernard rivers, Oyster Creek, and numerous meandering bayous, provided transportation. Between the Brazos River and Oyster Creek (an abandoned channel of the Brazos River), the Jackson family established their Lake Jackson Plantation.

In 1844, Abner Jackson began to acquire the land that would become his first plantation, Retrieve. That same year Jackson sold half of Retrieve and started purchasing land that would become the "Lake Place," the Lake Jackson plantation (see Figure 2).

Abner Jackson Strobel (Strobel 1926:22), the grandson of Margaret Strobel Jackson and the step-grandson of Abner Jackson, provides a description of the Lake Jackson plantation in his narrative of the old plantations of Brazoria County:

> Major Jackson...opened up the Lake Jackson Plantation during the period 1842 to 1845. His first home was made of logs from the nearby forest, mostly elm and ash. He soon, however, converted every building, cabins, sugar house and residence, into brick made on the plantation, and stuccoed with cement fully an inch thick, which made all buildings look like they were made from solid rock. The residence was a twelve room two-story house in the shape of an "I," with six galleries, and immense brick pillars the entire length of the galleries. It was cool in summer and warm in winter with its large fire places. Built Colonial style, the residence cost, exclusive of slave labor, over twenty-five thousand dollars completed. The lake abounded in fish...There were boats in plenty for the use of the guests and family, and the lake abounded in ducks in winter, and at that time and as late as 1868, plenty of deer, bears and

> turkeys could be found. The sugar house was built of brick, and the best of machinery for the making of sugar was obtained. There was an artificial island made in the lake, said to have cost $10,000 and is visible to this day [1926]. Fine orchards and gardens were on the plantation. Peaches, pears, quince, plums, grapes and strawberries were raised. Brick walks were laid in the orchard and garden. The slaves had use of both orchards and gardens.

The Brazoria County census taken on October 14, 1850 lists: Abner Jackson, 40; Margaret Jackson, 43; Arsenath M., 15; John C., 12 and at school in Brazoria County; Andrew, 10; George W., 8; and Abner Jr., 3. Margaret also had a son by a previous marriage, Louis M. Strobel, who is not listed.

Jackson continued to acquire property, and by 1850, the Lake Jackson plantation included 3744 acres. In 1852, Jackson produced 295 hogsheads of sugar with horse-driven machinery at the Lake Plantation, and with his partner, James Hamilton at Retrieve, he produced an additional 450 hogsheads.

On January 7, 1857, Margaret Jackson died. According to documents on file in the probates of Abner Jackson and Margaret Jackson, Abner Jackson asked his children and his stepson, Louis M. Strobel, not to claim their share of their mother's estate because he needed the estate intact for purposes of expansion. That same year, Jackson purchased the Darrington Plantation for $116,200. The sugar mill at the Lake Jackson plantation was upgraded with the addition of a steam engine in 1858 when 90 hogsheads of sugar were produced.

Death and the Civil War brought an end to the Jackson family's good fortune. Abner Jackson died in 1861 deeply in debt. Probate records indicate that during the Civil War, John C. Jackson tried to hold the estate together and pay off debts when funds were available. When the war ended, George W. Jackson returned home. John C. was in control of the estate and would not turn over any part of it to George. In September 1867, a court order enabled George W. Jackson to gain control of the Lake Jackson plantation (1867 Deed L-600), but conflict remained between the two brothers. In December 1867, George W. killed his brother John C. during a confrontation at the Lake Jackson plantation (Strobel 1926). George W. was never prosecuted for the murder and he died of tuberculosis on November 7, 1871 in Galveston (1871 Will, Case No. 923). Wm. J. W. Masterson became executer of the estate of Abner and Margaret Jackson. An attempt to hold the estate together was made, but documents indicate that debtors were demanding payment. Subsequently, the estate was sold piece by piece. When the estate was finally settled in 1873, only three members of the Jackson family remained: Lewis M. Strobel, son of Margaret Strobel Jackson; Arsenath Jackson Groce, the daughter of Margaret and Abner Jackson; and Frank Jackson, the son of John C. Jackson.

In 1873, William W. Phelps of New York bought the Jackson Plantation from the estate of George W. Jackson and his sister, Arsenath Jackson Groce, for $20,800 (1873 Deed, 19, 24). Phelps sold the property to A. J. Ward and E. D. Deevey for $36,000 that same year.

After the Civil War, Texas adopted a system of leasing state convicts to private companies and individuals. Due to the availability of convict labor, the 1870s saw an increase in agricultural production. "By the end of the 1870s, the sugar industry in Texas, according to production figures, was recovering from the effects of the Civil War" (Johnson 1961:52).

In 1871, the state leased the Huntsville State Prison and all of its prisoners to Ward, Dewey & Co. of Galveston for a 15-year period. They in turn leased convicts to the Lake Jackson Plantation. An 1874 inspection of the Lake Jackson Plantation and their prisoners found many of them to be ill and without medical attention. The inspector found that three convicts had been severely beaten on their backs; that prisoners were not being fed well; that a guard had pledged his own credit to procure meat for the convicts; that convicts had not changed their clothing for 10 weeks and that some could not cover their extremities; and that some prisoners slept on bare mattresses without cover (Governor's Records, State Archives 1874-1876:13). In the 1876 report, the inspector reported that the convicts "seems better clothed, fed, and in better health" (Governor's Records, State Archive 1876:7). In December 1876, when Inspector J. T. Gaines made his rounds, he reported that three convicts had died at the Lake Jackson Plantation: one died while being punished in the stocks, one in an escape attempt, and one from natural causes.

In 1875, Edward H. Cunningham and Littleberry A. Ellis formed a partnership. They contracted with the State of Texas to lease the entire convict population. Those convicts they did not use were sub-leased to other plantations. Their partnership and use of convict labor was the beginning of the Imperial Sugar Company of Sugarland, Texas (Armstrong 1991).

In 1882, 1040 prisoners were contracted out in groups to individuals for $15 per prisoner per month. The lessee had to furnish housing, food, and guards. Lessees were entitled to 10 hours of work per day per prisoner (Walker 1988:71). *The Biennial Reports of the Penitentiary Board and of the Texas State Penitentiary* (Governor's Records, State Archives 1880-1882) list the Darrington Plantation with 28 convicts and the Lake Jackson Plantation with 36 (Johnson 1961:43). In 1884, the Lake Jackson and Patton plantations, both in Brazoria County, had a combined total of 314 convicts (Governor's Records, State Archives 1886). The last listing for convicts at Lake Jackson was on November 1, 1884, with a total of 33 convicts (Governor's Records, State Archives 1884).

In 1900, the Lake Jackson Sugar Company took over the four acres containing the "sugar house, including the cane mill sheds, gin, saw mill, blacksmith shop" (1900 Deed: 51.245). The Lake Jackson Sugar Company operated only a short time. The mill was severely damaged during the 1900 hurricane and mill operations ceased.

The land was used for cattle grazing until 1941 when it was bought by A. P. Beutel. Beutel purchased much of the acreage around the lake (1941 Deed, Co. 346:537). The town site of Lake Jackson, Texas, was platted in 1943 on other portions of the land surrounding the original Lake Jackson Plantation. In 1945, Dow Chemical Company turned the area containing the ruins of the plantation into a park for public and company use. Called "Lake Jackson Park" and "Dow Park," the area was used for social activities of all kinds. In 1989, the park was closed and the land was traded to its present owners, the Lake Jackson Historical Association, who have turned the site into a historic park.

## THE ARCHEOLOGICAL FINDINGS

### The Main House

The main house was built in 1851. A. J. Strobel (1926) describes the house as a 12 room, two story structure. The exterior was of plastered brick. Figure 3 is the only known photograph taken of the main house before the 1900 hurricane, which damaged the structure. Abner L. Strobel is seen in the foreground of the picture. Figure 4 is an outline, or footprint, of the main house ruins drawn after excavations exposed architectural features.

The west side of the main house was chosen for excavation because this side of the house faced a number of structural ruins arranged in a manner suggesting that they functioned in association with the main house. One of the objectives of the TAS

Figure 3. Photograph of Lake Jackson Plantation Main House taken prior to 1900.

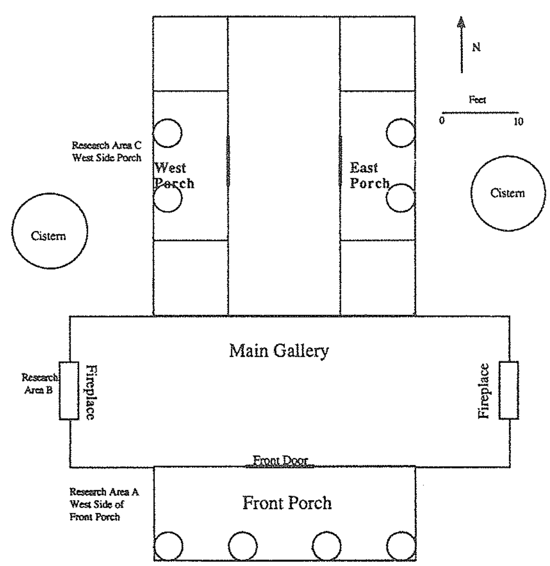


Figure 4. Main House Footprint.

field schools was to identify the plantation period exterior ground/living surface. To do this, we looked for evidence of walkways, garden borders, and brick roadways, as Abner L. Strobel's (1926) account of the plantation mentions orchards and gardens with brick walkways.

Excavations at the west side of the front porch of the main house (termed research area A) (see Figure 4), focused on uncovering the step area (Figure 5) and locating the drive and walkways around the main house. The front walkway/driveway was discovered with bricks of excellent quality, laid in a curved pattern (Figure 6).

Other features in the area of the front porch also document the ground surface level of the Jackson period. Just west of the front steps, a brick border was located. Just to the east of the brick border, between the front steps and the border, was a layer of *Rangia* shells all turned bulb, or outside, up. This same configuration of shells was found off the back porch below the convict period walkway and next to the Jackson period walkway.

On the back north side of the main house, the foundation was exposed down to its base. The level where the foundation joined the structure was the same level as the plaster base on the front porch that established ground level during the plantation period.

Off the west back porch, a convict period sidewalk was found above a Jackson period walkway (Figure 7). This uneven convict walkway of poorly-made whole and half bricks, one brick layer in depth, raised the walking area about 0.5 foot above the Jackson walkway and extended out from the back porch toward the cistern and Structure D.

For all of the above reasons, we conclude that the Jackson occupational level starts at 1.5 feet below the surface (base of level 3). Artifacts

Figure 5. Front Steps of the Main House, looking east.

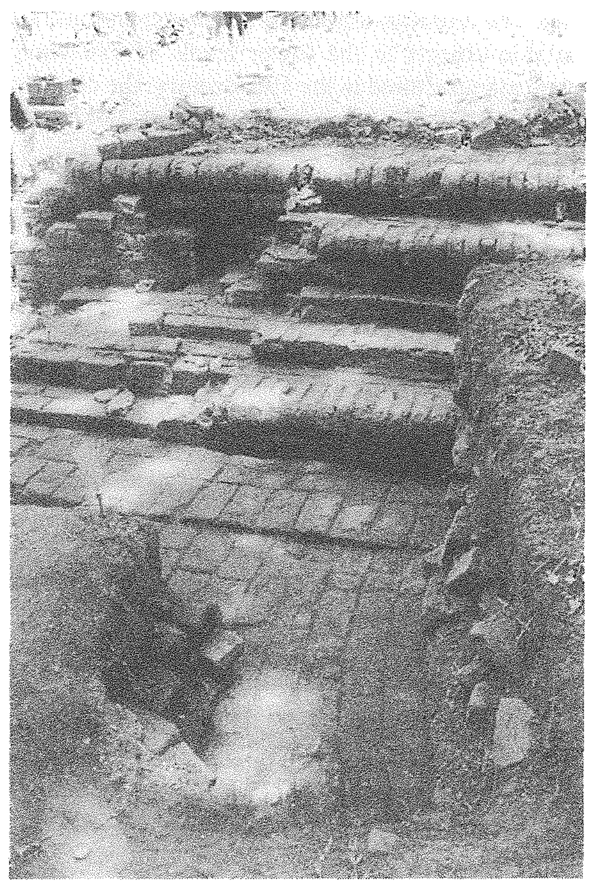

Figure 6. Front Porch of the Main House, looking north. Note the curvee bricks of the walkway/driveway in the foreground, and the rounded bricks of the steps.

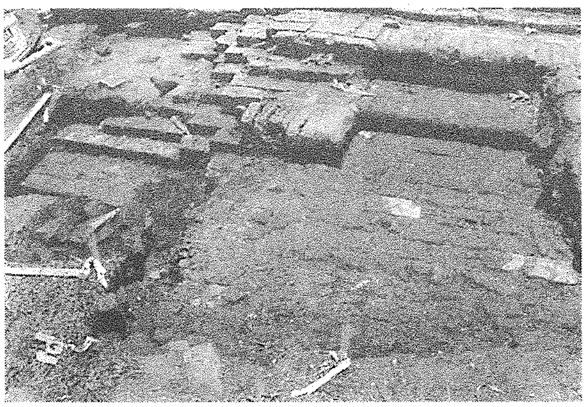

Figure 7. Convict-era walkway off the West back proch. Plantation-era sidewalk can be seen under the convict-era walkway in the far left.

between 1.5-2.0 feet below surface (bs) appear to be a mixture of the Jackson period and the late 19th century occupation. Deposits from 2.0-3.0 feet bs appear to represent the Jackson period use of the site. The artifacts, especially ceramics, buttons, and datable objects in the lower levels of excavation were manufactured in the 19th century: the ceramics from 2-2.5 feet bs ranged in age from 1847-1896, and dated from 1838-1879 in deposits below 2.5 feet bs. These dates are based on the minimum vessel count of each ceramic type/decorative style (and their corresponding diagnostic dates) in each level. Ceramic decorative styles are serial and documented with manufacturer's periods of production. The type of clay in the area would make for easy "percolation" of small artifacts moving up and down within the soil, thus making a clear line of distinction difficult between occupations.

Artifacts excavated in the Main House area total 44,935. Most were found between 1.0-2.0 feet bs (see Table 2).

## Architectural Features of the Main House

The front steps illustrate the quality of masonry construction of the main house. The specially designed bricks used in construction are in situ. The edge of the front porch and the edge of the three steps ascending the front porch are rounded (see Figure 5). The rounded edge is also found in the two steps of the west side back porch (see Figure 7). The front porch step area is of solid whole bricks, some laid on their sides for additional strength. Figure 6 shows the curved bricks of the front walkway/driveway. Portions of the plaster that originally covered the steps are still visible between the steps and under the curved edge bricks.

Another architectural feature of the porches is the columns. There were four columns spanning the front porch and two columns on the back west porch. These columns included triangular bricks (Figure 8). The triangular bricks alternated with hand-shaped bricks, bricks made whole but shaped by the mason to fit a specific place. This configuration of triangular and shaped bricks formed the circular shape of the columns.

Figure 8. Column Remains, note the triangular bricks.

The Front Gallery, or main room, was located on the south side of the house (see Figure 4). Excavation of the fireplace hearth indicated the height of the floor. The floor of the house is assumed to have been made of wood on a surface that was approximately three feet above the ground. A crawl or "ventilation" space was located between the floor and the ground as evidenced by the metal vents found on each side of the fireplace and in each of the north and south walls by the fireplace. The hooks for the grates that covered the vents were still in place on both sides of the west fireplace.

The back porch on the west side of the main house was a smaller version of the front porch, having two columns instead of four and two steps instead of three. The columns were identical in size to those on the front porch and the steps were identical with the decorative curved bricks on the edge of the steps. Columns and steps were plastered on both porches.

Personal artifacts found off the back porch provide a glimpse of the possessions of the people living and visiting the main house during the Convict Labor period (dating from 1873 to 1900). The Glass family was living in the house during the 1900 hurricane, when they lost most of their possessions, according to an oral history by Mrs. Rae Glass Smith (Murray 1976). Mrs. Smith recalled that the storm deposited a layer of mud. Some of the personal artifacts found in this back porch area that may have belonged to the Smith family include a ring, a 1893 penny, slate pencils, a key, a metal purse clasp, the lid to a cream jar, a pin (jewelry), a stone pipe fragment, the back of a pocket watch with the serial number 2330835, a rubber comb with an 1851 patent date, harmonica parts, pieces of a china doll head (found in five different excavation units), and a piece of shell jewelry. Also found was a 1945 nickel.

### Structure A

Structure A (Figure 9) was the first structure at Lake Jackson to be excavated (in 1991). During the 1994 and 1995 TAS field schools, the children continued the excavations. The ruins of this structure were at some time cleared and bulldozed, and grass was allowed to grow over the leveled structure. This was probably done as part of the Dow Park construction. As grass was cleared from the area, we uncovered the 20 x 20 foot structure with its brick floor intact. On the east side, we found a brick walkway similar to the Convict-era walkway found on the west side of the main house.

### Features

There are four features of significance in Structure A: the brick floor inside the structure; the brick walkway on the east side of the structure; the holes for roof support beams in the center of the structure; and a pothole dug through the floor of the structure after the structure was abandoned.

The brick floor was encountered just below the grass. The absence of overburden, the proximity to the surface, and the fact that the ruins had been bulldozed to ground level explains the absence of artifacts on the brick floor. No evidence was found for a hearth or doorways.

The area around the brick walkway contained the largest number and most important artifacts. Artifacts, including an array of tools (see below), were sandwiched between the walkway and a fallen brick wall. It appears that the east wall of Structure A collapsed outward during a storm (possibly during the 1900 hurricane), carrying with it the items attached to or leaning against the outer wall.

Holes for the roof support beams are large enough to support a 6 x 6 inch wooden beam. The holes show that the brick floor is two bricks thick. Artifacts of unknown age and type were seen in the dirt exposed under the brick flooring.

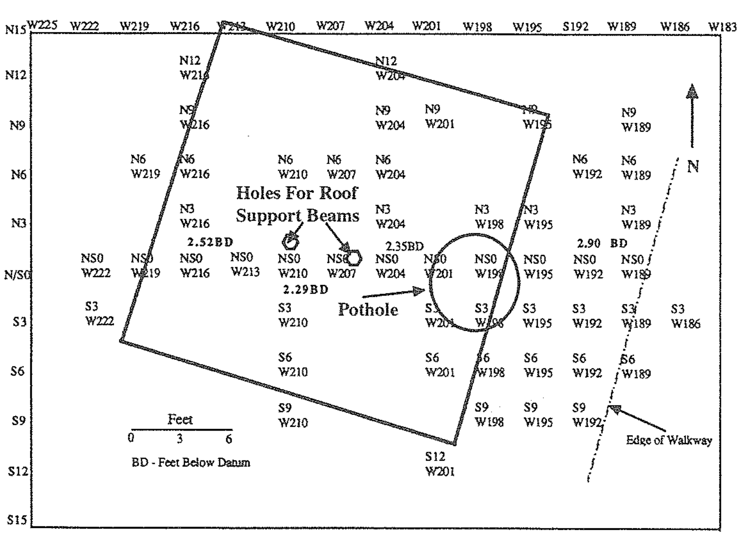


Figure 9. Structure A.

The pothole located on the east side of the structure extended under the brick floor on the west wall of Unit NS0/W201 (see Figure 9). The structure floor contained two layers of brick, with the bricks on the top and bottom layers alternating in direction. Historic artifacts were not detected under the floor in the profile; however, charcoal, shell, and prehistoric ceramic sherds were visible (but not removed) 0.5 feet below the brick flooring (see Few et al., this volume).

On the east side of the pothole the interior portion of the foundation of Structure A was cleared and examined. The foundation was not "stepped" on the interior face as was the Structure B foundation, which was built during the 1851-1873 plantation period.

### Artifacts in Structure A

The surface clearing and bulldozing of Structure A, and the material debris deposited during the Dow Chemical Park period (1945-1989), account for the artifacts found in the first level of the excavations. The only in situ artifacts were found east of the structure between the fallen east wall and the Convict period (1873-1900) walkway. These artifacts were mostly activity artifacts which included a wagon wheel hub, fragments of a metal plow, a horse shoe, a metal ring, hooks, a pipe wrench jaw, a cast iron frame for a pulley, a hatchet head, a T-shaped rail, a stove bolt with nut, a large metal chain, a cutter blade, gear fragments with 10 teeth, and a metal cylinder. A Yale lock, dated 1878, was also recovered. Cup fragments of a white granite ware were found in this area with a Holland mark that circulated between 1850-1890 (Pollan, this volume).

### Summary of Structure A

Structure A was built during the Convict Labor period, between 1873 and 1900. The TAS excavation of several other structures at Lake Jackson provide a standard for comparison, particularly with respect to the 1851 main house in terms of bricks (size, quality, uniformity) and building techniques. Several structural aspects point to the conclusion that Structure A was a post-Civil War structure: (1) the bricks are not uniform and are a different size from the main house bricks; (2) the bricks used in the construction of the main house bricks were whole, while both whole and half bricks were used in Structure A; (3) the masonry at the main house was solid and the mortar cleaned, but in Structure A, the mortar was allowed to "bleed" (i.e., it was not cleaned off of the sides of the foundation); (4) the interior foundation does not have "steps" like those in plantation period buildings; and (5) the exterior walkway on the east side of Structure A was constructed of the same type of brick and is the same quality and size as the Convict period walkway at the main house.

Artifacts found in Structure A date from the post-Civil War era to 1900. This supports the conclusions drawn from its structural aspects. The artifacts also support the idea that this may have been a storage structure. All of the artifacts in situ are activity artifacts that would have been kept in a barn or storage structure.

### Structure B

Structure B was a three room brick structure. The three rooms are A (north room), B (middle room with brick floor), and C (south room) (Figure 10). The exterior of the structure was covered with white-washed plaster, the interior, with whitewash on brick. The exterior dimensions of the structure were 30 x 15 feet. Rooms A and B were partially destroyed during the construction of a drainage ditch dug during the 1945 construction of Dow Park. A brick exterior surface/walkway was found east of

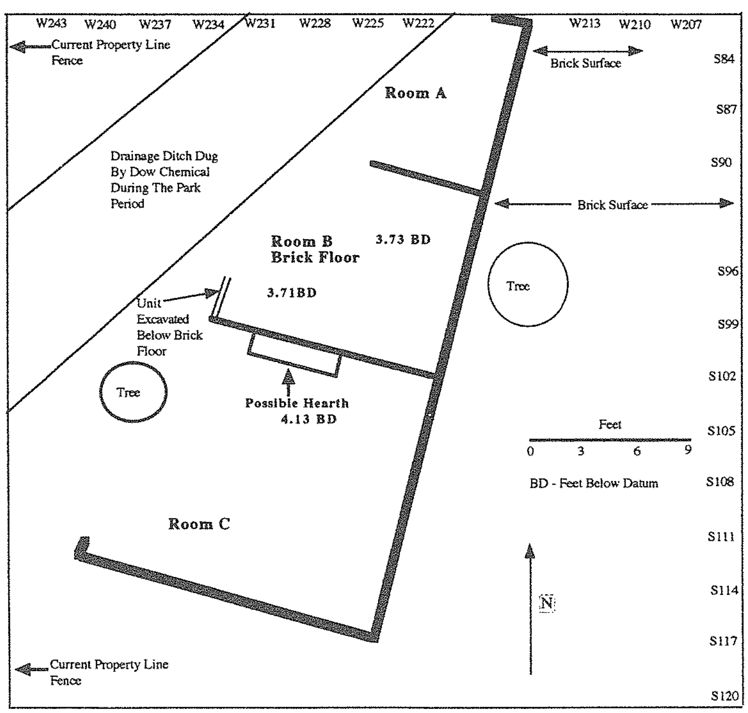


Figure 10. Structure B.

the structure. The technique used to construct the walkway dates it to the Convict period (1873-1900).

## Artifacts Recovered From Excavations of Structure B

A total of 8829 artifacts were recovered in the Structure B area (see Table 2). The artifact pattern by type for each room is given in Table 3. Artifacts found in room A totaled 356; in room B, 513; and in room C, 6,567. The discrepancy in the total number of artifacts is due to the differing number of units excavated in each room and the depth of each unit.

### Room A, Structure B

Five units were excavated to expose walls and foundations in room A. No evidence of a floor was found. Along the East wall, a door was bricked up and the new exterior wall area of the door was sealed with plaster and then whitewashed. There is no evidence of another door in the remains of room A. Most of the artifacts found in room A were bottle glass, nails, window glass, and animal bones; they were in areas where surface disturbance had occurred. Many were deposited in the 20th century.

### Room B, Structure B

Room B contained a brick floor, and excavation stopped at the surface of the floor (Table 4). In unit S99W234, the construction of the Dow drainage ditch disturbed the floor. Excavation of this unit exposed the two layer brick floor and exposed historic artifacts, which were not removed, under the floor in the east wall profile. The brick floor could be an addition covering an earlier living surface. The floor was level with a slight fluctuation. The 513 artifacts (primarily nails and window glass fragments) found in room B do not reflect any particular activity pattern. No evidence of doorways were detected in the excavations.

### Room C, Structure B

In room C (the south room) artifacts were most common in levels 5 and 6. The large number of personal and clothing artifacts suggest that room C may have been a domestic living area. Among the clothing artifacts were a Louisiana militia button of vest size with a pelican on the front and "extra quality" on the back. According to Albert (1976), this button was manufactured in 1859 and 1860. A thin gold coating on the button is still visible. The other 173 buttons found in Structure B were of

**Table 3. Artifacts in Structure B**

| Artifact Type | Room A | | Room B | | Room C | |
|---|---|---|---|---|---|---|
| | # | % | # | % | # | % |
| Kitchen | 41 | 11.5 | 42 | 8.2 | 566 | 8.6 |
| Bone | 136 | 38.2 | 90 | 17.5 | 3354 | 51.1 |
| Architecture | 134 | 37.6 | 333 | 64.9 | 1902 | 28.9 |
| Furniture | 4 | 1.1 | 0 | 0 | 17 | 0.3 |
| Arms | 1 | 0.3 | 1 | 0.2 | 31 | 0.5 |
| Clothing | 1 | 0.3 | 3 | 0.6 | 185 | 2.8 |
| Personal | 2 | 0.6 | 1 | 0.2 | 35 | 0.5 |
| Activity | 16 | 4.5 | 9 | 1.8 | 192 | 2.9 |
| Prehistoric | 10 | 2.8 | 2 | 0.4 | 53 | 0.8 |
| Miscellaneous (Modern) | 11 | 3.1 | 32 | 6.2 | 288 | 3.5 |
| Total | 356 | | 513 | | 6567 | |

**Table 4. Features in Structure B**

| Level | FBD* | Features |
|---|---|---|
| 2 | Surface-3.0 | Surface rubble |
| 3 | 3.0-3.5 | Surface rubble |
| 4 | 3.5-4.0 | Floor in room B, 3.73 FBD |
| | | Base of interior whitewash in room C, 3.86 FBD |
| 5 | 4.0-4.5 | Hearth surface in room C, 4.13 FBD |
| | | Highest number of artifacts in room C |
| 6 | 4.5-5.0 | 2nd highest number of artifacts in room C |
| 7 | 5.0-5.5 | Clay deposit, sterile at base |

* FBD: Feet Below Datum

china and bone that would have been used on cheap clothing, the type worn by slaves and house servants (Few et al. 1996:15.7). Several other types of clothing artifacts were found, including a brass shoe tap, scissors, hooks and eyes, buckles, a brass shoe eyelet, beads, a metal (?) thimble, and a copper thimble.

The personal artifacts in the room also suggest that this was a domestic living space. Level 3 included a watch crystal while a chain and two coins were found in level 4. A slate board fragment, a slate pencil, seven fragments of clay pipes, a rubber comb with a May 6, 1851 patent date, an 1860 Seated Liberty Dime, part of a pocket knife, a pocket knife blade, several pieces of broken jewelry, a copper harmonica reed, and a brass medal pendant were found in level 5.

The pendant has an eye on the top. On one side the figure of either Mercury or Perseus is wearing a winged helmet and carrying a raised sword in the right hand and a lowered shield in the left hand. He is striding across water where an immersed sea creature is holding a trident. Written around the edge is "QUIS UT" to the left of the figure and "DUES" to the right. This may translate as "Who as/that God." On the other side of the pendant is a female madonna-looking figure with hands crossed at the chest, standing on what looks like a curved pedestal. Around her head are dots representing a halo. To her left around the medallion is written "TOTA PULCHRA," with "ANTE SOEGU LAERAM" on the right. The pendant is very worn and lacks sufficient depth of detail to photograph.

In activity artifacts, the presence of children is indicated by a china doll head, marbles, a toy tea pot, and slate pencils. Most activity artifacts are unidentifiable metal fragments, but there are some tools. A large pulley and a nine foot-long gear bar in three foot sections were found in level 3, 1.5 inches above the brick floor in room B. A roller castor was found beside the bar. Attached to the back side of the gear bars were fragments of wood and whitewash, showing that it was mounted to wood, possibly on the ceiling.

A bone deposit was encountered in level 6 in the northeast corner of the room. This deposit had several large bovine bones (tibia and scapula) with butcher marks. A similar pattern was also observed in room A in structure D, where both ash and trash had been tossed to the right of the fireplace, into the corner of the room.

Along the north wall of room C, in the center, is a feature (three bricks thick) that may represent the remains of a hearth (Figure 11) . To the right is a single layer of bricks that abuts a brick ledge along the north wall at the level of the hearth. One possible explanation, based also in part on the depth of artifacts in room B, may be that room C originally had a dirt or wood floor and was occupied

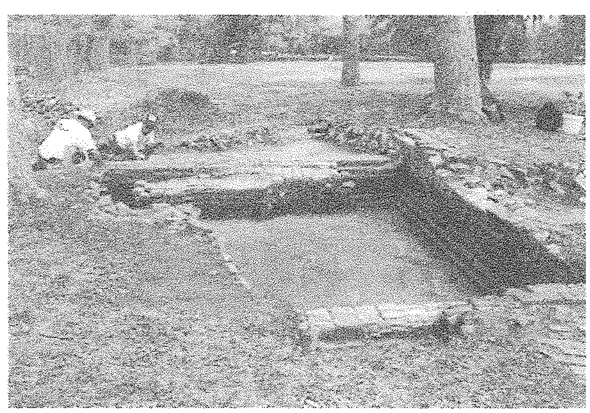

Figure 11. Structure B, with room C in the foreground.

during the Jackson period. Later a brick floor may have been added during the post-Civil War Convict period.

### Structure B Summary

Structure B was built during the Jackson plantation period and modified on several occasions. The brick foundation is similar in design and masonry to the main house built in 1851. Room C appears to have originally had a dirt or possibly a wooden floor. The amount of trash accumulated in the corner of room C at level 6 suggests a dirt floor. Interior whitewash was detected on the east wall in room C (see Table 4).

Room C was a domestic residence where plantation activities may have occurred. During the Convict period, a brick floor was laid down, as suggested by the bricks along the north wall of the room. The bricks of the original fire hearth were covered by the new brick flooring. In an oral history given by Mrs. Ray Glass Smith (Murray 1976), she referred to structure B as the "jail." If so, this structure could have been remodeled by sealing off one door, removing the interior walls, and installing a secure brick floor to leave a large space for confinement.

### Structure C

Structure C was excavated by the TAS Field School in 1994. It is located to the north of the main house and on the southern shore of Lake Jackson (see Figure 2). Structure C was built during the Jackson period. This is apparent because the structure was built with whole bricks of the same size, the masonry is of fine quality, and the stepped interior foundation of the structure is of the same type of construction observed in Structure B and the main house.

Several factors have impacted the archeological integrity of Structure C. First, aerial photos taken during the 1930s and 1940s indicate that Lake Jackson was smaller in size than today and is an oxbow lake or old channel of the Brazos River. However, Lake Jackson fluctuated in size according to rainfall. With the development of the residential area around the lake, the residents established a lake association that keeps the lake at a constant level by artificial means. Second, the north wall of Structure C is in the lake vegetation on the edge of the lake. The Lake Jackson Historical Association, owners of the Lake Jackson State Archeological Landmark site, are not members of the Lake Association; therefore, activities along the edge of the lake that might disturb the vegetation or stir up mud were prohibited. Third, Structure C shows evidence of having been mechanically leveled in the past. The standing ruins were removed (perhaps shoved into the lake) by heavy equipment, probably during the construction of Dow Park. The brick floors remain, but there are no standing walls.

Structure C is likely the wash house. It is composed of two brick floor surfaces (10.5 x 11.5 feet) that are surrounded by plastered drains. The drains empty north into the lake. The plaster is the same as that found on the exterior walls of the Main House and Structure B. The drain curbs are also plastered on the sides and tops. Along the south wall of the wash house, abutting the drain curb, is a brick border.

Most of the artifacts came from the surface of the brick floor or around the edges of the structure. Excavations uncovered the structure but did not excavate through it in order to preserve what was left of the structure. A hole in the brick floor in Unit N30/W63 (Figure 12) permitted subfloor excavations but no artifacts were found in the levels under the floor. Because of the previously mentioned leveling damage, and the close proximity of the floor to the ground surface, artifact integrity is dubious. A plantation the size of Lake Jackson and the number of people in the Jackson family would have required a considerable amount of time for washing linens, clothing, and dishes. Any objects that would fall on the floor during washing activities would probably have been either

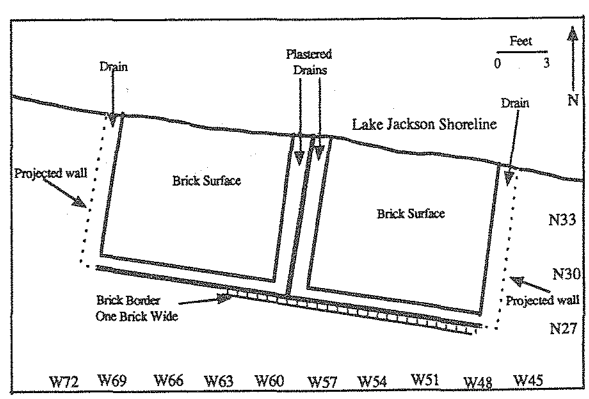


Figure 12. Structure C.

picked up, or washed from the floor into the drain and ultimately into the lake.

## Structure D

Structure D (Figure 13) was uncovered in the early spring of 1994 when the road laid by Dow Chemical Company for their company park was removed. The removal was accomplished by 1/2 inch "swipes" of a backhoe. The operator was very skilled and able to delicately position the backhoe for minimum damage to the remains under the road. Test units were excavated prior to 1994 by University of Houston Clear Lake students around the visible remains of Structure D, but the main interior excavations of the rooms in Structure D were undertaken by the TAS in 1994 and 1995.

The building of the road greatly impacted the structure. The road bed was bulldozed to grade in 1945, leaving only the foundation of the structure in place. Doorways could not be identified. The structure must have had a wood or dirt flooring. Artifacts below the road surface are from apparently undisturbed contexts.

Structure D was a 40 x 20 foot structure that had two rooms and two internal fireplaces in the center of the structure. The foundations of the fireplaces indicate that the hearth in room B was larger than in room A.

The two rooms, labeled A and B, had different quantities and types of artifacts. In room A, 13 3 x 3 foot units were excavated to sterile soil. Units in both rooms were selected to expose the fireplace hearth area or to randomly investigate the rest of the room. Provenienced historic artifacts in room A totaled 3986. The artifact pattern for room A is: Kitchen, 15.2 percent; Bone, 55 percent; Architecture, 25.6 percent; Arms, 0.3 percent; Clothing, 2.2 percent; Personal, 0.15 percent; and Activities, 1.3 percent. Kitchen artifacts recovered in room A included ceramics, a bone-handled knife, and two copper forks with silver plate. Architectural artifacts included window glass and round and square nails. Arms included lead shot, a fragment of a ram rod, and a shotgun shell base. Clothing included two buckles and buttons

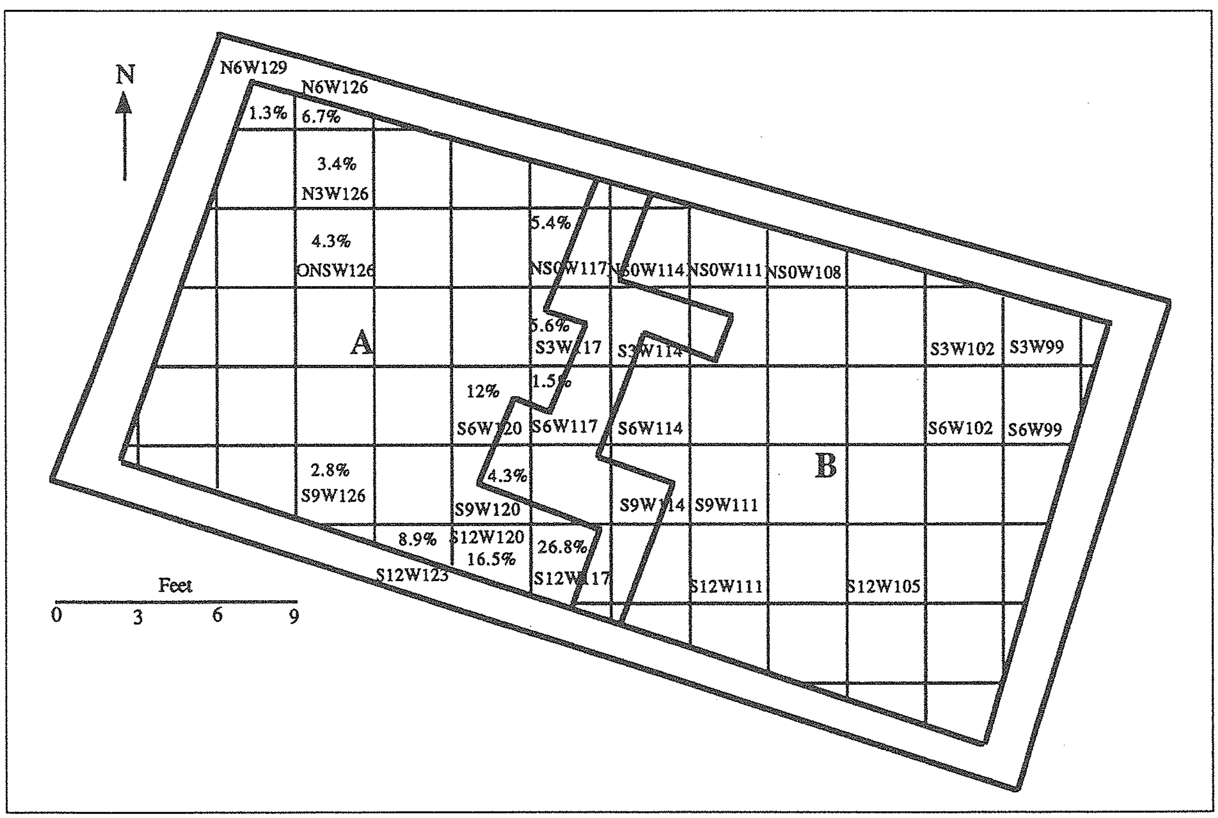


Figure 13. Structure D. Percentage amounts in Room A units indicate the amount of artifacts from that room found in each excavation unit.

garments (Few et al. 1996:15.7). Personal artifacts included a Seated Liberty U.S. Dime, and three clay pipe fragments. Activity-related artifacts included seven marbles, a porcelain doll face, and a lock with an 1878 date.

The overall distribution of artifacts in the room A units indicates a high concentration of debris was located south of the fireplace. The alcove/closet/cabinet (units S12W117 and S12W120) south of the fire hearth contained 43.3 percent of the artifacts found in room A and may have served as a trash dump. A trash deposit was also found near the fire hearth in the northeast corner of room C in Structure B. The largest fragments of ceramics, bone, knives, and forks were found in this deposit. The domestic artifacts suggest that a family lived in room A during the second part of the 19th century.

In room B, 13 3 x 3 foot units were excavated to sterile soil. As in room A, some units contained structural components and therefore were not completely excavated. Units were placed in the same manner as in room A. Room B had 446 historic provenienced artifacts from the 13 units. The artifact pattern is as follows: Kitchen, 30.9 percent; Bone, 39.9 percent; Architecture, 27.8 percent; and Activities, 1.3 percent.

Because the same number of units were excavated in rooms A and B, and in the same general areas, theoretically differences in artifacts may relate to differences in activities between the two rooms. The major differences in the types and quantities between the two rooms indicates that the rooms were not used in the same way (Figure 14). Room B may have had a domestic use but it does not reflect the same level of use as room A. Architectural artifacts were broken window glass and square and round nails. The activity artifacts in room B were all unidentified metal.

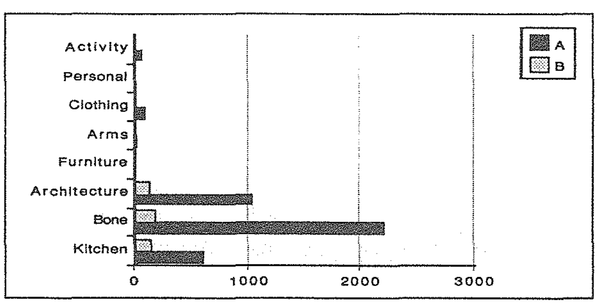


Figure 14. Comparison of Artifacts by Types between rooms A and B in Structure D.

## Structure D Summary

There are several architectural attributes that indicate this structure was built between 1873 and 1900 (Convict labor period). First, the bricks are not as high in quality as those in the Jackson period structures, in that their paste is less dense, more sandy, and less durable. Second, the masonry is poor quality whereas the masonry of the Jackson construction is excellent quality. Third, the bricks used in the foundation are fragmented, not whole. Finally, the mortar in Structure D was allowed to "bleed," a method not found in Jackson period construction. The poor construction techniques, along with artifacts found in Structure D, suggest that it was built after the Civil War. Room A may have been occupied by a family, and because of its proximity, could also have served as a kitchen for the occupants of the main house. Room B may have served (hypothetically) several different functions: office, jail, infirmary, residence, or guest quarters.

## Sugar Mill

Prior to the 1994 and 1995 TAS field schools, members of the Brazosport Archaeological Society (BAS), the Houston Archeological Society (HAS), and TAS spent many days removing the brick rubble overburden from the mill allowing the field school participants to excavate the mill. Excavation units at the sugar mill were 9 x 9 foot blocks to open large areas of this structure. Twenty-one blocks were excavated by the field schools. Unfinished blocks were completed by University of Houston Clear Lake field classes.

## Sugar Making Process

To understand the three processes involved in sugar making in the 19th century (i.e., extraction, reduction, and crystallization), it is important to understand what energy source was used to operate the cane crushers, how the liquid flowed through the process to become sugar, and how heat was used in the sugar reduction process (see Few, this volume). The historical records state that Jackson began the mill using horse power to run the cane crushers that extracted the juice from the cane. On the brick floor next to the cane crusher founda-

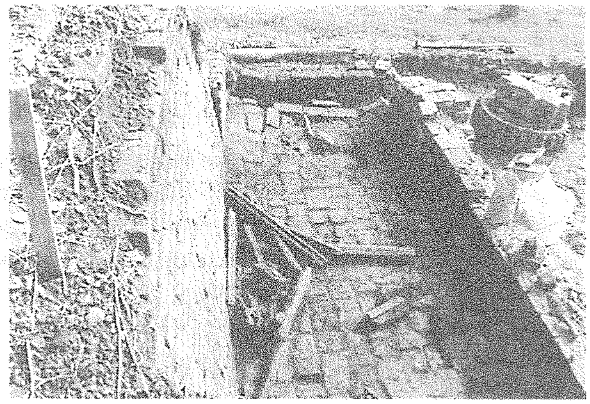

Figure 15. Remnants of Horse Tread Mill next to Cane Crusher Foundation.

the brick floor next to the cane crusher foundation, horse harnesses and large metal bands were found (Figure 15). Jackson may have left the horse tread mill in place as a back up power source after the installation of a boiler to produce steam power to operate the cane crushers. The foundation of the cane crusher has been identified through comparative studies of other sugar plantations (see Few, this volume). The large metal gears of the cane crushers were also found near the base of their foundation.

In 1858, Jackson installed a boiler, steam engine, and pump to operate the cane crushers. The locations of the mill's boiler, engine and pump have not been located. Although the boiler would have had a tall chimney, the chimney foundation has not been located. During construction of the Dow Park road, the southwestern corner of the sugar mill was bulldozed. It is possible that the boiler foundation and chimney may have been in this disturbed area. A possible foundation was discovered in 1994 just east of the foundation for the crusher engine. Next to this feature, part of a boiler governor was also identified.

In the original Jackson mill, sugar cane juice was reduced to a granular form in a "train of kettles" (Figure 16), a series of large to small kettles heated by a fire under the smallest kettle. The heat from the fire was pulled through a flue under the series of kettles by the draft of a flue chimney. The opening of the flue chimney and the chimney foundation (see Figure 16) also show the circular brick remains of the kettle settings between two walls. The flue chimney was separated from the kettle area by a brick wall during the Convict period alterations. When the sugar began to crystallize in the smallest, hottest kettle, the thick syrup was removed to cooling trays where the crystallization process continued. When the sugar cooled, it was placed in hogsheads (storage barrels) where the remaining molasses (uncrystallized syrup) was allowed to drain out of the hogsheads. The room where this separation occurred was called the purgery (Figure 17).

## Post-Civil War Sugar Production

The historical records and excavation results document that the sugar making process at the Lake Jackson mill changed after the Civil War to use steam heat ("steam train") to heat the sugar kettles in the reduction process. A property inventory done in 1878 documents the change from fire to heat the sugar kettles for the reduction process, to the use of steam as a heat source. The inventory lists the following items in use at the sugar mill: four boilers

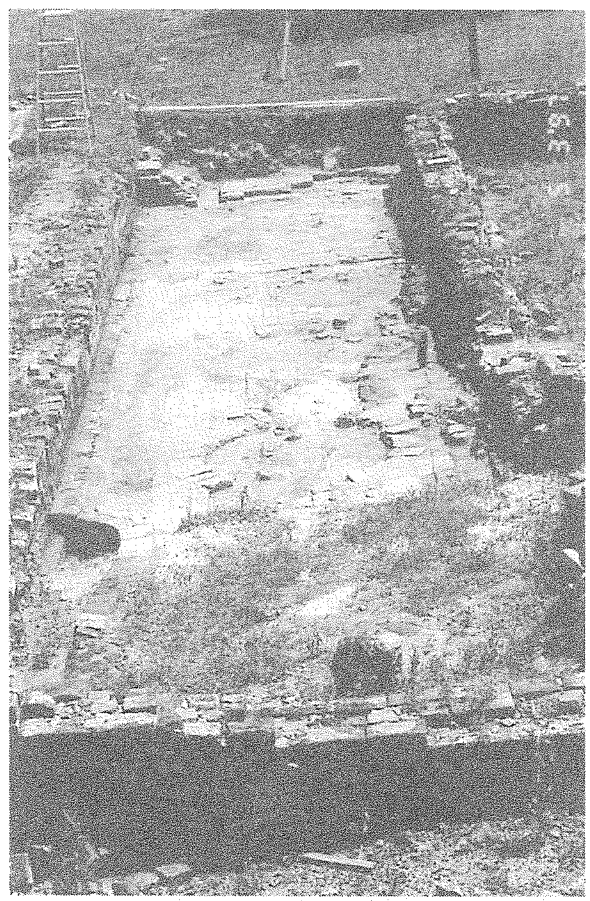

Figure 16. Original Kettle Settings.

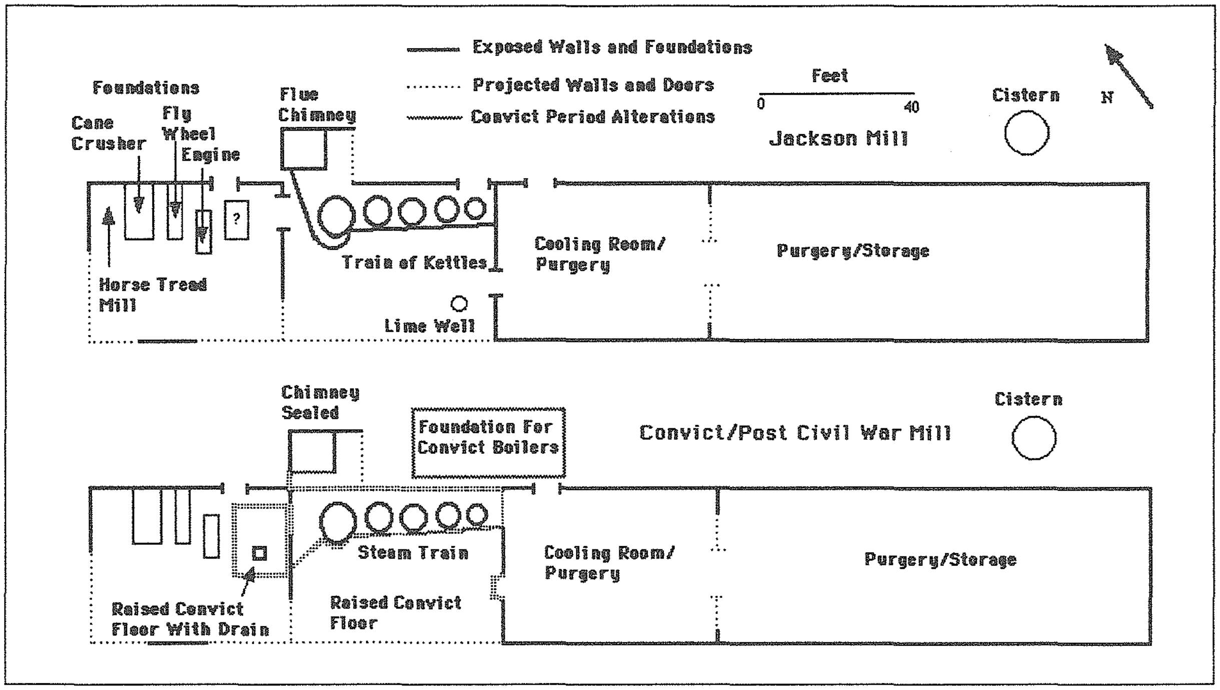


Figure 17. Jackson Period Sugar Mill and Convict Period Sugar Mill.

in use at the sugar house; one sugar mill (cane crushers); steam engine; iron juice boxes; syrup tanks, iron; wooden cisterns; iron coolers; Gannon steam pump; Blake steam pump; iron clarifiers; copper pans, clarifiers and copper pans constituting with their connections and attachments a "steam train;" iron strike car, together with all its pipes, connections, and attachments fastening to and used in connecting with each all of the articles mentioned above; sugar kettles; 1.5 miles of tram road including the rails, ties, and fastenings of the same; car used on said tram road; cane wagons; cane carts; and Bagasse carts (Bagasse is processed sugar cane after the sugar liquid has been removed). The inventory also listed every piece of equipment and tool that was on the plantation, including all mattresses, blankets, and articles used by the convicts, as well as all food reserves (see 1878 Deed, Q557).

TAS excavations discovered that at some point, the mill was substantially altered. The floors in the sugar mill were raised, architectural features were changed or demolished, walls were built, and doors were blocked. Presumably, these alterations coincide with a change in the way the mill was used.

It is important to understand how the Jackson period construction and Convict labor period construction were identified in the sugar mill (see Figure 17). Several attributes identify Jackson period construction techniques: bricks are the same size; bricks are high in quality; paste is homogeneous, clay is dense, and firing is regular; whole bricks are used in construction; bricks in foundations and walls are very level; and the quality of the masonry is excellent.

During the Convict Labor period, several distinctive construction techniques were used: bricks of different sizes; whole and half bricks are used together in construction; foundations and walls slope and buckle; and masonry is very poor, bricks are not level, mortar is uneven, and in some cases excess mortar is not removed to provide a smooth vertical surface. Evidence of alterations made by convict labor after 1873 includes:

*Blocked Passageways:* A blocked doorway was found in the wall separating the kettle area from the purgery. The east side of the wall shows an enclosed portal with plastered walls, while the west side has very sloppy, and uneven rows of bricks with "bleeding" mortar.

*Raised Walls:* The east/west wall, the south wall of the Jackson kettle enclosure, is an excellent example of a raised wall. A series of iron masonry braces, placed about every four or five feet, had been used to attach a new section of wall to the earlier one (Figure 18). This alteration may be due to the shift from fire heat (train of kettles) to steam heat. The upper portion of the train of kettles would have been removed to expose the sides of the kettles. After steam coils were wrapped around the kettles, the kettle area would have been sealed to enclose the kettles and contain the heat. This would explain convict walls on top of plantation walls in this area.

*Raised Floors:* The construction technique used in the lower Jackson-era floor resembles the foundation and walls built elsewhere in the site; that is, they are substantial, level, and have excellent masonry. The lime pit (see Figure 18) and original Jackson period floor found in 1994 became the cornerstone for all other Jackson floor identifications. By contrast, the upper or raised Convict period floors are uneven. When the floor is of brick, it is one brick thick and of poor masonry construction. Convict period floors were often of dirt and had between 1-1.25 feet of fill between the Jackson period floor and the convict floor.

In 1995, more of the original Jackson plantation floor was uncovered along with a kettle setting (see Figure 16) and a heat flue in the middle of the sugar mill. Since 1995, the other original kettle settings have been located and the boiler and engine platforms of the Convict period have been identified. Based on historical and archeological evidence, Figure 17 illustrates what the mill may have looked like before and after alterations

Figure 18. Braces in Sugar Mill Wall are in the background, and the lime pit is in the foreground. A filled-in door is on the right.

## Sugar Mill Artifacts

Eighty percent of the artifacts found at the Sugar Mill (see Table 2) were bottle glass, nails, window glass, and unidentifiable metal. Activity artifacts found in the Sugar Mill were: the rollers of the cane crusher; gears of the cane crusher; pipes and fittings; the governor of a steam boiler; wire cables; a spade blade; an iron hoe; copper plate; a mason's trowel; a blacksmith's punch; a cane knife; perforated copper sheeting; ball valves; elbow joints; a Texas Department of Corrections hoe; a plow; the top of an oil can or gasket; a shut off valve with an ornate handle; a mica schist "whetstone;" a gas engine fuel filter; metal strip fragments and barrel bands; Haymes harnesses; a copper skimmer; large pieces of metal which were probably parts of vats; and a round brick gaming piece.

Twenty personal artifacts were found, including a plastic folding comb, a slate pencil, a china doll's arm, a snuff can lid, a snuff box, an aspirin box, three nickels (1833, 1926, and 1944), a Walking Liberty Half Dollar, a knife, a key, a compass part, three clay smoking pipe fragments, and an unidentified effigy pipe fragment.

## Structure I

Structure I is located west of the Sugar Mill (see Figure 2). The structures close to the Sugar Mill—G-J—are referred to as the Industrial Complex. Twenty units were excavated during the TAS field schools. There are several factors that have damaged the archeological integrity of this structure, including the leveling of the structure by heavy equipment and the proximity to Lake Jackson. Structure I is on the edge of Lake Jackson. Because water and mud are holding the north wall of Structure I in place, the northern part of Structure I was not excavated.

The main objectives in the excavation of Structure I were to expose enough of the structure to determine the size, type of foundation, and structure function. The two weeks spent in excavation during the TAS Fields Schools did not accomplish this objective because this is a very large structure and there was not enough time to complete the excavations.

Two trenches were opened, one east-west and one north-south. The north-south excavations exposed a brick floor. The east-west excavations uncovered a rectangular hole between two brick walls. Excavation of the rectangle exposed two brick foundations resting on a brick surface. An architect and a brick mason concurred that this type of construction was used to support heavy load-bearing walls and to stabilize foundations.

Because of the disturbance of the ruins of Structure I by heavy equipment, interpretation of this structure must come from the architecture and artifacts in future excavations. The artifacts found in Structure I did not indicate the function of the building or the activities that may have taken place there. Unit N69E723 had the most interesting assemblage of artifacts, including 10 harness buckles, a metal bed frame part, a foot of a china doll, and a window sash pulley.

## SUMMARY

The Lake Jackson State Archeological Landmark (LJSAL) contains 2.719 acres of the approximate 5,000 acre plantation developed by Abner Jackson in the late 1840s. The main structures of the plantation were constructed on the south side of Lake Jackson with the residential and industrial areas about 300 feet apart. Historic records document Jackson as one of the largest sugar producers in the state prior to the Civil War. Less than 2 percent of the LJSAL has been excavated, but seven structures were partially excavated and five additional structures located during the TAS Field School investigations.

Archeological excavations revealed the original plan of the Sugar Mill, and the discovery of key artifacts and features have defined how sugar was made when the mill was first constructed. Horse harnesses and metal bands found next to the foundation of the cane crushers in the Sugar Mill give evidence of a horse/mule treadmill as the original source of power for the cane crushers. Comparative studies of sugar mills in the Brazos River valley (Few, this volume) supports the identification of the foundation of the cane crushers at Lake Jackson. Finding the rollers and gears of the cane crushers on the floor next to the cane crusher foundation verified the identification.

The location of the train of kettles and the flue chimney are evidence that in the early years sugar was processed by heat reduction, with fire being the source of heat. Historical records state that after the Civil War, the source of heat used in the reduction process changed from fire to steam: the "steam train" method. This is supported in the archeological record by the extensive architectural alterations made to the Sugar Mill around 1873: (a) the flue chimney, a critical component in the use of fire for heat, was sealed and walled off from the kettle area; (b) the brick foundations that held the kettles were partially destroyed so that steam coils could be attached to the kettles; (c) the foundations were then rebuilt, resulting in convict-built walls on top of Jackson period slave walls in the kettle area; (d) foundations for the boilers were built north of the original mill to provide steam heat to the kettles; (e) floors were raised; and (f) product traffic patterns, documented by sealed doorways, were altered to accommodate the new reduction process.

The evidence provided by artifacts cannot address the issue of the self-sufficiency of the pre-Civil War plantation operation because the only provenienced domestic artifacts firmly associated with the Jackson period are the ones in room C of Structure B. The structure size, location, and the simplicity of the artifacts (cheap buttons and common china) suggest the residence of slaves/house servants. All of the items found were of industrial manufacture, not home-made. The bricks used in the Jackson buildings were made on site according to historic records. They were of excellent quality and did not bare makers marks; on some bricks, hand prints of the workers can be seen. In the Sugar Mill, bricks were found with makers marks (which have not been identified) that may be associated with the alterations to the mill after the Civil War. Fire bricks (i.e., bricks with large coarse temper to withstand high heat) were found in the arch of the flue chimney, and were part of the Jackson period construction. All of the artifacts found in the Sugar Mill relating to the sugar making process were imported and industrially made.

Because of damage to the site and its structures, starting with the hurricane of 1900 and ending with the development of the Dow Chemical Company park, which leveled many of the ruins and built roads on top of others, the architectural remains of the structures have provided the most important cultural information about the site. Foundation construction, size and type of bricks, and quality of masonry have made possible the identification of Jackson period structures, post-Civil War structures (Convict period), structural alterations, and structure function.

The main house, Sugar Mill, and structures B, C, and I were built during the Jackson period. Structures A and D were built during the Convict period. Structures E-H and J have not been excavated. The Sugar Mill was extensively altered after the Civil War. Structure B was altered by sealing doors, adding brick floors, and possibly removing interior walls. Excavations around the main house found convict walkways above Jackson period walkways. Jackson period walkways helped determine the exterior living surface during that period. The absence or presence of exterior plaster covering the bricks of the main house, as well as the dividing line between foundations and walls, also helped determine the exterior living surface. Profiles of builders trenches in the Sugar Mill, built in the late 1840s, identified the land surface on which the Sugar Mill was built; these surfaces are at the same level as the main house built in 1851.

Buttons, chinawares, and bones, when found in situ, can reveal information on activities, status, time, cost, and trade. At Lake Jackson, some of these artifact types were found in areas that can be associated with the residents of the main house during the Convict period (1873-1900); the people living in room C of Structure D during the Jackson period (1851-1873); and the residents of room A, Structure D, during the Convict period. Only one artifact, a Texas Department of Corrections hoe found in the Sugar Mill, can be associated with the convicts during the Convict period at the site.

The buttons found (Few et al. 1996:15.8) date from the 19th century. Buttons were found in all areas of the site but the highest concentrations were at the main house and Structures B and D. Most of the buttons reflect everyday clothes. Buttons from the Victorian period were found at the main house in levels associated with the Convict period.

The majority of bones (see McClure, this volume) were found in areas where surface disturbance, such as site leveling for the construction of Dow Park and the construction of the Dow road, made cultural associations difficult if not impossible to ascertain. Structure B (Jackson period), in the lower levels of excavation in room C, contained domestic (cow, pig, and chicken) bones mixed with indigenous wild species of mammal, fish, and fowl. The trash deposit to the right of the fire hearth in room A of Structure D (Convict period) contained a wide variety of domestic and wild animal bones. These two undisturbed areas in Structures B and D provide the best view of food resources during the Jackson and Convict periods.

Ceramics found at the site (see Pollan, this volume) are simple, not expensive wares. Their presence documents British trade wares in Texas during the 19th century. The wares found in structures B and D, and around the main house, allow inferences concerning the class and economic status of the residents of Lake Jackson during the Jackson period as well as the later Convict period.

Most of the major components of the Sugar Mill have been exposed and identified. The structural alterations in the mill document the changes in sugar making in the 19th century. The personal and activity artifacts found give a glimpse into the daily lives of the occupants: toys of the children; round gaming pieces of brick found in the Sugar Mill; and the pocket watch, harmonica, simple jewelry, and buttons from other contexts. The artifacts from the Dow Park period suggest that picnicking, fishing, beer drinking, and target practicing were frequent activities.

In summary, archeological excavations at Lake Jackson between 1991 and 1998 have added to our knowledge of the Indians that camped around the lake (see Few et al., this volume). We also learned more about the sugar industry that dominated the economy of Brazoria County during the 19th century, and the way public park areas were used during the 20th century.

## ACKNOWLEDGMENTS

The 1994 and 1995 Texas Archeological Society (TAS) Field Schools were made possible by the efforts and support of the Brazosport Archeological Society (BAS), Lake Jackson Historical Association, Dow Chemical Company, City of Lake Jackson, University of Houston Clear Lake (UHCL), Houston Archeological Society (HAS), Texas Parks and Wildlife Department (TPWD), Brazosport College, Brazosport Museum of Natural Science, Lake

Jackson Lake Association, Texas Archeological Research Laboratory, The University of Texas at Austin, Lake Jackson Chamber of Commerce, and the Lake Jackson Tourist Bureau.

The accomplishments of the field schools is a result of the excellent leadership provided by the many crew chiefs and the hard work by hundreds of participants. If possible we would list every participant to acknowledge their contribution to Texas archeology and history.

The BAS was pivotal to both field schools; society members dedicated three years to this effort. Johnney Pollan was responsible for local arrangements; Sue Gross was registrar; Chris D. Kneupper, programs; and Sandra Pollan curated all artifacts. Juliann Pool (TPWD) was lab director; Anne Fox, University of Texas at San Antonio, Pat Mercado-Allinger, State Archeologist, and Robbie Brewington, Texas A & M University and UHCL, served as area supervisors; photographers were Sherri Avery, Joanne Ancira, Elvis Allen, and Raymond Blackstone; field secretaries were Vicki Hatfield, Karen Acker, Marcy Grubbs, and Velicia Hubbard. Members of the HAS contributed many hours of logistical and manual support.

The productivity of the field schools was enhanced by the many volunteers from BAS, HAS, and TAS who spent many weeks in the spring of 1994 clearing overburden from the site. The initial research on the site was by Sue Gross, Chris D. Kneupper, Johnney T. Pollan, Sandra D. Pollan, James L. Smith, Judy S. Wayland and David J. Wayland. Barbara Butler (UHCL) served as administrative secretary and UHCL coordinator for both field schools.

Artifact analysis was by Karen Elliott Fustes, Indian ceramics; Sandra D. Pollan, historic ceramics; Juliann Pool, buttons; and William L. McClure, bone. This author is deeply indebted to the encouragement and professional support given by Dr. Mary G. Hodge (1946-1996) to the Lake Jackson State Archeological Landmark Site research program.

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# The China Cabinet at the Jackson Plantation: Ceramic Analysis from the Lake Jackson State Archeological Landmark Site (41BO172)

*Sandra Driskill Pollan*

## ABSTRACT

Archival research indicates three historical occupation periods at the State Archeological Landmark site (41BO172) located in Lake Jackson, Texas. The ceramics recovered corroborate the three occupations as well as establish the occupants' use of the prime ceramics of choice during each of the site's incarnations as Antebellum plantation; post-Civil War sugar mill; and as a 20th century community park.

## INTRODUCTION

Once the hub of a Texas sugar empire created by entrepreneur Abner Jackson, a Virginian by birth, the Lake Jackson plantation no longer even faintly resembles that long ago domain. Rather than stretching to the Brazos River some miles west, little more than two acres remain along one border of Lake Jackson. Remnants of the Lake Place, as it was known in its heyday, consist of a few overgrown mounds of building debris and the sad ambience of earlier glory. This plot, set aside and preserved from development in the small city of Lake Jackson, was deeded to that city's historical association by the Dow Chemical Company. The Lake Jackson Historical Association then had the site designated a Texas State Archeological Landmark, thus protecting it for posterity.

Historical archeology classes began excavation at the site in 1992 under the instruction of Joan Few of the University of Houston, Clear Lake. The Texas Archeological Society annual summer field school supplemented these efforts in 1994 and 1995. More progress toward understanding the history of this site is gleaned every season of excavation, and the site promises many more years of study. The intent of this paper is to discuss the ceramics and how they corroborate or refute the written records of early Brazoria County, and more specifically, those concerning the Lake Jackson plantation.

The advantage to historical archeology is the existence of a written record to corroborate and expand the archeological record. In this case, archival research defined three basic occupation periods at the Lake Jackson State Archeological Landmark (LJSAL). The Jackson family's tenure comprises the first (1842-1873) —known as the slave-labor or Jackson period (Gross et al. 1989:4, 8). The second, the convict-labor period, existed at the plantation from as early as 1874-1884, but may have lasted as late as 1912 (Few 1995:4.6; Walker 1988:94). The land served as pasture for several different owners during the first half of the 20th century. Eventually Dow Chemical Company established a park on the property for its employees living in the adjacent company town of Lake Jackson. The land served in this manner from 1945 until its closing in 1989 (Gross et al. 1989:2).

Further archival research has gleaned additional details concerning the Jackson property, including that an early 20th century habitation was in or near the Sugar Mill (Gross et al. 1989:9). Another recounts a noon meal served at the Retrieve sugar house (another Jackson property in Brazoria County), a practice that may have been common during the peak cane season (*Democrat and Planter* 1858). These two items may explain the presence of 20th century and Jackson period ceramics in the Sugar Mill. A third item found in the Jackson probate records details an 1863 estate sale that may account for the low numbers of Jackson-era ceramics evidenced so far at the home compound (Brazoria County Probate Record Case 764: C627).

## THE SITE

An archeological survey conducted by the Brazosport Archaeological Society in 1989 documented at least eight structures (Gross et al. 1989:13). Excavation and road removal bring the total to at least 11. Excepting the Big House and the Sugar Mill, each structure is known by its letter designation until the buildings' function(s) within the plantation can be determined. To recognize patterns in the character and distribution of the ceramics, they are analyzed structure by structure; as a whole; and within two groups: the residential component and the industrial element. The residential component, or Home Compound, includes the Big House and structures A-F (see Few, this volume). These buildings are located very near the main residence and may have housed activities involved in the upkeep of the physical plant or sustenance of those living in the Big House. The Industrial Complex consists of the Sugar Mill and structures G-J. These buildings are larger than those surrounding the Big House and are grouped in the general vicinity of the Sugar Mill. Structures A-E, and the Big House from the Home Compound, the Sugar Mill, and structure I of the Industrial Complex, have all been excavated to some degree. At this time, structure B has been explored more thoroughly than any other building. For that reason, the ceramic assemblage from structure B can be viewed with more dependence than the other less completely investigated structures.

## THE CERAMICS

The site's ceramics are typed by body color, then sorted by decoration. Each sherd is tested for vitreousity by absorption and light penetration (Majewski and O'Brien 1987:113). The minimum vessel count is then established based upon the number of different rim sherds and basal fragments. Also assigned vessel numbers are the decorated sherds that obviously belong to vessels other than those represented by the rims and bases. Next, recognized vessel forms are ascribed.

Using this information, the vessels are attributed to a particular time period using the median date of production. The mean date allows attribution of a greater percentage of the ceramic vessel collection. This is particularly the case for the porcelains, which have enjoyed a lengthy production period and popularity. Without marks, temporal attribution of porcelain is very nearly impossible. The 1800+ ceramic sherds from the site represent a minimum of 283 vessels. This includes sherds from 24 vessels without provenience; these ceramic vessels are not reflected in the percentages cited throughout this paper, and are not discussed further.

Within the previously mentioned buildings, there are 259 vessels. Featuring a number of decorative techniques, 202 are white-bodied earthenware or porcelain. A few redwares and yellow wares, and many more stonewares, are also in the collection. The Jackson period accounts for 75 vessels; 170 vessels are from the convict-labor period; and a minimum of seven can be attributed to the park period. Another seven vessels lack traits that would allow for their temporal attribution, although two can be recognized for form or use (one is a tableware, the other a teaware). These unattributed vessels represent 3 percent of the assemblage.

The British dominated the world ceramics market from late in the 18th century through most of the 19th century (Majewski and O'Brien 1987:114). Nevertheless, upon their arrival in America in the 17th century, colonists immediately searched out and settled in locales compatible with the maintenance of pottery kilns (McConnell 1988:18). They needed access to fuel and appropriate clays as well as transportation venues. The first American efforts were directed towards the production of red-bodied wares, and American potters soon commanded the redware market.

Porous if left unglazed and basically rather fragile, redware generally takes the form of preparation and storage vessels, as do the three redware vessels recovered, all at the home compound. These vessels all date to the Jackson or slave-labor period since, according to Ketchum (1983), virtually all commercial redware production in the United States had ceased by the mid-19th century.

Except in structure I in the industrial complex, stoneware was recovered from every structure on the site, albeit in small numbers. Some crocks, large mixing bowls, several ginger beer bottles, and at least one jug were recognizable among the 38 stoneware vessels. Chiefly produced for use in the kitchen and pantry, stoneware vessels are typically heavy and bulky, designed for usefulness rather than beauty. Much hardier than redware, stoneware is virtually watertight once it is fired, but most is glazed anyway (Ketchum 1983:19). Two stoneware marks were identified, both American, one of which (the Western Stoneware Company mark) dates to after 1906 (Lehner 1988: 513-514, Mark 13). The Macomb Pottery mark dates from ca. 1890-1906 when Macomb was bought out and his pottery incorporated into the previously mentioned company (Lehner 1988:274). Of the 38 stoneware vessels, 12 can be attributed to the Jackson period and 26 to the convict-labor period.

Yellow ware, the next and largest American ceramic endeavor, is lighter weight than stoneware, yet far more durable than redware. The Americans' installation of gas-fired kilns in the 1870s wrote finis to England's dominance in this particular market (Leibowitz 1985:9). Principally produced in useful kitchenware and toiletware, most yellow ware is porous and therefore requires a glaze. This type of ceramic has been formed in molds since the late 1830s, and any decoration is added prior to applying the final colorless glaze (Gallo 1985:39). Of the five major decorative styles usually applied, only mocha motifs and flint enamels are lacking on the nine vessels recovered, none of which bears a mark (Gallo 1985:41). Both styles of Rockingham glaze (dipped and spattered); relief-molded bodies; colorless glaze; and slip bands occur on such items as large bowls, a spittoon, and a chamber pot. Relief molding became popular late in the 19th century (McAllister and Michel 1993:31), while slip banding occurred on vessels dating from ca. 1850 and continued well into the 20th century (Gallo 1985:42). By the 1870s, there were very few potters who were not using Rockingham glazes on their yellow-bodied products (Leibowitz 1985:14).

A fourth ceramic category, porcelain, makes up approximately 12 percent of the LJSAL ceramics. Over half of the 27 porcelain vessels recovered are from the Big House, but they are distributed in every structure except structure I in the Industrial Complex. Structures A and the Big House also have bone china. This form of porcelain, softer-bodied and more translucent, became the standard English porcelain body early in the 19th century (Majewski and O'Brien 1987:127). It was marketed not as bone china but as porcelain and exhibits various types of on-glaze decoration. The remainder of the porcelain vessels (n=20 vessels) consist of hard paste porcelain. Few are recognizable by form, with the exception of at least one parian (unglazed) figurine, a souvenir mug, and one dinner plate.

The fifth ceramic type is refined white-bodied earthenware. The English truly controlled the market for this particular class of ceramics. It was not until the late 19th century that sufficient renovation enabled most American potteries to profitably produce the much higher firing white-bodied ceramics (Majewski and O'Brien 1987:103). Many years of experimentation ensued to perfect the product as well as persuade the home market to rely upon their compatriots for the ceramics they used in their homes. American potters enjoyed greater success marketing their products by applying counterfeit English marks on them (Majewski and O'Brien 1987:166). In the 1897 Sears, Roebuck & Company catalogue, 16 of the proffered 17 whiteware sets originated elsewhere (Israel 1993). Eleven of 16 sets advertised in the 1902 catalogue were produced in America (Gramercy Books 1993), and the 1908 version featured 17 sets, of which only five were of American origin (Schroeder 1969).

Present throughout the site, whiteware (n=175 vessels) represents 68 percent of the entire ceramic assemblage. These vessels take the forms of tableware, teaware, and utilitarian kitchenware and toiletware, with greater numbers of teaware. Fifty-two whiteware vessels date to the Jackson era; 118 others date to the convict-labor period; and five date to the park period.

The site's whitewares are sorted by decorative style as defined by George L. Miller (1980, 1991) in his cost indices for the classification and economic scaling of English ceramics. Miller's scheme applies only to those whitewares marketed prior to 1870, essentially the Jackson or slave-labor period. This is due to insufficient contemporary data, both here and abroad, to formulate price scaling of ceramics marketed after the Civil War. Table 1 illustrates the four basic classifications of these wares, based upon ceramic costs as fixed by the manufacturers themselves. The descriptive terminology used here, and by Miller, originates with the potters as well and reflects the way each style was marketed in the 19th century. CC (cream-colored) is undecorated non-vitreous white earthenware that after 1820

**Table 1. Slave-Labor Period Ceramics Arranged in Ascending Order According to Price-Fixing Established by English Potters (Miller 1991)**

| Percentage | Decorative Type (and No. of Vessels) |
|---|---|
| Before 1850: | |
| 7 | CC (cream-colored): undecorated (4 vessels) |
| 12 | Shell edge, Sponge-decorated, and Dipt: Minimally decorated, requires low level of expertise (6 vessels) |
| 10 | Handpainted vessels with more intricate, standardized patterns (flowers, leaves, landscapes) (5 vessels) |
| 29 | Transfer-printed vessels (15 vessels) |
| After 1850: | |
| 42 | White granite (Classic Ironstone) (22 vessels) |

Note: The white granite includes only the vitreous variety that was produced prior to 1870

was limited to utilitarian items such as chamber pots, etc. (Miller 1993:5).

Based upon the premise that selecting the mold constitutes the principal choice in the decorative process (Majewski and O'Brien 1987:135), primary decoration includes shape and relief molding and the underglaze treatments: edging (shell edge), slip applications (dipt/dipped), painting, and printing. Secondary, or overglaze, decoration includes enamel, luster, gilt, decal, and engobes (Majewski and O'Brien 1987:164). "White granite" refers to what has also been called "ironstone" or "classic ironstone"; that is, the plain all-white dishes that emerged ca. 1840 and dominated the ceramic market from 1850-1890 (Figure 1).

Regardless of their lack of applied decoration, white granites were costlier to produce than even the expensive transfer-printed dishes. To a large degree, this was due to the longer, higher firing necessary to produce the vitreous English white granite of the 1840s-1860s. By 1877, a non-vitreous white granite was being produced by decreasing the final firing time, thus reducing production costs and lowering prices (Miller 1993:6). The Staffordshire potteries adopted this policy to overcome the high cost of fuel and shipping and the enormous tariffs the U.S. Congress exacted on imported ceramics following the Civil War (Miller 1993, 1996).

In addition to price fixing, the English manufacturers established the sizes and types of sets available. Most vessels were either a tableware, teaware, toiletware, or plain but useful kitchenware. Tablewares included tureens, covered and non-covered vegetable dishes, platters, and various sizes of plates. Sets averaged more than 100 pieces but did not include cups or saucers (Coysh and Henrywood 1982:107). Cups and saucers were ranked as teaware along with waste bowls for dregs, serving plates, covered sugars, creamers, and teapots with stands (Godden 1991:47). Kitchenware were vessels used in food preparation and/or storage: bowls, churns, crocks, canning jars, butter pots, bakers, and milk pans. Most kitchenware was produced in yellow ware or stoneware, although stoneware was used more in storage than preparation. Kitchenware was selected from open stock rather than by the set, although several different vessel forms were sold in sets of graduated sizes (Gallo 1985; Leibowitz 1985; McAllister and Michel 1993). Toiletware, however, was sold in sets that could include a basin, ewer, brush holder, covered soap

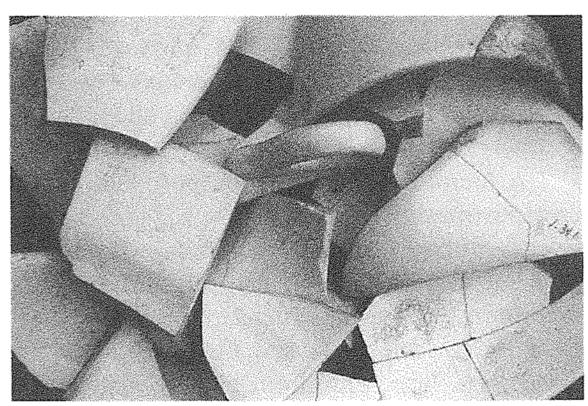

Figure 1. Assorted White Granite Sherds from the Big House.

dish, slop jar, chamber pot, and possibly a hotwater jug and/or a spittoon (Kamm 1951:245). Spittoons were usually sold from open stock, but for classification purposes have been lumped with toiletwares in this paper.

Of the 259 vessels, 74 percent had recognizable vessel forms. These 193 vessels include: 28 percent tableware, 44 percent teaware, 25 percent kitchenware, and 3 percent toiletware.

Tableware, teaware, and kitchenware was present throughout the site. Toiletware was recovered from the home compound only. Tableware consisted of 54 vessels, while there were 85 teaware vessels, 49 kitchenware vessels, and five toiletware vessels. The industrial complex accounted for only 19 of the vessels: six tableware, seven teaware, four kitchenware, and two unrecognizable for form or use.

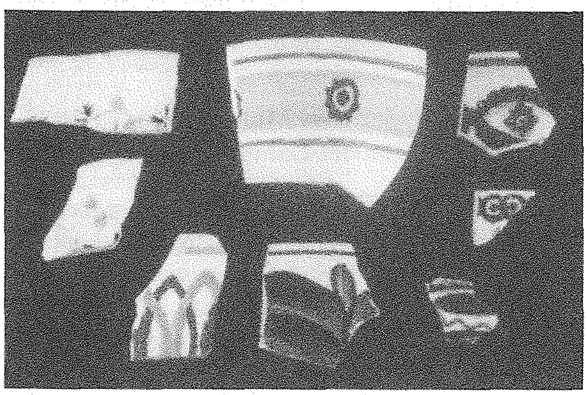

Figure 2. Hand-Applied Decoration in the Big House Sherds, Including Brush Painted Designs and Stamped or Cut-Sponge Decorated Earthenware.

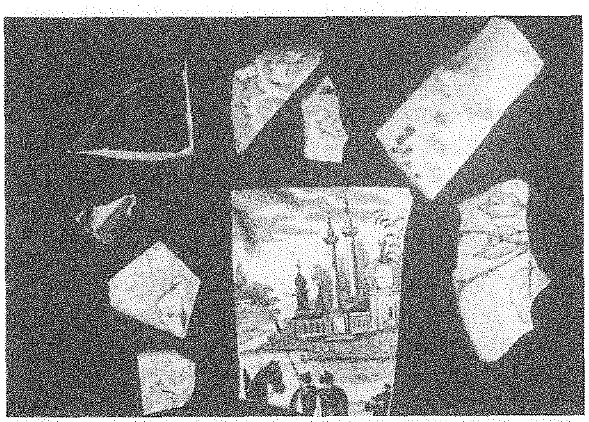

Figure 3. Eight of the 15 Transfer-Printed Patterns on Refined White Earthenware, all from the Home Complex. Beginning with the Dark Flow Blue Sherd (upper left) and continuing clockwise, the vessel patterns are from Structure A, Structure D, Structure D, Big House, Structure D, Big House, Big House, Structure B, and Structure B.

About 70 percent of the 175 white earthenware vessels are white granite; 29 percent are decorated, and the remainder (n=4 vessels) are totally undecorated cream-colored (CC), the cheapest white ceramic available. The three shell edge plates, the nine cut-sponge stamped teas (cups and saucers), and three annular "dipt" bowls comprise the next category, the cheapest decorated wares.

Decoration requiring a higher level of expertise, the monochrome and polychrome brush-painted wares (Figure 2), appear in the moderate cost category (see Table 1). They amount to six vessels. These include "thick-line" motifs that cover the greater part of each vessel and can be dated by the colors present. Sprig, another painted style involving hairline stems (usually black) with tiny leaves and blossoms, covers much less of the surface of the one saucer found. One other example combines characteristics of both thick-line and thin-line painting and dates to the same general time period, ca. 1840-1860 (Majewski and O'Brien 1987:157). Also produced during that time are four of the nine cut-sponge teas. These four teawares, with simple cut-sponge motifs with no additional embellishment, were from structures A, B, and the Big House. The "ghost" of the fugitive enamel patterns, both floral, precludes assigning specific dates. At least one is a teaware, and most likely the other one is as well (Miller 1996). These overglaze treatments may indicate that the popular "china painting" hobby was employed by one of the residents during the period 1880-1905 (Majewski and O'Brien 1987:154).

Transferwares, the costliest dishes during the majority of the Jackson period, account for 15 vessels, of which three of the print-decorated vessels are flown (Figure 3). Ordinarily, transferwares simply have a printed pattern applied, then are dipped in a lead glaze after which they undergo a very high firing in the glost oven, thus fusing the lead glaze to the surface of the vessel (Coysh and Henrywood 1982:8). This glass finish serves to protect the decoration from wear for eternity or until the vessel or glaze is broken. Applying this type of decoration requires skill and delicacy to prevent smearing the design or tearing the tissue upon which the pattern is printed. The "flown" variety of transfer-print decoration, or painting for that matter, includes the introduction of lime or ammonium chloride into the glost kiln during the final firing (in some cases, much like salt is thrown into the kiln for salt glazing). The chemical creates an atmosphere in the kiln in which the print bleeds into the glaze rather than the glaze sitting atop the print. This creates a halo effect, diffusing the pattern and "leaking" pigment into the colorless glaze (Coysh and Henrywood 1982:140). Flown prints were most popular ca. 1835-1870 (Coysh and Henrywood 1982:10), but enjoyed a resurgence towards the turn of the 20th century (Snyder 1992:7). Some painted wares were treated in the same manner (Miller 1991:8).

## OCCUPATION PERIODS

### Glory Days: Jackson Plantation or Slave-Labor Period

The Jackson era ceramics consist of 10 stonewares, three redwares, and four yellow wares, all of which are kitchenware and toiletwares. Fifty-two whitewares, of which 22 are vitreous white granite, and three porcelains (including two bone china teas), date to this same period. Decorated whitewares include monochrome and polychrome broadline paint, sprig paint, edgeware, enamel, and print (both regular and flown). All four CC vessels found at the site date to the slave-labor period.

No marks appear on any of the flown sherds, nor are any of them large enough to identify the pattern. The regularly printed sherds yielded three marks, one maker/pattern, one pattern, and one importer's mark. The maker/pattern mark is for the pattern *Palestine* produced, in this case, by William Adams & Sons, 1819-present (Pollan et al. 1996:59). Godden (1991:21, mark 22) dates the mark type to ca. 1819-1864. Because the color is brown, this vessel was not produced prior to 1828 (Hughes and Hughes 1968:151).

The second pattern mark is one for the *Scotts Illustrations* series produced between ca. 1835-1860 by Davenport, who operated from 1794-1887 (Lockett and Godden 1989:73). This particular vessel features *The Legend of Montrose* as its central view. The pattern of the hollow vessel on which we find the Henderson & Gaines import mark cannot be identified. Henderson & Gaines, only one of several New Orleans import partnerships, operated between 1836 and 1867 (Black and Brandimarte 1987).

The estate sale of 1863 does not describe the dishes sold at that time. With the exception of the "sett china...$28.00" that refers to porcelain, there is no way of knowing what kind of dishes were sold (BCC 1863: PR:C627, Case 764). It would be helpful to know how early in the 19th century white granite became the ceramic of choice on the Gulf Coast. At Lake Jackson, white granite represents 70 percent of the whitewares. Eighteen percent of the white granite is vitreous, suggesting it probably belonged to the Jackson's and was used during the slave-labor period. These heavy thick-walled vessels sport octagonal and hexagonal shapes, some with naturalistic relief molding, some simply plain, but nowhere nearly as plain as white granite would become later in the century (Majewski and O'Brien 1987:154).

### Under New Management: Convict-Labor Period

Post-Civil War ceramics are dominated by white granite as well. A few decorated items appear, but of the 118 whiteware vessels attributed to the convict-labor period, white granite makes up 85 percent. By 1870, white granite shapes began to soften, and round shapes appeared. Body walls began to thin and the body color evolved into a creamy rather than bluish or grayish white (Majewski and O'Brien 1987; Wetherbee 1980). By ca. 1877, non-vitreous white granite was also produced.

Among the few decorated vessels attributed to the convict-labor period are one transfer-print; two cut-sponge teas of the "Portneuf" variety; two open-sponge decorated vessels; three band and line teas; and two Tea Leaf teas. The aforementioned decorative techniques can be found applied to white granite as well, but once decorated, white granite is classified by its decoration just as is whiteware (Miller 1993:4).

The later transfer-printed designs differ from earlier styles. For instance, much less of the vessel was decorated and the palette was limited to brown, navy blue, and sometimes, black. Central scenes were minimized, if not completely eliminated, at least until Japanese patchwork designs appeared. Some vessels were printed in outlines to be filled in later with color (Coysh and Henrywood 1982; Wetherbee 1985) .

Open sponge decoration, the style still applied to stonewares today, originated in 1860 and was used until 1935. It appeared on tableware and kitchenware made of whiteware as well as stoneware and was produced by both American and British potteries. This technique involves "stamping" color onto a vessel using a natural sponge dipped in paint. This differs from cut sponge in that the process was the same but used shapes cut from the more compact stems of the sponge. Open sponge applications often overlap colors while spatter and cut sponge usually segregate the colors more into patterns (Majewski and O'Brien 1987:162). Two examples (one open sponge cup and one unknown form) are present at the plantation.

What we know as Tea Leaf is actually "Lustre Band and Sprig," a decorative style introduced by Anthony Shaw ca. 1850 (Heaivilin 1981:108) but not perfected until the late 1870s (Figure 4). The process consists of first painting a motif (or the vessel's relief-molded design) in a base color of greenish-brown, glazing and firing the vessel, and then applying a coat of lustre just upon the painted design. Even though the luster is then "set" in an oven, the polished copper finish is vulnerable to regular use. For this reason, many 19th century examples evidence no luster at all. The improvement developed by Shaw ca. 1870 enabled the potters to apply the luster under the glaze, thus protecting it as well as the underlying painted motif (Wetherbee 1980:123). One of the plantation's two Tea Leaf examples is shiny and lustrous, the other is bilious brown. Usually this dull brown would be a temporal indicator, but not in this case. The bilious saucer has a maker mark, W.H. Grindley (England, 1880-present) dating this teaware to 1891-1925 (Godden 1991:294).

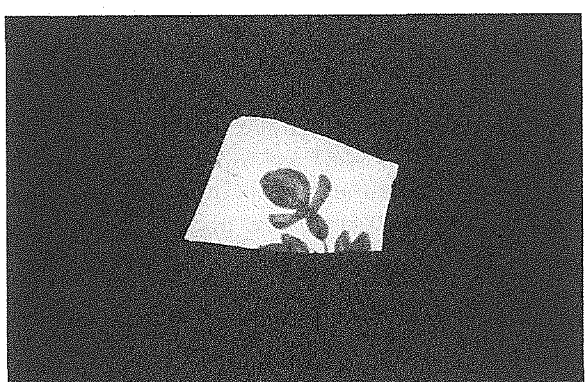

Figure 4. This Lustre Band and Sprig, or Tea Leaf, motif adorns a saucer recovered in Structure C of the Home Compound.

Another decorative style that emerged very late in the 19th century is band and line decoration. Usually brown, green, or blue, the application involves painting a tiny stripe or line parallel to and very near the edge of a vessel, then adding a slightly broader band next to it. This banded ware is the precursor of the heavy striped hotel-wares (Miller 1991:7).

Portneuf-type cut-sponge decoration originated in England or Scotland ca. 1840 and was exported into the 1920s. The decoration consists of brightly colored cut-sponge motifs with brushed or sponged bands of vibrant colors (Majewski and O'Brien 1987:162). Several vessels with this decoration, all teaware, occur at the plantation but are confined to the residential compound.

## Rest and Relaxation or The Park Period

Not long before the emergence of band and line ceramics, decalcomania made its appearance in America. Imported primarily in porcelain, very few earthenware examples appeared before the turn of the 20th century. Decal-decorated wares remained popular well into the 1950s. For this reason, the median date falls within the park period rather than the convict-labor period. Although decal printing was available in America as early as 1894 (Downes 1994:68), it was not economically feasible for potters to use American-made decals until the 1930s. Decals are often combined with relief molding and, more particularly, gilding. They are applied on-glaze and are subject to wear. Often all that is left is a ghostly outline that can be felt with the fingertips. They are generally floral motifs with distinctive shading; the earliest decals were monochrome, and later they were multi-colored. Another type of decal involves outline art that is later filled in with color and is often confused with the earlier transfer-printed outlines that have been enameled between the lines (Majewski and O'Brien 1987:146-147).

Other than hundreds of white sherds that may represent undecorated portions of any number and style of different vessels, there remains only the infamous engobe to be accounted for, otherwise known as Fiestaware. Created in 1935 by Homer Laughlin & Co. (Lehner 1988:248), Fiesta livened up the tables of America through 1972. It then enjoyed a revival in 1986. The opaque, colored all-over glaze covering an ironstone body owed its popularity to its bright colors and the play of light on the art deco shapes and angles of the vessels. At least three engobes occur at the plantation, oddly enough all at the Big House. One is goldenrod yellow, one is a pastel blue, and one is pale lemon yellow. The two yellow vessels are both tablewares (Figure 5), one a plate and one a rectangular casserole or shallow serving dish. The pale blue vessel is definitely a piece of hollowware with a floral embossed pattern of daisies on its exterior (unlike Fiesta that is typically very plain, relying upon geometric vessel shape rather than embossing for its appeal). Naturally, these items fall into the park period.

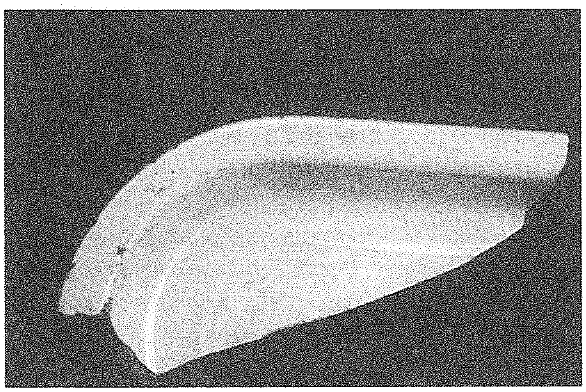

Figure 5. One of three Engobes from the Big House. This yellow-glazed rectangular dish lacks any embellishment other than its all-over glaze and molded concentric lines.

## COMPONENTS

While the ceramics from the home compound run the gamut of types available for the different occupations at the site, the industrial complex has no toiletware but otherwise includes vessels one would expect to find in a residential/industrial plant. Markedly different, the park period with a mere three percent of the site's ceramics graphically illustrates the effect of organized sanitation systems upon the world we live in.

### Home Compound

The Home Compound accounts for 93 percent of the ceramics with 23 vessels from structure A, 35 from structure B, 10 from structure C, 46 from structure D, and 115 from the Big House itself (seven of which are undateable). Seven vessels were recovered between the Big House and structures A and B, while the walkway between structures A and B yielded another four. All the ceramics are consistent with food preparation and dining, with the exception of the toiletware. Tableware amounted to 27 percent; teaware, 45 percent; kitchenware, 25 percent; and three percent toiletware.

Structure A had moderately priced goods during the Jackson era and top-of-the-line goods during the convict-labor period. No park period ceramics are present. This structure had no toiletware, either personal or general. All 23 vessels were temporally attributable, but only 17 were recognizable as to form or use.

Eighty-three percent of the Structure B vessels were whiteware. All were dateable, and 27 were recognizable in form or use. The range of ceramics suggests this structure was inhabited throughout the site's main occupations (no park period ceramics). Slightly more than half of the ceramics date to the convict-labor period. Both periods reflect a wide variety of decorated ceramics, although the convict-labor ceramics are not cost scaleable. Wares range from a CC ointment pot, yellow ware and stone kitchenwares, low to high-end decorated ceramics for the table, and a Rockingham-glazed spittoon. They exhibit a wide selection of decorative styles, including three edgeware plates, several printed items, and white granite plates. One of the monochrome blue printed vessels (unidentified) contains a William Adams & Sons mark dating to 1819-1864 (Godden 1991:21). Also present are a dipt waste bowl (teaware), banded teaware, and "Portneuf"-like cut-sponge teaware; in fact, teawares (37 percent) dominate the Structure B assemblage.

Structure C, the small building on the edge of the lake behind the Big House (see Few, this volume), has eight recognizable vessels: 25 percent tableware, 25 percent teaware, and 50 percent kitchenware. The four vessels from the Jackson era are kitchenware except one unidentified printed vessel. The postbellum wares consist of one stoneware hollow vessel, two white granite plates, and two teawares, one of which is the bilious brown tea leaf saucer.

Many more ceramic items were found at Structure D, a two-room building found during removal of the road that forks around structure A and on into the park. The recognizable wares from the

Jackson era include kitchen containers, two CC ointment pots, and two teas: one printed and one polychrome painted. Unidentified print vessels at this structure include a Davenport pattern mark for *Legend of Montrose* of the *Scott's Illustrations* series (Pollan et al 1996:68), a brown print cup, and a flown black hollow receptacle. The 33 convict period vessels are dominated by white granite, both tableware and teaware; two cut-sponge teas, a dipt waste bowl, as well as three porcelain teas number among them. The park period is represented by a single unidentified porcelain vessel. In all, of the 46 vessels from Structure D, 35 were recognizable by age and 44 classified by form/use. The two unclassified items include two decalcomania examples; one of which is gilded.

The walkway excavations (originally known as Structure E) between structures A and B recovered four vessels: a granite plate, a porcelain cup, and two hollow stonewares. One stoneware is wheel-thrown and one is mold-formed, dating it to no earlier than the 1880s (Ketchum 1983:19). Except for the wheel-thrown stoneware, all date to the convict-labor period.

No definite walkway patterns were found between the Big House and structures A and B, but seven ceramic vessels were. One early hollow redware vessel dates to the Jackson's' residency, while the balance of the vessels—one stone kitchenware and four white granites—date to after the Jackson's' departure.

Within the confines of the Big House, ceramic variety is the rule. Tradition has it that some walls of the Big House were still standing when development of the park first began. In the process of preparing a safe recreational area for the public, those standing walls were pushed in and the building debris was consolidated into one large pile. At some point a fence was added to prevent park visitors from climbing around among the crumbled walls. No doubt refuse was tossed on the pile as well, which may explain the presence of 20th century ceramics within an inaccessible area. A total of 115 vessels have been recovered in the investigation of the mansion. All but five vessels were datable, and 78 could be recognized for their use. Tableware and teaware includes white granite (75 percent), painted, dipt, printed, enameled, gilded and embossed, and 20th century engobes.

Among the household items auctioned in 1863, Andrew outbid everyone for multiple spittoons, one lot of dishes (meaning serving pieces), one lot of plates, two large wasters and the aforementioned set of porcelain, not to mention four pitchers, a couple of wash stands with pitchers, a mug, and a castor that may not have been ceramic. John, on the other hand, acquired a soap dish and cup and nine soup plates. These were the only family members bidding, but five other bidders walked away with "lots" of dishes, thus contributing just under $200 toward the settling of the estate (BCC 1863: PR:C627, Case 764). This was at a time when a 203-piece dinner service cost less than £8 sterling (Coysh and Henrywood 1982: 107).

Even given the auction, enough ceramic pieces have been left in the ground before and since the estate sale to consider the lifestyle of the Big House occupants. One chamber pot (white granite) and one CC ointment pot comprise the toiletware. Seventeen kitchenwares include one manganese-glazed redware, twelve stoneware, and four yellow wares. Both Albany and Bristol slip finishes and, of course, salt glazes occur on the stonewares; a number of the vessels are ginger beer bottles. One of the yellow wares is a large mixing bowl with bright blue and white slip banding.

Jacksonian teaware (n=35 vessels) outnumber tableware (n=24 vessels). Our only example of sprig painting, a saucer, was found at the Big House as was a thick-line motif vessel, two cut-sponge teas, and all of the main house transfer-prints. These prints include the blue-printed bowl with the Henderson & Gaines import mark, the brown-printed *Palestine* vessel, a blue-printed plate, a red-printed sherd, a black all-over "marble" print, and a purple-printed hollow ware handle. A dozen white granites of various forms and a child's bone china mug complete the picture for the Jackson era.

The last quarter of the 19th century includes the use of 18 white granite and one porcelain plate. This plate, one of 14 porcelain vessels, four of which are bone china, attributed to this period, echoes the white granite shapes of this period in its simplicity and lack of decoration. One white granite pattern, *Nosegay*, has been identified on an unknown hollow vessel. *Nosegay* is a product of the E & C Challinor pottery of Staffordshire, England, who operated under this name from 1862-1891 (Godden 1991:137), but who only produced white granite from 1850-1875 according to Heaivilin (1981). The remainder of the white-bodied wares are teas: one dipt, one banded, 19 plain white granite, and one lustrous copper tea leaf cup. Four of the 14 porcelain vessels from this period are bone china, most of them undecorated, although one sports a gilded ruffled rim. The stoneware from this period includes a "moonshine" type jug with a white Bristol interior and exterior and one ginger-beer bottle.

By far the largest segment of the Big House ceramics (63 percent) are attributed to the convict-labor period. The park era has only 3.5 percent of the vessels, including all three engobes and one unidentified bone china vessel. This leaves five vessels whose attribution to a single occupation period cannot be made. These include one gilded and embossed tea, three unknown porcelain vessels, and one enameled porcelain mug embellished with the haunting legend, "remember me."

The residential compound comprises 93 percent of the total vessel count at the site (Table 2). Ninety-seven percent of these vessels are datable, and 73 percent are recognizable for form or function. All decorative styles previously described are present as well as all of the possible vessel forms. The Jackson era accounts for 26 percent of the vessels from the site; the convict-labor interval, 62 percent; and the park term, 2 percent; leaving 3 percent in an "attribution unknown" category.

## Industrial Complex

Prior to beginning the LJSAL excavation, not much thought had been given to what type or form of ceramics might occur within the industrial complex. Interviews conducted during the 1989 archeological survey suggested that the sugar house had been occupied as a residency at one time by a descendant of one of the original plantation slaves. Found later were the reference to meals held during the round-the-clock operation of mills at peak harvest time each year, and the inventory turned over to the new owner when the property changed hands in 1873 (Few 1995:3.22). The latter listed the dishes used by all the convicts. No doubt one or more of these events accounts for the variety of ceramics recovered at the Industrial Complex.

The Industrial Complex ceramics make up 7 percent of the entire site collection. The 19 vessels comprise 26 percent tableware, 37 percent teaware, and 21 percent kitchenware. No toiletware has been recovered. The other 16 percent represent unrecognizable vessel forms. The park period accounts for 10 percent of these ceramics; the convict-labor period contributed 53 percent; and the Jackson era, 37 percent. There were no decorated wares prior to the park period, and then, only one unidentified decalcomania vessel.

The function of structure I is unknown, however, much livery furniture turned up as well as five ceramic vessels. Two white granite tablewares date from the Jackson era. One yellow ware and one white granite tea date to the convict-labor period, and the park era contributed one unknown decalcomania vessel produced by the French China Company of Sebring, Ohio from shortly before 1900-1916 (Lehner 1988:155).

The Sugar Mill ceramics with 14 vessels was no more diverse than structure I. All the vessels were temporally attributable, and 12 were recognizable by form or use. While staffed by criminals, the mill's collection was dominated by white granite (63 percent) (Figure 6), but included two stone kitchenwares—one a jug and one a ginger-beer bottle—and a fluted porcelain teacup. While operated by slaves, the mill acquired four white granite teawares and one kitchen stoneware vessel. One unidentified decal-decorated vessel comprises the park period collection at the Sugar Mill.

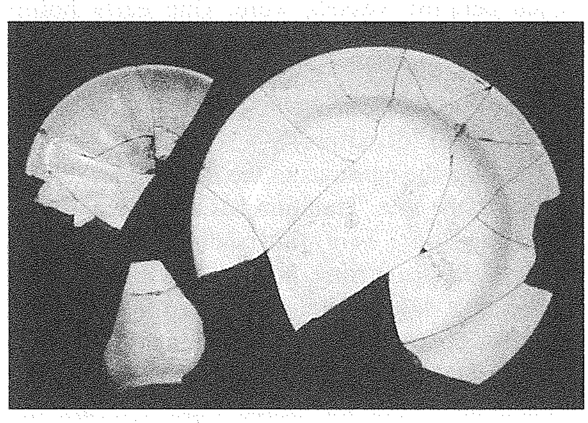

Figure 6. White Granite vessels from the Sugar Mill. The cup and saucer date to the Jackson era, and the round plate is from the convict-labor period.

## SUMMARY

The ceramic assemblage hints at the functions of the Lake Jackson structures. As it stands today, kitchenware occurred at every structure, yet dominated only the structures A and C collections. Toiletwares appeared in very limited numbers and only at structures B, D, and the Big House. With

**Table 2. Vessel Distribution by Ceramic Type and/or Decorative Style**

| Ceramics | Home Compound | | | | | | | Industrial Complex | |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | 1x1 | Main House | I | Sugar Mill |
| **Refined White-Bodied Earthenware** | | | | | | | | | |
| Cream-colored | | 1 | | 2 | | | 1 | | |
| Edgeware | | 3 | | | | | | | |
| Sponge | 1 | 2 | | 2 | | | 5 | | |
| Dipt | | 1 | | 1 | | | 1 | | |
| Paint/Enamel | 1 | 2 | | 1 | | | 4 | | |
| Print | 1 | 3 | 1 | 4 | | | 6 | | |
| Tea Leaf | | | 1 | | | | 1 | | |
| Banded | | 2 | | | | | 1 | | |
| Decal | | | | | | | | 1 | 1 |
| Engobe | | | | | | | 3 | | |
| White Granite | | | | | | | | | |
| Vitreous | 1 | 2 | | 1 | 1 | | 12 | 2 | 4 |
| Non-Vitreous | 10 | 13 | 4 | 19 | | 5 | 42 | 1 | 5 |
| **Porcelain** | | | | | | | | | |
| Hard Paste | 1 | 2 | | 5 | 1 | | 10 | | 1 |
| Bone China | 1 | | | | | | 6 | | |
| **Coarse Earthenware** | | | | | | | | | |
| Redware | | | 1 | | | 1 | 1 | | |
| Stoneware | 7 | 1 | 3 | 9 | 2 | 1 | 12 | | 3 |
| Yellow ware | | 3 | | | | | 5 | 1 | |
| TOTALS | 23 | 35 | 10 | 44 | 4 | 7 | 110 | 5 | 14 |

only two exceptions, teaware consistently occurred in greater numbers than tableware (Table 2).

As a Jackson holding, the full spectrum of decorated whiteware appears at structures B, D, and the Big House, with the most expensive styles dominating in all cases. Only 22 white granite vessels dating to this period were recovered, and then only at the Big House, structure I, and the Sugar Mill. Ointment pots are the only toiletwares appearing from the slave-labor period. Teaware dominated every structure except structures E and I, where low sample sizes prevented functional determinations. In fact, no teaware or kitchenware occurred at structure I during the slave-labor period. This same period evidences no tableware at structures C, D, or the Sugar Mill.

The convict-labor period saw more parallels between structures B, D, and the Big House. White granite, the ceramic style of choice and the most expensive, dominated every structure until the style was superseded by elaborate decorative styles such as decalcomania. Where there is decorated whiteware, however, it is either the cheapest (dipt or cut-sponge) or the latest and greatest (tea leaf and banded) style available; the decorated vessels are always tea wares. No kitchenware occurs at structure B during this period and no tableware was present at structure I. The only toiletware recovered is one yellow ware spittoon at structure B and one white granite chamber pot at the Big House.

By dint of their long popularity, the median date for decalcomania falls within the park period. Some of it probably pertains to the convict-labor period, but some, no doubt, represents the owner's less valuable dinnerware used on a picnic at the park. By the 1940s and 1950s, this decorative style had become quite affordable and was gradually declining in popularity. None of the decalcomania is recognizable by form, and no kitchenware occurs in this period. Two of the three engobes from this period are tableware, but the other is unidentified.

Besides the establishment of waste management systems, the paper and plastic goods designed specifically for recreational meals eventually had an immense effect upon the material recovery or lack thereof for the park period. Nevertheless, humans continue to eat, sleep, excrete, and create trash, and will forever leave material remnants of some sort to betray their presence, if only for the landfill archeologists of the future.

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# The Vertebrates from Lake Jackson State Archeological Landmark

*W. L. McClure*


## ABSTRACT

Recent excavations at Lake Jackson State Archeological Landmark yielded more than 17,000 elements of vertebrate animals. Bones of native and introduced animals may have accumulated at the site in prehistoric times, during construction and operation of the plantation and sugar mill, after they were abandoned, and when the site became a public park. The vertebrate remains were examined to help determine cultural activities during particular occupation intervals at the various structures.


## INTRODUCTION

The Lake Jackson State Archeological Landmark (41BO172) is in Lake Jackson, Brazoria County, Texas, on the banks of Lake Jackson. It is the location of a plantation and sugar mill that were constructed and operated in the last half of the 19th century. Operations ceased on the property when the structures were severely damaged by the 1900 hurricane, and they remained unused until a public park was developed there in 1945. This development included the major movement of soil, rubble, and archeological materials about the site.

Archeological testing and excavations were carried out at the Lake Jackson site from 1991-1996 during University of Houston at Clear Lake classes and during the 1995 and 1996 Texas Archeological Society field schools, all under the direction of Joan Few. This work documented a prehistoric occupation; a pre-Civil War sugar and cotton plantation; a post-Civil War sugar mill run by convict labor; and after a 45-year hiatus, a 20th century park. The remains of vertebrates that were recovered during excavations at Lake Jackson have been identified to the extent possible to determine if information concerning cultural activities during the four episodes of site occupation could be ascertained.

In addition to excavations at the various structures, areas between several of the structures were tested, and the matrix from some of these tests were fine-screened. Numerous fragments of marine mollusks, including complete gastropod shells, were common, and these appear comparable to materials found on the beach of the Gulf of Mexico. The mollusks were probably brought to the site for stabilization of the roadway.

## FORMATION PROCESSES

Park development activities would have fractured bones and mixed them, as well as artifacts, from different areas and strata. This made it necessary to search for evidence of disturbance and alteration of the bone sample before attempting to assign vertebrate remains to a particular structure or occupational episode.

Many things can and do happen to bones between the time that they are part of a living animal and the time they are examined by a faunal analyst. Animals that are raised or acquired for food purposes are butchered with various different parts being discarded or used for non-food purposes from one culture to another. From personal experience I know that the heads, tails, and lower parts of legs of game animals are often left at the kill site. Some hunters take home only the breast of game birds. Fish are often beheaded and filleted in the field. The bones from the spare parts would not be in the refuse around the cooking place. Butchering separates bones from each other and reduces some bones to parts, depending on the intended cooking process. Various bones or parts of bones may be distributed to other households before or after cooking. The method of cooking will leave some bones more subject to decomposition than others.

Disposal of bones and other refuse after food consumption will differ between various groups and from different circumstances. Cooking will seldom cause the bones to be burned completely, although the ends and edges may show signs of exposure to fire. Wild fires through a disposal area will burn the edges and upper surfaces of bones more than the lower parts. A mixture of burned and unburned bone at one place is an indication that some mixing has occurred since the primary disposal of the bones. Disposal of the inedible parts of the animals and the bones after consumption is also variable, and pet dogs can be involved in the breakage and scattering of bones.

Traffic by vehicles, animals, and humans can fragment and disperse bones. The recent construction of the park road and ditch at Lake Jackson would have fragmented and rearranged the bones and artifacts. Fragmentation and degradation of bones also occurs in the soil due to chemical actions, moisture changes, and the activities of fossorial animals. Excavation, screening, washing, and transport during archeological activities also impact the bone assemblage.

Bones recovered in archeological contexts may also be indicative of natural deaths of domestic stock or wild animals. Consumption by carnivores and scavengers leaves bones in different conditions than would consumption by raptors or reptiles.

## RESULTS OF THE FAUNAL ANALYSIS

There are 17,459 vertebrate remains in the assemblage, including bones, bone fragments, fish scales, and bird egg shell fragments (Table 1). Most of the bones are incomplete, but their condition is good. Of these, 42 percent are too fragmentary to identify beyond unidentified vertebrate. Of the 10,111 elements that have been identified, 50 percent are fish, less than 1 percent are amphibians, 6 percent are reptiles, 6 percent are birds, and 38 percent are mammals (see Table 1).

Eleven varieties of fishes are identified. This includes three coastal marine fishes (gafftopsail catfish, sea catfish, and sheepshead) and freshwater species that are native to the area and are probably in Lake Jackson today (Hubbs 1982). Gar (n=2436) appears to be the dominant fish. Only 19 of the gar elements are vertebrae and cranial bones, while the rest are scales that are resistant to degradation and more apt to be preserved than other bones. Bones of largemouth bass, sunfish, and freshwater catfish are present in larger numbers than freshwater drum and smallmouth buffalo. Unidentified fish remains include 1863 scales, 92 vertebrae, and a few other parts. Less than 2 percent of these are from fish as small as a four inch-long sunfish or as large as an 18 inch-long bass, while the remainder are from fish between those lengths.

There are four varieties of amphibians in the sample. Bullfrogs, leopard frogs, tree frogs, and toads are common in the area today (Dixon 1987).

Reptiles are represented by alligator, six kinds of turtles, two kinds of lizards, and three kinds of snakes. The slider is the most plentiful turtle in the assemblage. The others are snapping turtle, mud turtle, stinkpot, box turtle, and softshell. The lizards include green anole and ground skink. The snake species are rat snake, kingsnake, and water snake. All of these reptiles are currently common in and around Lake Jackson (Dixon 1987).

Twenty-two varieties of birds are identified, both migratory and resident. Migratory birds include cormorant, wigeon, teal, shoveler, mallard, gadwall, Canada goose, snow goose, ruddy duck, hawk, sanderling, mourning dove, brown thrasher, meadowlark, and grosbeak (Teres 1980). Among the resident birds are little blue heron, yellow-crowned night heron, turkey, blue jay, and mockingbird. Domestic duck and domestic chicken are introduced species. The unidentifiable bones range in size from ducks and chickens to turkey. Egg shell fragments are comparable in size and texture to chicken eggs.

Thirty-one kinds of mammals are represented in the Lake Jackson bones. The only migratory mammal is a hoary bat. Resident native mammals include oppossum, short-tailed shrew, least shrew, armadillo, swamp rabbit, cottontail, gray squirrel, fox squirrel, pocket gopher, beaver, harvest mouse, pigmy mouse, white-footed mouse, rice rat, hispid cotton rat, woodrat, raccoon, mink, skunk, bobcat, and deer (Davis and Schmidly 1994). Domestic

**Table 1. Number of Identified Specimens in Each Structure**

| TAXON | STRUCTURES | | | | | | | | | TOTALS |
|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | I | MH* | SM* | EXT* | |
| Unidentified vertebrate (Vertebrata) | 1034 | 2153 | 45 | 1439 | 8 | 256 | 2344 | 28 | 41 | 7348 |
| Unidentified fish (Teleostei) | 62 | 76 | 2 | 137 | – | 17 | 2099 | 7 | – | 2400 |
| Gar (*Lepisosteus* sp.) | 1549 | 99 | – | 39 | – | 20 | 708 | – | 21 | 2436 |
| Channel catfish (*Ictalurus* cf *punctatus*) | 3 | 8 | – | 18 | – | – | 23 | 1 | – | 53 |
| Gafftopsail catfish (*Bagre marinus*) | – | – | – | – | – | – | 1 | – | – | 1 |
| Sea catfish (*Arius felis*) | – | – | – | – | – | – | 1 | – | – | 1 |
| Smallmouth buffalo (*Ictiobus bubalus*) | – | 3 | – | 1 | – | – | 14 | – | – | 18 |
| Sunfish (*Lepomis* sp.) | 1 | 1 | – | 7 | – | – | 33 | – | 1 | 43 |
| Largemouth bass (*Micropterus salmoides*) | – | 14 | – | 7 | – | 1 | 41 | – | – | 63 |
| Freshwater drum (*Aplodinotus grunniens*) | – | – | – | – | – | – | 1 | – | – | 1 |
| Sheepshead (*Archosargus probatocephalus*) | – | – | – | – | – | – | 1 | – | – | 1 |
| Treefrog (*Hyla* sp.) | – | 1 | – | – | – | – | – | – | – | 1 |
| Toad (*Bufo* sp.) | – | 1 | – | 3 | – | – | – | – | – | 4 |
| Bullfrog (*Rana catesbeiana*) | – | – | – | 1 | – | – | 1 | 1 | – | 3 |
| Leopard frog (*Rana sphenocephala*) | – | 3 | – | 1 | – | – | – | – | – | 4 |
| Alligator (*Alligator mississippiensis*) | 2 | 10 | – | 1 | – | 54 | 2 | – | – | 69 |
| Unidentified turtle (Testudinata) | 26 | 20 | 4 | 46 | – | 2 | 81 | – | 21 | 200 |
| Snapping turtle (*Chelydra serpentina*) | – | – | – | 1 | – | – | – | 2 | – | 3 |
| Mud turtle (*Kinosternon subrubrum*) | – | – | – | – | – | 7 | 1 | – | – | 8 |
| Stinkpot (*Sternotherus odoratus*) | – | – | – | – | – | – | 1 | – | – | 1 |
| Slider (*Chrysemys* sp.) | 48 | 31 | 19 | 19 | 7 | – | 49 | 22 | 47 | 242 |
| Box turtle (*Terrapene carolina*) | – | – | – | – | – | – | 2 | – | – | 2 |
| Softshell (*Trionyx* sp.) | 2 | – | – | – | – | – | – | – | – | 2 |
| Green anole (*Anolis carolinensis*) | – | – | – | – | – | – | 6 | – | 1 | 7 |
| Ground skink (*Scinella lateralis*) | – | – | – | – | – | – | 2 | – | – | 2 |
| Unidentified snake (Serpentes) | – | – | – | 2 | – | – | 4 | – | – | 6 |
| Rat snake (*Elaphe* sp.) | 3 | 2 | – | 1 | – | – | – | – | – | 6 |
| Kingsnake (*Lampropeltis* sp.) | – | – | – | 6 | – | – | – | – | – | 6 |

* MH=Main House; SM=Sugar Mill; EXT=Exterior areas

**Table 1.** *(Continued)*

| TAXON | STRUCTURES A | B | C | D | E | I | MH* | SM* | EXT* | TOTALS |
|---|---|---|---|---|---|---|---|---|---|---|
| Water snake (*Nerodia* sp.) | – | – | – | – | – | – | 24 | – | – | 24 |
| Unidentified bird (Aves) | 5 | 127 | 2 | 138 | – | – | 129 | 9 | 2 | 412 |
| Heron (Ardeidae) | – | 1 | – | – | – | – | – | – | – | 1 |
| Little blue heron (*Florida caerulea*) | – | 1 | – | – | – | – | – | – | – | 1 |
| Yellow-crowned night heron (*Nyctanassa violacea*) | – | – | – | – | – | – | 1 | – | – | 1 |
| Double–crested cormorant (*Phalacrocorax auritus*) | – | – | – | – | – | – | 1 | – | – | 1 |
| Wigeon (*Anas* cf *americana*) | – | 4 | – | 12 | – | – | – | 2 | – | 18 |
| Teal (*Anas* sp.) | 1 | 14 | – | 17 | – | – | 7 | – | – | 39 |
| Shoveler (*Anas* cf *clypeata*) | – | – | – | – | – | – | – | 1 | – | 1 |
| Mallard (*Anas* cf *platyrhynchos*) | – | 4 | – | 11 | – | – | – | 1 | – | 16 |
| Gadwall (*Anas* cf *strepera*) | – | – | – | 13 | – | – | 2 | 1 | – | 16 |
| Canada goose (*Branta* cf *canadensis*) | – | – | – | 1 | – | – | – | – | – | 1 |
| Snow goose (*Chen* cf *caerulescens*) | – | 1 | – | – | – | – | – | – | – | 1 |
| Ruddy duck (*Oxyura jamaicensis*) | – | – | – | 1 | – | – | 1 | – | – | 2 |
| Domestic duck (*Cairina moschata*) | – | – | – | – | – | – | – | 31 | – | 31 |
| Hawk (*Buteo* sp.) | – | 1 | – | – | – | – | – | – | – | 1 |
| Domestic chicken (*Gallus gallus*) | – | 14 | – | 12 | – | – | 26 | 6 | – | 58 |
| Turkey (*Meleagris gallopavo*) | – | 2 | – | 5 | – | – | – | 1 | – | 8 |
| Sanderling (*Calidris alba*) | – | 1 | – | – | – | – | – | – | – | 1 |
| Mourning dove (*Zenaida macroura*) | – | – | – | 1 | – | – | – | 1 | – | 2 |
| Blue jay (*Cyanocitta cristata*) | – | 2 | – | 1 | – | – | – | – | – | 3 |
| Mockingbird (*Mimus polyglottos*) | – | – | – | – | – | – | 2 | – | – | 2 |
| Brown thrasher (*Toxostoma rufum*) | – | – | – | 1 | – | – | – | – | – | 1 |
| Meadowlark (*Sturnella* sp.) | – | 2 | – | – | – | – | 1 | – | – | 3 |
| Rose–breasted grosbeak (*Pheucticus ludovicianus*) | – | 1 | – | – | – | – | – | – | – | 1 |
| UID small to medium mammal (Mammalia) | 13 | 42 | 5 | 68 | 1 | – | 97 | 5 | 6 | 237 |
| UID pig/deer–size mammal (Mammalia) | 72 | 206 | 3 | 164 | 2 | 16 | 74 | 16 | 58 | 611 |
| UID cow–size mammal (Mammalia) | 17 | 209 | 10 | 37 | – | 3 | 45 | 4 | 4 | 329 |
| Opossum (*Didelphis virginiana*) | 2 | 27 | – | 5 | – | – | 22 | 5 | 11 | 72 |
| Short–tailed shrew (*Blarina brevicauda*) | – | – | – | – | – | – | 3 | – | – | 3 |

* MH=Main House; SM=Sugar Mill; EXT=Exterior areas

**Table 1.** *(Continued)*

| TAXON | STRUCTURES | | | | | | | | | TOTALS |
|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | I | MH* | SM* | EXT* | |
| Least shrew (*Cryptotis parva*) | – | – | – | – | – | – | 31 | – | – | 31 |
| Hoary bat (*Lasiurus cinereus*) | – | – | – | 1 | – | – | – | – | – | 1 |
| Nine–banded armadillo (*Dasypus novemcinctus*) | 203 | – | – | 2 | – | 1 | – | – | 2 | 208 |
| Swamp rabbit (*Sylvilagus aquaticus*) | 1 | 45 | – | 53 | – | – | 35 | 20 | 1 | 155 |
| Eastern cottontail (*Sylvilagus floridanus*) | 1 | 16 | – | – | – | – | 9 | – | – | 26 |
| Gray squirrel (*Sciurus carolinensis*) | – | 5 | – | 37 | – | – | 7 | – | – | 49 |
| Fox squirrel (*Sciurus nigra*) | – | – | – | 1 | – | – | 4 | 1 | – | 6 |
| Louisiana pocket gopher (*Geomys breviceps*) | – | – | – | 3 | – | – | – | – | – | 3 |
| Beaver (*Castor canadensis*) | – | – | – | 1 | – | – | – | – | – | 1 |
| Rat or mouse (Rodentia) | – | 14 | – | 15 | – | – | 140 | 1 | – | 170 |
| Fulvous harvest mouse (*Reithrodontomys fulvescens*) | – | – | – | – | – | – | 14 | – | – | 14 |
| Pigmy mouse (*Baiomys taylori*) | – | – | – | – | – | – | 2 | – | – | 2 |
| White–footed mouse (*Peromyscus* sp.) | – | 1 | – | – | – | – | – | – | – | 1 |
| Rice rat (*Oryzomys palustris*) | – | 1 | – | 1 | – | – | – | – | – | 2 |
| Hispid cotton rat (*Sigmodon hispidus*) | – | 161 | – | 1 | – | – | 101 | – | – | 263 |
| Eastern woodrat (*Neotoma floridana*) | – | – | – | – | – | – | 7 | – | – | 7 |
| House mouse (*Mus musculus*) | – | – | – | 8 | – | – | 14 | – | – | 22 |
| Norway rat (*Rattus norvegicus*) | 5 | 138 | 4 | 145 | – | – | 18 | 6 | – | 316 |
| Black rat (*Rattus rattus*) | – | 5 | – | 34 | – | – | 5 | – | – | 44 |
| Raccoon (*Procyon lotor*) | – | – | 2 | 6 | – | 3 | 21 | 1 | – | 33 |
| Mink (*Mustela vison*) | – | – | – | – | – | – | 1 | 1 | – | 2 |
| Striped skunk (*Mephitis mephitis*) | – | – | – | – | – | – | – | 23 | – | 23 |
| Carnivore (Carnivora) | 1 | – | – | – | – | – | – | – | – | 1 |
| Domestic dog (*Canis familiaris*) | – | 1 | – | – | – | – | 1 | – | – | 2 |
| Domestic cat (*Felis domesticus*) | 1 | – | – | – | – | – | 1 | 8 | – | 10 |
| Bobcat (*Lynx rufus*) | 1 | – | – | – | – | – | – | – | – | 1 |
| Domestic pig (*Sus scrofa*) | 43 | 174 | 4 | 142 | – | 8 | 48 | 13 | 14 | 446 |
| White–tailed deer (*Odocoileus virginianus*) | 2 | 18 | – | 6 | – | 1 | 7 | 1 | 1 | 36 |
| Domestic cow (*Bos taurus*) | 128 | 441 | 14 | 56 | 6 | 8 | 44 | 23 | 31 | 751 |
| Horse (*Equus caballus*) | 3 | 1 | – | – | – | – | 1 | – | – | 5 |
| Human (*Homo sapiens*) | – | – | – | 1 | – | – | – | – | – | 1 |
| TOTALS | 3229 | 4101 | 114 | 2729 | 24 | 397 | 6361 | 242 | 262 | 17460 |

* MH=Main House; SM=Sugar Mill; EXT=Exterior areas

mammals include dog, cat, pig, cow, and horse. Introduced rodents include house mouse, Norway rat, and black rat. One human specimen is a tooth with a large cavity.

Because there are no unquestionable bison bones at the site, and there is little possibility of there having been bison in Brazoria County at the time of the historic occupation, large bovid bones are probably all of domestic cow (see Table 1). The fragments of bones of cow-size mammals are also likely from cows. Since 13 times as many pig bones as deer bones were identified, it is probable that most of the pig/deer-size bones are of pigs.

### Structure A

Structure A was built during the post-Civil War era. It may have been a storage building.

Potential food resources in the fauna are fish, turtle, duck, rabbit, deer, pig, and cow. Of these animals, most of the recovered materials are from non-edible parts. The pig bones include teeth, cranial fragments, and foot bones; five of the pig long bones were sawed for steaks. The cattle bones include many teeth and several foot bones. Six of the cow bones have been sawed; one is a sirloin steak and another is a chuck roast cut. Other pig and cow bones have been hacked with a cleaver or heavy knife, and vertebrae have been severed longitudinally during butchering. Animal bones that are probably not related to food consumption include snake, armadillo, rat, cat, and bobcat.

The distribution of the armadillo bones provides clues concerning past site disturbances. Its 203 bones are scattered in many different levels of many excavation units, but are probably from the same individual. As the armadillo first entered Texas after 1900 (Davis and Schmidly 1994), this particular armadillo died sometime after termination of the sugar mill operations and prior to the park construction. Another clue to disturbances is the 1548 gar scales (probably from the same fish) that are scattered in several levels and units, some of which also include armadillo bones.

Burned bones are in many levels and units, and comprise 11 percent of the bones (excluding gar scales) in these contexts. These levels also include gar scales, armadillo bones, and prehistoric artifacts. Below the mixed zone are pig bones sawed for steaks.

The considerable vertical and horizontal distribution of gar and armadillo remains, and their mixture with prehistoric materials, indicates that much of the excavated deposits at Structure A have been brought in from other locations. Its origin is probably as refuse from butchering, along with the consumption of pig and cattle and a few wild species. This refuse apparently has accumulated on an area that has evidence of prehistoric occupation. Remains of non-domestic animals may have been added at the same place during post-1900 activities. The major movement of the deposits occurred after 1900, probably during preparation of the park grounds.

### Structure B

Structure B was constructed prior to the Civil War, when the plantation and sugar mill were in operation. It served as a domestic residence and perhaps as a jail (see Few, this volume).

The identifiable non-domestic bones include non-edible parts of fish, alligator, and deer along with mostly non-edible parts of turtles, birds, opossum, and rabbits. The chicken, pig, and cow bones include both edible and non-edible parts. Three pig bones have been sawed for steaks, and 17 of the cow bones are sawed; none of the pig and cow vertebrae have been longitudinally severed.

There is a low percent of burned bones at Structure B, indicating some movement of the remains subsequent to their initial disposal. However, the most notable feature of the bones is the preponderance of rodents, including numerous bones of native and introduced rats. This may represent a period when owls dropped the bones within regurgitated pellets in or at that building. The rodent bones are scattered both vertically and horizontally in most of the excavated area. This distribution could not have occurred from owl droppings with walls standing while nearly five feet of debris accumulated. This suggests that the soil containing the rodent bones has been thoroughly mixed and is from another source. There also are many gar scales and opossum bones (probably from one individual each) scattered throughout the same areas to further suggest mixing by agents other than scavengers. Prehistoric artifacts are present with and above these same remains. It is likely that the majority of the excavated material at Structure B represents materials from a source that includes a standing structure that had been used by owls.

There is some indication that portions of the lower deposits in the northeast corner of room C next to the hearth may not have been disturbed. The presence of edible and non-edible parts of bones of domestic stock as well as fish, turtles, rodents, and wild game suggest that room C may have been a work area as well as a living space. However, there are numerous rodent bones in the corner of the room, suggesting it may have been the drop zone for owl pellets. This further suggests that the mixed material from much of Structure B has been reworked by the bulldozers rather than having been brought from a distance.

Consideration of the vertebrate remains from Structure B indicates that almost all of the excavated matrix has been disturbed during the park construction. Prior to that event, Structure B was used as a dump for food processing, and at a different time part of the structure was still standing and used by owls as a roost. Hunters and fishermen may have field-dressed their game and fish at the site after 1900.

### Structure D

Structure D was built after the Civil War. It was used as a residence, and perhaps for functions related to running the mill. A part of room A appeared to have been undisturbed by park construction activities.

Bones of fish, turtles, wild ducks, rabbits, and squirrels, are common in the assemblage from Structure D. However, rodent bones are more plentiful. Levels 3 and 4 contain 94 percent of the rodent bones, and these probably represent the surface in room A between the time of the 1900 hurricane and 1945 park construction. Part of the structure must have been still standing and served as a perch for owls. The fish and game animal bones may reflect disposal during the same interval by local people. The bones include representative elements of edible and non-edible portions of domestic and game animals. Food preparation as well as consumption may have occurred in the room. The ratio of bones of fish, birds, rabbits, pigs, deer, and cows at Structure D is comparable to the array of bones from the overseer's house at Eagle Island Plantation (Gross et al. 1993). Eagle Island Plantation (41BO141) is the next plantation downstream from the Lake Jackson Plantation.

### Main House

The Main House was built in 1851 by Abner Jackson. It served as a residence for the owners and/or managers during the time the plantation and sugar mill were operational (see Few, this volume).

More vertebrate remains have been recovered from the Main House than from any other structure (see Table 1). Bones of cows and pigs are equally represented, along with chicken. Deer and turkey indicate the hunting of larger game, but fish, turtles, birds, rabbits, and squirrels are also prominent. The bones of fish, and domestic and game animals, are distributed in all excavated areas. Rodent bones are numerous, although they are not found on the east side of the house. This concentration on the west side—with 91 percent in levels 3 and 4—suggests that owls may have been using the house or nearby trees for roosts. The bones from the Main House, although of unknown source, appear to represent one or more locations where wild fish and game, and domestic stock, have been processed, consumed, and the refuse discarded.

### Sugar Mill

The Sugar Mill structure was built and partially rebuilt during the occupation of the site by the Jacksons and later owners. Its purpose was to convert sugar cane into sugar and molasses.

At the Sugar Mill, a few bones of chickens, pigs, and cows have been recovered as well as bones of fish, turtle, birds, and small mammals. The bones from all parts of the bodies of domestic ducks, rabbits, skunks, and cats are scattered about the excavated area. This array of bone appears to be typical of natural scavenging activities rather than wholesale disturbance by human activities. It is unlikely that cats and domestic ducks were in the area before the park was established. The fish and rabbit bones may have been discarded at the same time. Thus, it appears that the deposits around the Sugar Mill have not been as extensively disturbed as some of the other structures. An ischium of a pig, a cow tibia, and a cow thoracic vertebra are the only bones that have been sawed.

### Structures C, E, I, and Areas between Structures

The numbers and kinds of bones recovered in the other structures, as well as in the various excavations outside of the structures, are not useful in resolving questions about the past use of the site. These excavations have only between 24-397 bones per area (see Table 1).

## SUMMARY

A large number of bones of vertebrates were recovered during the Lake Jackson excavations. These bones probably accumulated in several distinct intervals: (1) prior to the arrival of Europeans; (2) during construction and operation of the plantation and sugar mill; (3) after the structures were abandoned following destruction of some of them by the 1900 hurricane; and (4) after establishment of a park on the site. Major alterations of the structures and sediments occurred at the beginning of the final interval.

Domestic fowl, stock, and pets (other than possibly dogs) would not have been present during the first interval. Chickens, pigs, and cattle would have been raised for consumption during the second interval, while rodents and insectivore bones would have accumulated at the partially demolished structures during the third interval. Bones of fish and game animals would be expected during each interval. Armadillos would not have been there before the third interval.

Study of the bones indicates that domestic stock, fish, and wild animals were butchered and consumed on the grounds. Bones were discarded with only a small percentage being burned. Casual acquisition and consumption of fish and game animals, and the discarding of their bones, occurred after the mill and residences were abandoned. Major disturbance of the area during park construction mixed the sediments and cultural debris, after which there was a limited accumulation of fish and game fauna.

Because of the major disturbance known to have taken place during creation of the park, little of the fauna was considered to have come from sufficiently undisturbed contexts to segregate associated groups of animal remains that could be attributed to a particular temporal interval. Additional information about the specific food habits of the people that lived at Lake Jackson can only be ascertained when undisturbed areas can be found and excavated.

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# Texas' Early Sugar Industry: A Comparative Study of Four Antebellum Sugar Mills in Brazoria County, Texas

*Joan Few*

## ABSTRACT

Between 1828 and 1861, approximately 40 sugar plantations and mills were constructed in the lower Brazos River valley of Texas, producing millions of pounds of granulated sugar and thousands of barrels of molasses each year. No blueprints or documents have been found that describe in detail the construction of these mills. This article compares the information obtained through archeological research on four Texas sugar mill ruins that have identified architectural features which reveal patterns in the components and configuration of the sugar refining process.

## INTRODUCTION

Columbus brought cuttings of sugar cane to the Western Hemisphere on his second voyage. He planted it in Santo Domingo in what is now the Dominican Republic. The first sugar mill in the Western Hemisphere was built in 1508 in Isabela, a village near Santo Domingo.

After his conquest of Mexico, Hernando Cortes established two plantations. From these beginnings, the cultivation of sugar cane spread to Brazil, Peru, and Argentina. By the mid-1600s, tropical America became the greatest sugar-producing area in the world (Pennington 1977:768).

Moses Austin, an impresario in Spanish Texas in 1820, stated to the Spanish governor at San Antonio that "it was his intention to provide for his subsistence by raising sugar and cotton" (Creighton 1975:196). The Spanish governor must have been aware that sugar cane would grow in Texas because a sugar mill was established by 1755 at Mission San Jóse y San Miguel de Aguayo in San Antonio (Clark 1976:245).

Yldephonso Marmolejo, in an inventory of Mission San Jóse in 1755, "described the *ingenio* at the mission as being 15 varas long, 6 1/2 varas wide roofed with tule or native cane. It had wooden moledoras for crushing the cane, three cauldrons for boiling the syrup and a trough for conducting the syrup from the mill to the vats" (Clark 1976:247). An inventory made by Governor Manuel Muñoz in 1794 listed a water mill to grind the cane, and he described the mill as "a vat of masonry with a metal basal grate weighing 338.9 pounds for the cooking of sugar cane syrup to make sugar cones." Muñoz also noted that 207,186 sugar canes were grown in 186 rows in four fields (Clark 1976:247).

This type of sugar mill compares in size and processing with other small 18th and 19th century mills used to process cane and sorghum in Texas, Georgia, and Mexico. The differences between the small mill at Mission San Jóse and the industrial mills that developed in the 19th century in the Brazos River area of Texas include the size of the mills; the quantities of sugar produced; the quality of the sugar produced in the industrial process; and the world market of the industrial mills compared to the domestic market of the San Jóse mill.

After receiving his royal commission to bring 300 families to Texas, Austin returned home to Missouri and died soon after his return. His son, Stephen, agreed to carry on the impresario grant. Austin traveled to Natchitoches, where he met with Spanish commissioners who acknowledged him as heir to his father's grant (Fehrenbach 1968:136). Austin was allowed to survey the country and choose a site for his colony. He searched the area between Nacogdoches and San Antonio, and eventually claimed the land south of the Camino Real and between the Colorado and Brazos rivers (Fehrenbach 1968:137).

Austin's colonists began to arrive in 1821 (Fehrenbach 1968:138). The settlers in the colony recognized three types of soil in what came to be Brazoria County: (1) "cane land," very rich and easily cleared; (2) "peach land," considered the finest; and (3) "prairie land" (Platter 1962:4-5). The "peach land" was identified by the wild peach, and the cane land by dense stands of hardwood trees (United States Department of Agriculture 1981). According to Johnson (1961:11):

> Brazoria, Fort Bend, Wharton, and Matagorda counties soon became recognized as the best cane lands. Within these counties, the growing season was long enough to allow the cane to mature sufficiently for the extraction of sugar. Counties to the north of this region produced cane which would yield juice too low in saccharin [sucrose] content to produce sugar...

In 1828, sugar was growing in Texas and Texans produced between sixty to eighty hogsheads (barrels containing about one thousand pounds of crystallized sugar); for 1829, 140 hogsheads were produced (Creighton 1975:197). Johnson (1961:11-13) suggests that:

> [a]lthough the sugar industry was fast expanding in the early 1840s, it was still in an experimental stage. All mills used horses for power and most used wooden rollers for crushing the cane...
>
> In 1843, Captain William Duncan erected a steam mill on his Caney Creek plantation. This was the first steam powered mill in Texas. It came, no doubt, as a result of Duncan's shift from cultivation of the Creole variety of cane to the purple ribbon variety, which due to its very tough fiber, required a steam mill.

In the 1840s, a substantial amount of money was required to establish a sugar plantation and mill. To build the mill and acquire the approximately 50 slaves needed (at $500 per slave), required about $50,000 (Johnson 1961:15). This was a very large sum of money in the pre-Civil-War years; however, farmers in Texas were better off than their counterparts in the other Southern states during this period. Land was available and it was cheaper (Lowe and Campbell 1987).

In 1852, according to P. A. Champomier (1852:44), a Louisiana sugar authority, Texas planters produced 11,023 hogsheads of sugar. Production fluctuated according to the weather and rainfall: in 1853, 8.228 hogsheads were produced; 7,513 hogsheads in 1854; 8,977 in 1855; 150 hogsheads in 1856; 2,000 in 1857; and 6,000 hogsheads in 1858 (Champomier 1853, 1854, 1855, 1858; Creighton 1975:205).

After the Civil War, Texas planters began to revive the sugar industry using convict labor. The Imperial Sugar Company began with the 1875 partnership of Edward H. Cunningham and Colonel Littleberry A. Ellis. To operate their sugar lands, they leased the entire Texas prison population and sublet those laborers they did not need (Armstrong 1991). In the 1890s, Colonel Cunningham built a mill and installed the machinery needed to refine sugar. In 1905, it became Cunningham Sugar Company and in 1917, the Imperial Sugar Company.

In 1878, the state produced 5,664 hogsheads of sugar, and by 1882, there were 46 planters operating sugar mills. A trend towards consolidation of sugar mills diminished the number of mills to 14 in 1892 and only 10 in 1909 (Johnson 1961). At the turn of the 20th century, Texas was producing 0.03 percent of the total United States supply of sugar (Johnson 1961:54). The decline in sugar production in Texas was mainly due to the loss of prison labor, as a 1910 law prohibited the leasing of any convicts (Johnson 1961). Sugar cane is no longer grown commercially along the upper Texas Gulf coast, but the Imperial Sugar Company still refines sugar imported from Hawaii, Louisiana, and Puerto Rico (Johnson 1961).

## FOUR SUGAR PLANTATIONS IN BRAZORIA COUNTY

This article looks at the architectural features and floor plans of four sugar plantations that were constructed in Brazoria County before the Civil War: Lake Jackson, Osceola, Varner-Hogg and Bynum (Figure 1).

The Lake Jackson plantation was established by the Abner Jackson family in the late 1840s and was a leading producer of sugar in Texas. Jackson eventually owned three plantations: "Lake Place," Darrington, and Retrieve. The history of the Abner

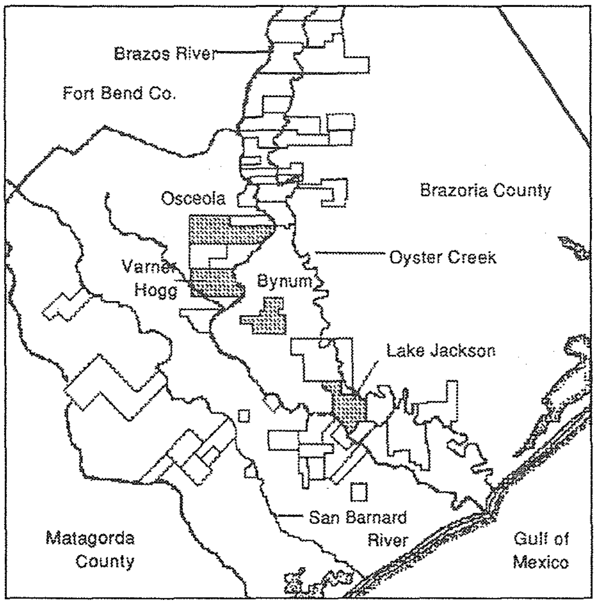


Figure 1. Antebellum Plantations in Brazoria County (after Platter 1961).

Jackson family and the development of the Lake Jackson plantation is published in Few et al. (1996), and is also summarized by Few (this volume) in an article reporting on the 1994 and 1995 Texas Archeological Society Field Schools. The Lake Jackson State Archeological Site is owned by the Lake Jackson Historical Association and the site is open to the public the first Saturday of each month.

Osceola plantation was part of the original grant of James Brown Austin, the son of Moses Austin, and the brother of Stephen F. Austin. His widow was Eliza M. Westall Austin, the daughter of Thomas Westall. Eliza Austin's second husband, Phillips, died at a young age. As a wealthy, twice widowed young lady she married her third husband Colonel William G. Hill in 1836. They established their first plantation, Waverly, and their second plantation, Osceola, on land she inherited from her first husband (McCormick 1897:142). Osceola is the best preserved sugar mill ruins in Brazoria County because of the protection and preservation efforts of the present owners. They have preserved a significant monument of Texas history.

The original owner of the Varner-Hogg plantation was C. R. Patton, who began building his sugar mill in 1847. Patton died in 1856 and his plantation went through several owners, the last and most influential owner being Governor James S. Hogg of Texas, who called the plantation, Varner (Texas Parks and Wildlife Department 1983). The plantation is now the Varner-Hogg State Park and is open to the public.

Bynum plantation was one of the two plantations owned by the Mills Brothers: David G. and Robert. Their two plantations, Low Wood Place and Bynum Place, were the largest sugar producers in Texas, according to the sugar production reports of P. A. Champomier (Champomier 1852-1858). Bynum is on privately owned land.

Information about Texas planters is found in census records, probates, financial records, newspapers, and plantation journals. No records or blueprints have been found that describe in detail how Texas planters constructed their sugar mills. Extensive archeological excavations have been conducted at the Lake Jackson State Archeological Site (Lake Jackson Plantation) by faculty and students from University of Houston Clear Lake (UHCL), with assistance from the members of the Texas Archeological Society (TAS), the Brazosport Archaeological Society (BAS), and the Houston Archeological Society (HAS). Limited excavations and a surface survey have been conducted at Osceola with UHCL students and volunteers from TAS, BAS, and HAS. At Varner-Hogg and Bynum, I have done surface mapping. A surface survey at Varner-Hogg has also been conducted by Texas Parks and Wildlife Department archeologists (Texas Parks and Wildlife Department 1983). All the mill ruins contain structural evidence that documents how they produced sugar. This research focuses on the similarities in these four mills in construction, size, and basic layout.

## THE SUGAR MAKING PROCESS AT OSCEOLA SUGAR MILL

Osceola plantation, in my opinion, is the best preserved of the 19th century sugar mills in Texas and will be the basic model for comparison. The mill has been mapped and photographed, and limited excavations were conducted to expose the kettle area, fire box, flue chimney, and the front of the boiler (Figure 2).

The boiler, boiler chimney, engines, and cane crushers are the components of the first phase of sugar processing: the extraction of the juice from the sugar cane. The foundations for these components are substantial structures.

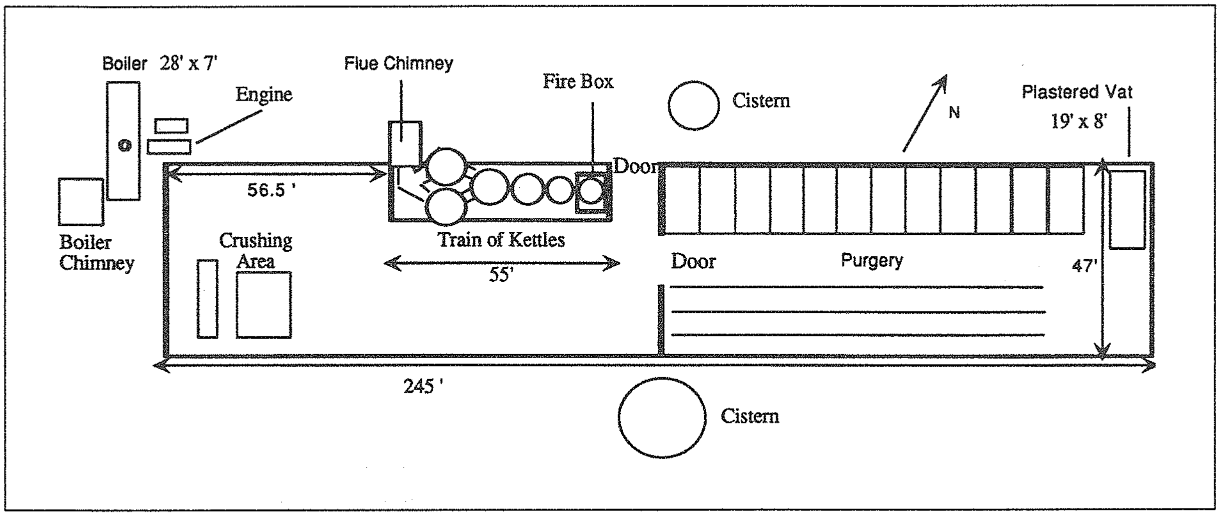


Figure 2. Interpretive Drawing of the Osceola Sugar Mill.

The boiler is 28 feet in length and in excellent condition (Figure 3). The boiler produced the steam that powered the sugar cane crushers. The boiler chimney is approximately 45 feet tall. The height of the chimney "pulled" the heat through the boiler.

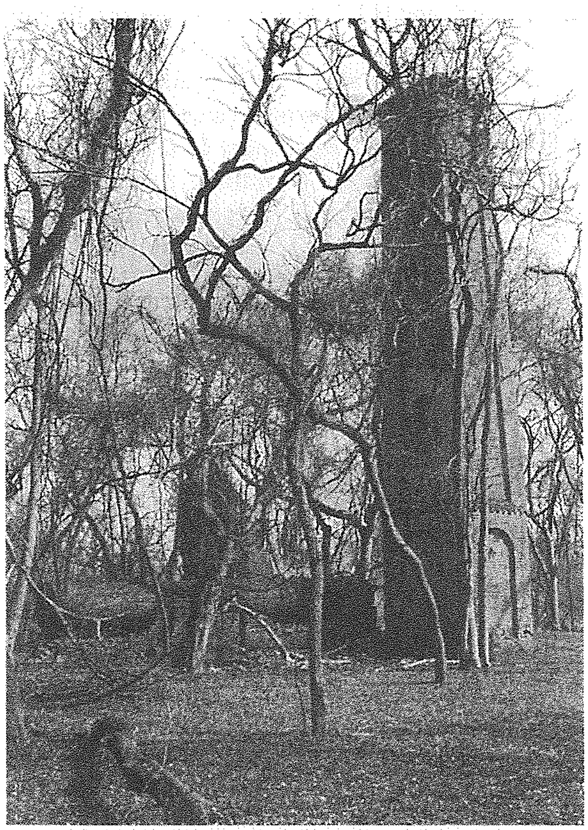

Figure 3. Osceola Boiler and Boiler Chimney.

Two feet of alluvial fill covers the base of the boiler chimney and the boiler foundation. The Bynum plantation boiler chimney is also still standing. Both chimneys have a double chimney construction with air spaces between the inner and outer chimneys; this allows the inner wall to retain heat to assist with the chimney draft.

Figure 4 shows the brick foundations that supported the cane crushers and the engine that ran the crushers. The better designed mills in Louisiana were two stories high (Creighton 1975:199), and the height of the foundations of the cane crushers at Osceola puts them on the second floor. The height allowed the extracted juice to be moved by gravity to the first floor. Almost identical brick foundations for engines and crushers were found at the Indian Church mill in Belize that operated ca. 1860-1875 (Pendergast 1982). The Indian Church mill still has the cane crushers and the engine, that powered the crushers, on their original foundation, making the identification of these brick structures possible. The ruins at Osceola, Bynum, and Varner-Hogg indicate that they had arched supports under the cane crusher (see Figure 4). Lake Jackson had a solid brick foundation under the crushers; gears from the crushers were found at the base of the foundation during excavations.

The second phase of making sugar is the reduction process and the associated components are the fire, the kettles, and the flue chimney, called the train of kettles. Figure 5 shows the basic layout of a "typical" train of kettles. This drawing does not

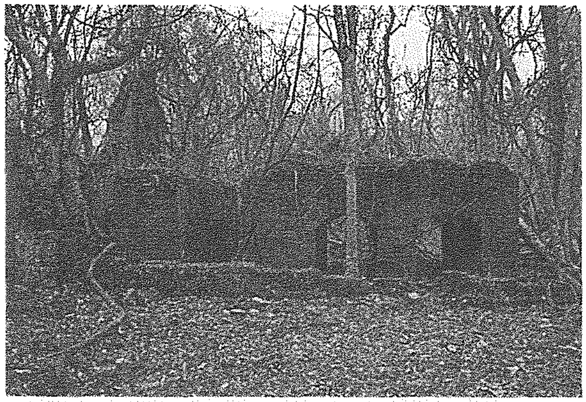

Figure 4. Brick Foundations at Osceola that supported the Engine and Cane Crushers.

give the size of a typical train: the Osceola train is 55 feet in length. The heat was produced by a fire under the smallest kettle (about 6 feet in diameter). The heat was then "pulled," by the height of the flue chimney, through the flue under the kettles, and it exited up the flue chimney. The lips of the kettles rested on brick supports that anchored the kettles over the flue. Plenums in the flue kept the heat close to the kettles. The area around and between the kettles was plastered to prevent heat from escaping from the flue. The fire box, flue, kettle supports, plenums, and flue chimney are all visible at the Osceola mill.

William Johnson (1961:25) gives this description of the reduction process in the kettles:

> The first kettle was filled with juice flowing from the reservoir vats. A mixture of slaked lime and cane juice, as a clarifying agent, was poured into the grande. As the juice began to boil a greenish-gray scum formed on the surface and became thicker as the temperature rose. As soon as a watery vapor forced itself through the scum, skimming was begun. The scum was swept into an adjoining vat and carried away. When the skimming was completed the juice was ladled into the next kettle, where scum not removed in the first was boiled up. Thus the juice passed from kettle to kettle until it had passed through the entire set. Above the kettles a steam chimney was used to carry away vapor from the rapidly evaporating cane juice.
>
> The last kettle, the batterie, received the concentrated juice which had been skimmed and tempered with lime. When the juice reached the proper consistency for granulation, it was ladled into cooling troughs, where it formed into crystals.

The metal "grates" of the firebox at Osceola are of different sizes and form a circular shape (Figure 6). The fire was on top of the grates and the ash dropped below them. The smallest kettle was supported by a brick foundation above the fire. The flue, above the fire area, conducted the heat of the

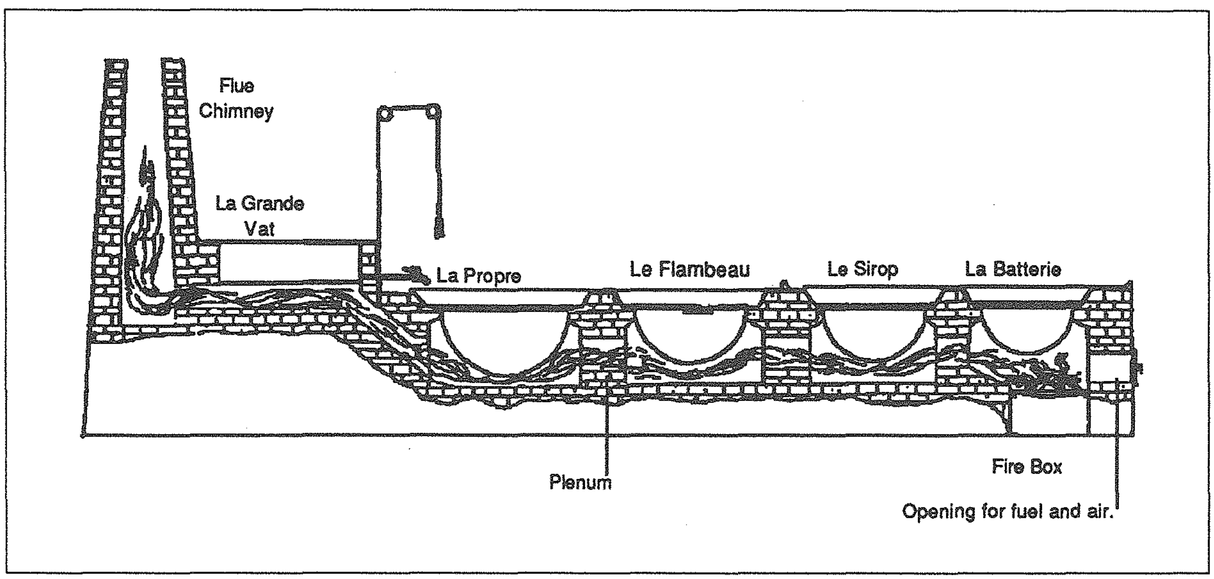


Figure 5. Train of Sugar Evaporation Kettles (after Olcott 1857:Figure 7).

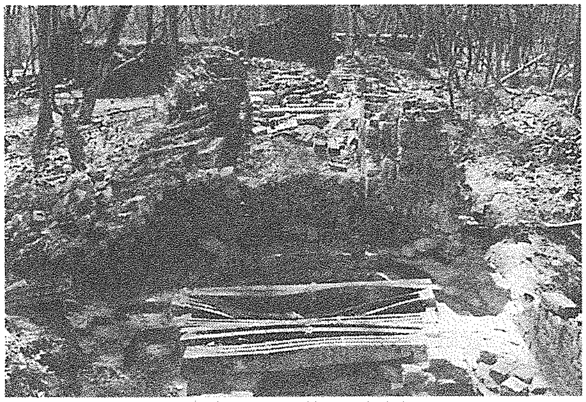

Figure 6. Fire Box and Train of Kettles at Osceola Sugar Mill. The fire sat on top of the metal grates in the foreground. The flue can be seen between the brick supports of the "Train." Rubble was left in the flue for preservation.

Figure 7. Arched Brick Entry of Flue Chimney. On the left can be seen the arched brick dome of the entrance to the flue chimney. The flue took a right turn to enter the chimney from its path under the kettles seen on the right.

fire under the larger kettles. It forked at the end of the train and provided heat for two La Grande kettles. Having two kettles made it possible to have one kettle of juice always warmed and skimmed of contaminants ready for the reduction process. The complete process, once started, continued 24 hours a day until the entire sugar crop was processed (Creighton 1975:200). If a kettle became too empty and the sugar carbonized, then the entire operation had to be stopped, the kettles cooled and cleaned, and the process started up again. Having a continuous flow of cane juice was critical to the process.

At Osceola and Lake Jackson, the flue takes a right turn after going under the largest kettle, as it enters the flue chimney. The arched bricks are a signature of the opening of the flue chimney (Figure 7), and this opening is in good condition at Osceola and Lake Jackson.

The final phase of the sugar process was granulation, cooling, and purging, which took place in the purgery. When the syrup in the smallest and hottest kettle began to crystallize, the sugar maker would call "strike!," initiating the removal of the crystallizing syrup to the cooling trays. Cooling trays were usually wooden troughs, about 10 feet long, five feet wide, and 10-12 inches deep. The sugar maker would sometimes stir the sugar syrup mass to promote crystallization (Olcott 1857:97).

Cooling trays could remain in the kettle area, or be removed to the purgery. After a few days, the coolers were emptied into hogsheads that rested on supports above a molasses barrel. It required about 30 days for the molasses, uncrystallized syrup, to drain from the sugar hogshead (Johnson 1961:25). The architectural features of the purgery are the large space for purging and storage, the interior brick walls that supported the hogsheads, and a wall or space between the mill and the purgery for fire protection.

## A COMPARISON OF SUGAR MILL FLOOR PLANS

Figure 8 provides interpretive drawings of the four sugar mills in this study. The mills are arranged with their purgeries on the right to make comparison easier.

There are three main components of the sugar making process: extraction, reduction, and purging. The principal components of the extraction process are the boiler, the boiler chimney, the engines, and the crushers. Identification of these components can be made by the size and shape of their foundations (Table 1). The boiler is in place at Osceola, and the boiler chimney is still standing at Osceola and Bynum. The foundations for the cane crushers and their engines are identifiable at all four plantations.

The reduction phase of the process was carried out in the train of kettles that includes the fire box, the kettles, and the flue chimney. The foundation of the flue chimney is visible at all four mills and is located outside of the main walls of the mill. The flue chimney opening is visible at Osceola and Lake Jackson. The fire box is visible at Osceola and Lake Jackson.

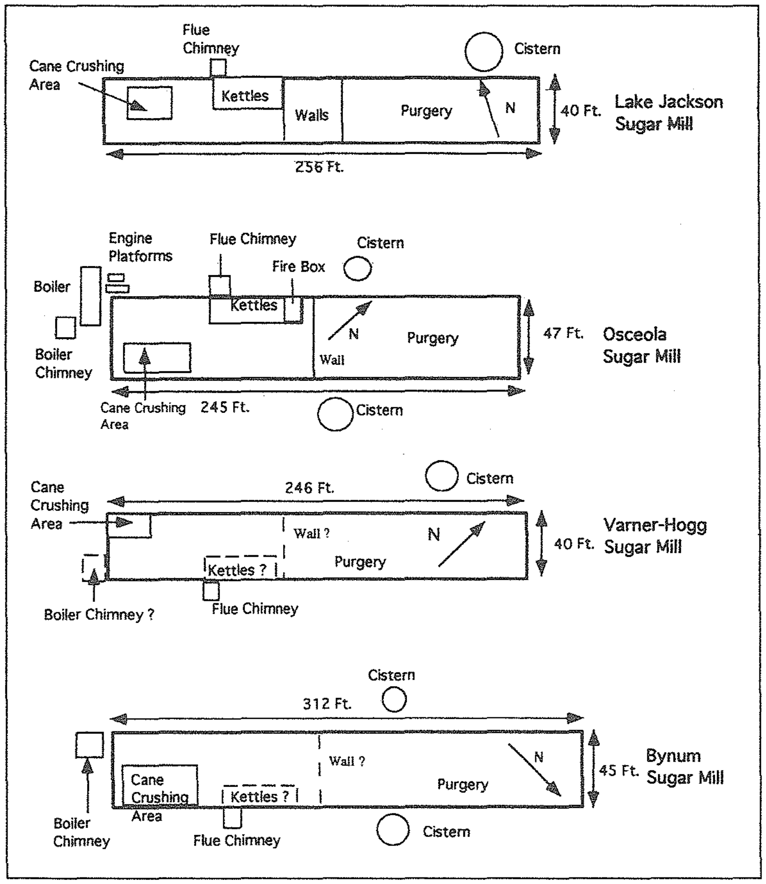


Figure 8. Comparative Layout of Four Sugar Mills.

The purgery where crystallization occurred and where molasses was purged from the granulated sugar is seen in all the mills as a large space surrounded by walls. The supports for the hogsheads are visible at Osceola.

## CONCLUSION

The architectural patterns seen in these four mills are a similarity of size; the sugar making process is arranged in the same way with the extraction, reduction, and purgery in the same positions; the flue chimney foundations are outside the mill walls; and the cisterns are located in the area of the purgery. This information can be used to make identification of components of other sugar mill ruins.

## ACKNOWLEDGMENTS

Archeological excavations have been conducted at Lake Jackson State Archeological Landmark Site by the University of Houston Clear Lake (UHCL) under the direction of the author and with student assistance. Research at the site was petitioned and supported by the Brazosport Archaeological Society, and enhanced by the 1994 and 1995 field schools of the Texas Archeological Society, with the assistance of the Brazosport Archaeological Society and the Houston Archeological Society. The owners of the property, the Lake Jackson Historical Association, have been cooperative and supportive.

**Table 1. Attributes of Four Sugar Mills**

| Attributes | Lake Jackson | Osceola | Varner-Hogg | Bynum |
|---|---|---|---|---|
| Sugar Mill Length | 256* | 245 | 246 | 312 |
| Sugar Mill Width | 40 | 47 | 40 | 45 |
| Boiler Chimney Base | NA | 10.5 | NA | 8 |
| Boiler Chimney Height | NA | 45 | NA | 40 |
| Cisterns | 1 | 2 | 1 | 2 |
| Wall Width | 2.67 | 1.5 | 2.0 | 1.33 |
| Flue Chimney Width | 9.5 | 7.5 | 10 | 10 |
| Boiler Length | NA | 28 | NA | NA |
| Boiler Diameter | NA | 3.5 | NA | NA |

* Measurements in feet; NA = not available

The owners of the Osceola Plantation wish to remain anonymous. Their protection of the sugar mill ruins is a great contribution to Texas history. This research could not have been conducted without access to the Osceola mill. Special thanks to UHCL students Karen Elliott Fustes and Justin Taliaferro for their assistance with the Osceola mapping and research, and to volunteers from the Brazosport, Texas, and Houston archeological societies.

The ideas presented in this article are solely those of the author and do not reflect on any of the organizations or individuals who participated in this study.

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# The Prehistoric Component at the Lake Jackson State Archeological Landmark (41BO172), Brazoria County, Texas

*Joan Few, Karen Elliott Fustes, and W. L. McClure*

## ABSTRACT

The Lake Jackson State Archeological Landmark (LJSAL) (41BO172) in Brazoria County, Texas, contains three cultural components: a prehistoric hunter-gatherer occupation, a 19th century sugar and cotton plantation, and a 20th century recreational park. The historic structures have impacted the prehistoric component, mixing artifacts and destroying prehistoric occupation surfaces. Artifacts, a shell midden, and a small portion of an undisturbed prehistoric camp comprise the prehistoric component at LJSAL. The different ceramic technologies in the assemblage suggest the site was utilized by hunter-gatherer groups of the Gulf Coast region that moved between Galveston Bay and Matagorda Bay. One prehistoric ceramic vessel, an import atypical of the region, was found in an historic archeological context at the site.

## LAKE JACKSON STATE ARCHEOLOGICAL LANDMARK

The Lake Jackson State Archeological Landmark (LJSAL) site (41BO172) is located on the southeastern edge of Lake Jackson in Brazoria County, Texas (Figure 1), in an area of intense prehistoric activity (Figure 2). This 2.719 acre site, owned by the Lake Jackson Historical Association, is on a thin strip of land between Lake Jackson and the Dow Chemical Company canal excavated in the 1940s. The site contains prehistoric and historic remains. Archeological excavations between 1991 and 1998 exposed a *Rangia cuneata* shell midden under the sugar mill and a prehistoric camp site in the main house area. The historic remains include a 19th century sugar and cotton plantation and a 20th century park created by Dow Chemical Company for its employees and the public (Few, this volume).

Lake Jackson is an abandoned channel of the Brazos River. The lake is owned by the Lake Jackson Lake Association, an organization of home owners around the lake, and is kept at a constant level by artificial water supply. An aerial photograph of the lake taken in the 1930s shows that the lake size fluctuated with rainfall prior to development in the 1940s. The formation of the lake can be placed in geological context. The surface sediments within Brazoria County slope toward the Gulf of Mexico and were deposited during the Pleistocene (Beaumont Formation) and Holocene time periods. "The present course of the Brazos River subparallels an older, prehistoric course, now Oyster Creek. The Oyster Creek

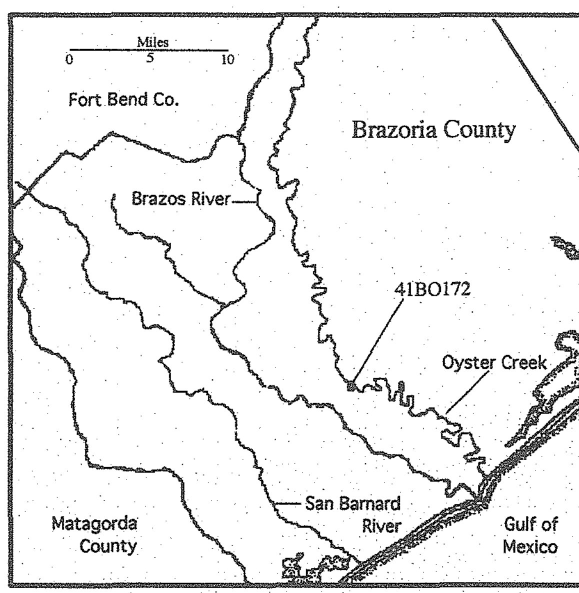


Figure 1. Brazoria County, Texas and 41BO172.

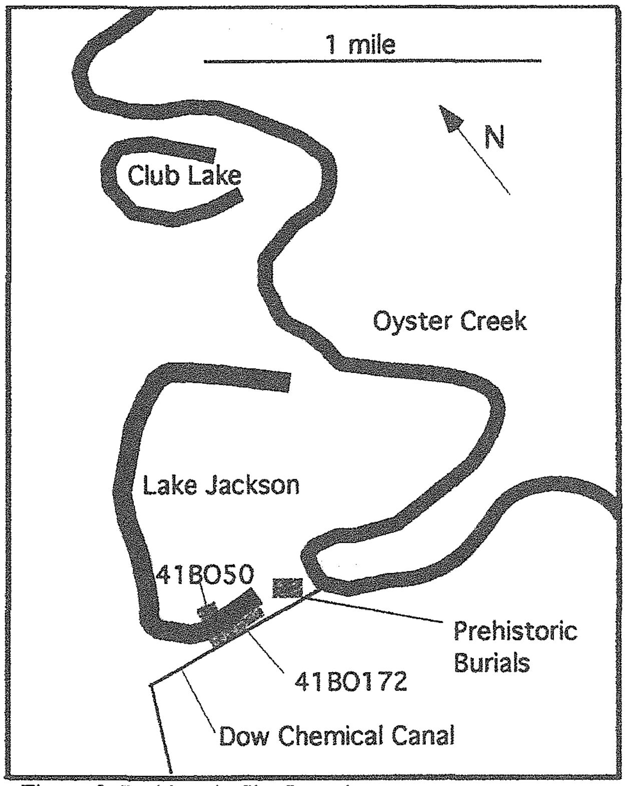


Figure 2. Prehistoric Site Locations.

course was abandoned by the Brazos River about 1,000 years ago" (USDA 1981:80-81).

The presence of Native Americans in the Texas Coastal region during historic times is documented by Aten (1983) Glass (1989), and Ricklis (1996); Aten (1983), Hamilton (1987), and Ricklis (1996) discuss the prehistory of the area. Site 41BO50 (see Figure 2), across the lake from the LJSAL site, was excavated by Lawrence Aten in the 1950s. Excavations at 41BO50 revealed, "two thin *Rangia cuneata* shell lenses separated by about 5 cm of sterile silty clay" (Aten 1983:199). "Both zones contained ceramics, arrow points, seasonality samples, and a large quantity of faunal remains" (Aten 1983:200). Two radiocarbon dates taken for the lower zone indicate a possible occupation of A.D. 300, and Aten (1983:200) concluded that "the upper zone is undoubtedly habitation refuse from the main grog tempered ceramic period, equivalent to the Round Lake Period of the Galveston Bay Area."

In 1957, the Gulf Coast Archeological Society excavated a prehistoric burial ground approximately 300 yards east of the LJSAL boundary (see Figure 2). These burials were found during the construction of a road. Numerous prehistoric sites were recorded in the Lake Jackson area by the Gulf Coast Archeological Society and their artifacts and notes are housed at the Brazosport Museum of Natural Science.

The term "Karankawa" can historically be linked to five primary groups along the upper and central Texas Coast: Copanes, Coapites, Cujanes, Carancaguases, and the Coco. The group living near the mouths of the Colorado and Brazos Rivers were probably Cocos (Ricklis 1996:5).

The Karankawa material culture is referred to as the Rockport phase and is identified by stone tools (arrow points of the Perdiz type, small unifacial end scrapers, small perforators or drills), bifacially flaked knives, sandstone metates, or milling slabs, and shell and bone tools. The ceramics were of a sandy paste clay, sometimes decorated with paint or coated with asphaltum, a naturally occurring tar that washes up on Gulf Coast beaches from petroleum seepages on the Gulf floor (Ricklis 1996:17-29).

## Historic Impact on Evidence of Prehistoric Occupation

Construction of the "Lake Place" Plantation by Abner Jackson in the late 1840s impacted the remains of prehistoric occupations at the site. Archeological excavations between 1991 and 1998 have uncovered prehistoric artifacts and exposed disturbed and undisturbed prehistoric deposits. As trenches were excavated to lay the historic foundations, prehistoric artifacts were disturbed and mixed with historic artifacts. The construction of the main house and associated structures disturbed the remains of a prehistoric camp. Archeological excavations at the Sugar Mill have exposed two areas of a prehistoric *Rangia cuneata* shell midden.

Construction of the Dow Chemical Company Park in the 1940s disturbed plantation and prehistoric deposits. Bulldozers were used to level plantation ruins, excavate drainage ditches, and build a road. These activities brought prehistoric artifacts to the surface and spread them around the site. The prehistoric surface under Structure D was only 3-5 cm below the base of the road bed. In 1993, a backhoe was used to remove the Dow-built road that ran the full length of the site. The removal was done under the direction and supervision of the senior author, but the area just below and to the side of the road was disturbed. Because of these disturbances, the artifacts located in disturbed areas can be analyzed only in terms of a site assemblage, not by location. Two areas of prehistoric deposits appear to have minimal disturbance and will be discussed in this article.

Structures A, B, D, and the Sugar Mill (Figure 3) have undergone the most extensive archeological investigation and, therefore, have yielded the most prehistoric artifacts. Excavations at Structures C, I, and the main house were limited to exposing the structures. Structures J and H were not excavated because they were virtually destroyed during the construction of the Dow Chemical Company Canal in the 1940s. Structures E, F, and G have not been excavated due to lack of time and man power.

An undisturbed prehistoric surface was found under Structure D in units S3/W99 and S6/W99 inside room B. This deposit is 3-5 cm below the base of the Dow Chemical Company road. In unit S3/W99 (Level 3), 57 prehistoric artifacts were found: 31 pieces of lithic debris, six bone fragments (to small to identify), two points, and 18 pottery sherds. In S6/W99 (Level 3), 83 prehistoric artifacts were found, including 67 bone fragments to small to identify, eight lithic debris, and 8 pottery sherds. Of the sherds found, 10 were large enough to be analyzed: they had a sandy paste with sand or shell temper. Six exhibited a film on the interior and two of these had an exterior film as well. One sandy paste sherd with sand temper had an asphaltum film on the exterior and interior surfaces.

When the sugar mill was being built, builders' trenches for the foundation of the mill impacted a *Rangia cuneata* shell midden. A thin lens of *Rangia* (10 to 15 mm) was found in Block N18/E918 (Figure 4) in Level 3, at 3.20 feet below datum. In this lens, no other artifacts were found other than *Rangia* shell. Shells were counted in the field and totaled 1,954 halves. Two 9 x 16-inch soil sample bags were used to collect a sample of the midden for 100 percent recovery utilizing water screening through fine mesh in the laboratory. No artifacts were found other than shell, however. Of note was the uniformity of the shells in Block N18/E918: 90 percent measured 1.8 cm across the widest point, 10 percent measured 2 cm across, and only five shells measured 3.1 cm across. This uniformity may indicate selective gathering of *Rangia*.

Another portion of this midden was uncovered in Block N54/E927 in Level 3 (Figure 5). The midden was two to four shells (1.5-3 cm thick) in depth. The *Rangia* shells had the same uniformity and size range as those found in Block N18/E918. The midden was divided into three equal portions and removed in soil sample bags for water screening. The fine screening produced three pottery sherds and bone fragments. There were 100+ unidentified vertebrate bone fragments. Identified bone

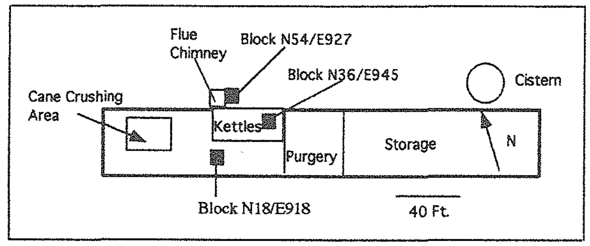


Figure 4. Plan of Lake Jackson Sugar Mill.

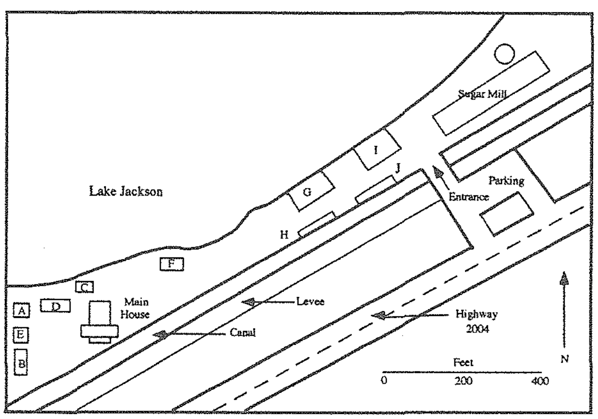


Figure 3. Structures at the Lake Jackson State Archeological Landmark.

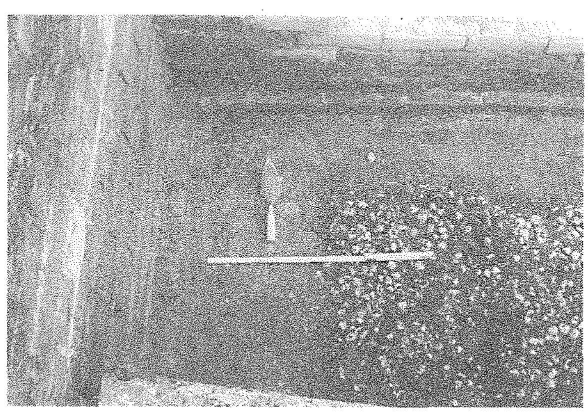

Figure 5. Shell Midden in Block N54/E927. Note builders trench between shell midden and brick structure.

included long bone shaft fragments of a deer-size mammal; gar scales, teeth and vertebrae; teleost fish vertebrae, spines and ribs; catfish spines; frog scapula, radio-ulna and vertebra; leopard frog (a subadult of *Rana sphenocephala* ) maxilla; an unidentified mammal deciduous tooth fragment; a rodent tibia; and a hispid cotton rat (*Sigmodon hispidus*) molar. This is a very small sample; however, the evidence of deer-size mammal, *Rangia,* and fish as the main food sources may indicate a late summer to early fall occupation (Hamilton 1987:124).

## ARTIFACTS

Five hundred and six prehistoric artifacts were found in the LJSAL excavations. The assemblage includes five arrowpoints, 39 pieces of lithic debris, four chert tools, bone fragments (n=304), ceramic sherds (n=153), and one oyster shell with a possible drilled hole. The bone fragments included in the prehistoric assemblage are those found in the undisturbed prehistoric deposits under Structure D and the Sugar Mill.

### Lithics

Four complete projectile points (Figure 6), and one broken arrow point were found: three Perdiz, one triangular in form, and one unidentified point (#9.059) (Table 1). Four lithic tools were also recovered (Figure 7): a graver, two scrapers, and a chopper. The graver appears to be made from a broken point, and the unifacial scrapers and the chopper are from flakes. Thirty nine unutilized flakes were also found in the prehistoric deposits.

### Prehistoric Ceramics

Prehistoric pottery sherds were counted, washed, weighed, and numbered. The following attributes were examined on sherds larger than 2 cm in length and width (n=49): thickness, paste, temper, rim, diameter, evidence of forming marks, exterior surface modifications, and interior surface modifications. Results of the ceramic analysis are tabulated below:

Sherd thickness: 3 mm (n=4); 4 mm (n=7); 5 mm (n=22); 6 mm (n=9); 7 mm (n=7).

Rim diameter: 1 rim fragment, 38 mm diameter; 1 rim fragment, 18 mm diameter

Paste, temper, and interior and exterior modifications:

- sandy paste and sand temper (n=24),
- sandy paste, sand temper, exterior and interior film (n=4),
- sandy paste, sand temper, exterior and interior asphaltum (n=3),
- sandy paste, sand temper, and interior asphaltum (n=2),
- sandy paste, grog temper (n=3),
- sandy paste, grog temper, and exterior and interior asphaltum (n=1),
- sandy paste, grog temper, and interior asphaltum (n=2),
- sandy paste and shell temper (n=4),
- sandy paste, shell temper, and exterior film (n=3),
- silt paste, grog temper and exterior film (n=1),
- silt paste and sand temper (n=1), and
- silt paste, grog temper and interior film (n=1).

The term film used in this paper is the same as "floating" described by Hamilton (1987:95): "The

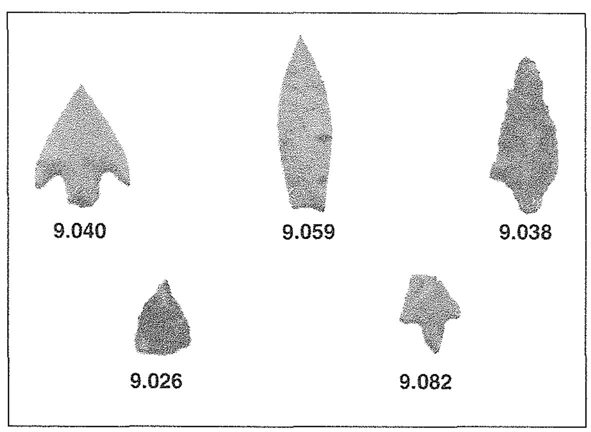


Figure 6. Arrow points.

**Table 1. Projectile Points and Tools**

| # | Type | Length* | Width | Thickness | Beveled Pt. | Beveled Stem | Serrated Edge | Shoulder | Barb | Stem |
|---|---|---|---|---|---|---|---|---|---|---|
| Arrow points | | | | | | | | | | |
| 9.040 | Perdiz | 31 | 23 | 2.5 | + | - | - | - | + | Square |
| 9.059 | Historic | 44 | 15 | 4 | + | + | - | - | - | Square |
| 9.038 | Perdiz | 40 | 18 | 3 | + | + | + | + | - | Contracting |
| 9.026 | Triangular | 19 | 14 | 3 | + | - | - | - | - | Flat |
| 9.082 | Perdiz | 26 | 15 | 2 | + | + | – | + | – | Pointed |
| Tools | | | | | | | | | | |
| 9.027 | graver | 12 | 19 | 2 | made from a broken point | | | | | |
| 9.043 | scraper | 14 | 31 | 6 | unifacial | | | | | |
| 9.063 | scraper | 35 | 24 | 7 | unifacial; made from a reduction flake, the holding edge contained cortex and is 7 mm thick with the working edge 1 mm in thickness. | | | | | |
| 9.021 | chopper | 55 | 55 | 19 | worked on both sides with well worn edge; holding edge is bulb of percussion (19 mm thick) with the working edge 4 mm thick. | | | | | |

* Dimensions in mm
+=presence, -=absence

term floated refers to the process of lightly rubbing the surface of the vessel, while the clay is still wet, with a film of water that floats the finer particles of the clay in the paste to the surface and results in a thin, lustrous film on the surface of the vessel, giving the appearance of a slip."

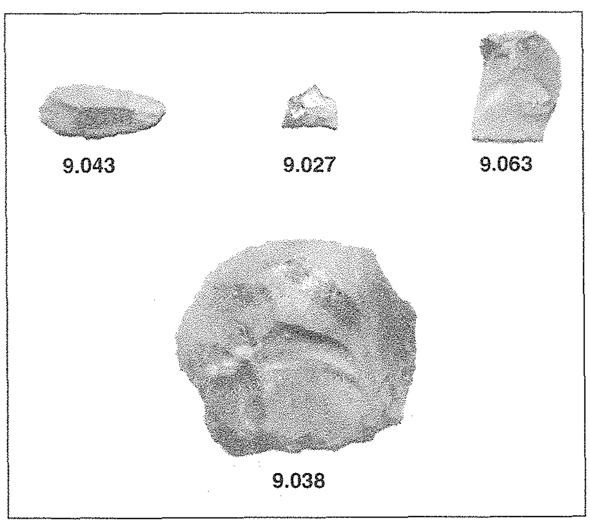


Figure 7. Lithic Tools.

No decorated wares were found and no forming marks were apparent in the small sample of sherds. According to Aten (1983) undecorated sandy paste, sand-tempered sherds are Goose Creek Plain, and grog-tempered pottery is San Jacinto Plain. This classification is also used by Hamilton (1987:104). The presence of asphaltum on a sandy paste vessel may also indicate Rockport Black-on-Grey wares (Ricklis 1996:29). This is a very small assemblage, but the presence of different ceramic technologies may suggest the area was used by various groups who hunted and gathered in the Galveston Bay to Matagorda Bay areas.

## Ceramic Vessel

In 1997, 17 sherds from an almost complete vessel (Figure 8) were found in Block N36/E945 in the sugar mill (see Figure 4). They were mixed with 19th century historic debris about 10 cm above the floor of the train of kettles. The vessel (Specimen

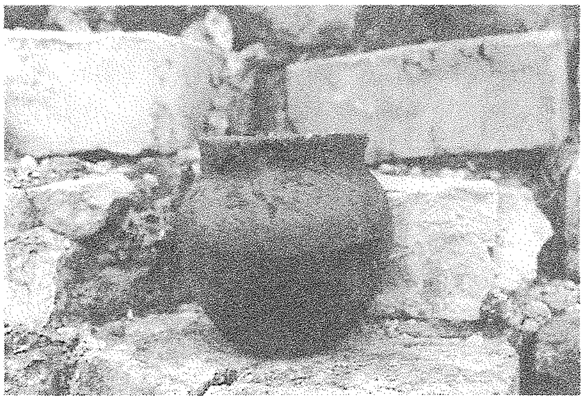

Figure 8. Sherds from an almost complete vessel.

#9.125) has no similarities with locally made prehistoric vessels and because of its historic archeological context is not included in the prehistoric assemblage at this site. It resembles in shape a Karnack Brushed-Incised jar illustrated in Suhm and Jelks (1962:Plate 43F). This vessel has a silty paste with no discernible temper. Its measurements are: base thickness, 6.12 mm; rim thickness at base of rim, 5.33 mm; rim thickness at top edge of rim, 4 mm; exterior mouth, 90 mm; diameter at largest point, 110.9 mm; and height 111.25 mm. The exterior of the vessel has markings that may be from smoothing or brushing. There is evidence on the exterior of a black slip or film.

## CONCLUSIONS

Prehistoric artifacts, a shell midden, and a small portion of an undisturbed prehistoric camp comprise the prehistoric occupation at LJSAL. The artifact assemblage, from disturbed and undisturbed deposits, may represent different time periods that the site was used as well as use by different hunter-gatherer groups. An almost complete vessel was also recovered in 19th century archeological contexts in the sugar mill that is not typical of local ceramic wares.

The Lake Jackson State Archeological Landmark site is in a geographic area where many prehistoric sites have been located and excavated. One point (see Figure 6, Specimen 9.059) does not resemble a common arrow point type and may date to the historic period. The artifact assemblage documents the utilization of the area by coastal hunter-gatherers and may also substantiate an aboriginal presence in the 19th century material culture found at the Lake Jackson site.

## ACKNOWLEDGMENTS

Excavations at the LJSAL were made possible by the efforts and support of the Brazosport Archeological Society, the 1994 and 1995 Texas Archeological Society Field Schools, the Lake Jackson Historical Association, Dow Chemical Company, the City of Lake Jackson, University of Houston Clear Lake, Houston Archeological Society, Texas Parks and Wildlife Department, Brazosport College, Brazosport Museum of Natural Science, Lake Jackson Lake Association, Texas Archeological Research Laboratory, Lake Jackson Chamber of Commerce, and the Lake Jackson Tourist Bureau.

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# Knapping Implements in Mortuary Context: A Case from Morhiss (41VT1) with Comparative Data from Texas and the Midcontinent

*John E. Dockall and Helen Danzeiser Dockall*

**ABSTRACT**

Burial 119 from the Morhiss site (41VT1) was interred with an assemblage consisting of a variety of antler, bone, and lithic artifacts. All grave associations were coated with red ocher prior to interment. The technological aspects of the artifacts suggest their use in both the manufacture and maintenance of flaked stone tools and may tempt some to refer to the assemblage as a "toolkit" or "flintknapper's kit." An examination of the composition of similar mortuary assemblages from Texas sites suggests that reference to "kits" and "toolkits" indicate that there is considerable variability in what may be considered representative of these "kits." In these cases, we are not presented with a complete picture of the composition of stone tool manufacture and maintenance tool sets.

## INTRODUCTION

The purpose of this paper is twofold. First, we want to provide a detailed description of Burial 119 from the Morhiss site (41VT1) that includes osteology, pathology, and associated artifacts. Second, we wish to promote discussion and further critical thinking in interpreting such patterned archeological remains. The significance of this burial is related to the array of grave goods, the symbolic treatment of those artifacts upon interment with the individual, and the comparison to similar examples from Texas and the midcontinental United States.

The identification of stone tool/weapons system manufacture and maintenance implements in an archeological context usually leaves little doubt as to their function and the general modes and situations of use. But when these same implements are recovered in mortuary context, we can no longer assume that we understand the reasons why the implements were interred with the deceased. Variously, such archeological materials have been interpreted as being personal belongings of the deceased who may have been a specialist at some level in the manufacture of stone tools. Seeman (1985:Appendix 1.1) provides a detailed list of interpretations for mortuary associations of knapping implements from sites in the Midcontinent.

In most instances it can be said that individuals were interred with an array of artifacts that included implements employed to maintain and manufacture stone tools. Little is often said as to whether these assemblages are complete tool sets or represent instances of craft specialization. Differences between inferred knapping or arrow/dart-making toolkits from the Midcontinent and possible examples from Texas suggest that there are some potentially significant differences that can be identified that may relate to individual status, sex, and in some cases, craft specialization. But is there more that can be obtained from further study of these mortuary associations and their composition? Torrence (1989:2) informed us that it depends on the nature of the questions that we are asking when she stated:

> How do tools contribute to social reproduction in societies with varying degrees of complexity and how do they relate to other forms of behavior such as exchange, ritual, or symbolic systems? How can we explain variability in the way people manufacture and use tools as well as differences in the tools themselves?

## SITE DESCRIPTION

Morhiss is an Archaic mortuary site located on the Western Gulf Coastal Plain in Victoria County, Texas (Figure 1). The site is located on a remnant river terrace on the east bank of the Guadalupe River, approximately 3.8 km south of the modern city of Victoria (Campbell 1976:81). Morhiss was excavated from October 1938 to January 1940 by workers for the Works Project Administration (WPA) under the direction of project archeologist William A. Duffen. The site measures 145 m long and 91 m wide (Campbell 1976:81). The site was also about 32.3 km from the nearest portion of San Antonio Bay and 64.4 km from the coastal strand.


Figure 1. Location of the Morhiss site (41VT1) in Victoria County, Texas within the West Gulf Coastal Plain.

Morhiss had remained undated by chronometric means until recently, but projectile point styles indicated a strong Archaic period occupation (Dockall 1997:45). The lithic assemblage consisted primarily of Morhiss, Lerma, Refugio, Pandora, Nolan, and Darl Archaic dart points (Campbell 1976:83). There are traces of Late Paleoindian and Late Prehistoric components as well. In 1995, the Texas Archeological Society Donor's Fund enabled the junior author to obtain one AMS radiocarbon date on skeletal material from Burial 159 from Morhiss. The resulting uncorrected and uncalibrated date is 2410 ± 50 B.P., or 460 B.C., a firm Late Archaic date (Dockall 1997:46). This date is significant because it demonstrates that at least some of the Morhiss burials are contemporaneous with those of the Group 2 burials at Ernest Witte (see Hall 1981).

WPA excavations recorded 219 poorly preserved human burials, with the majority being recovered on the southeastern slope of the site (Jackson 1939:70). Due to poor preservation, only 181 discrete individuals were curated at the Texas Archeological Research Laboratory at The University of Texas (Dockall 1997:43). In addition, over 30 hearths were identified during excavations (Campbell 1976:83). Also recovered was one of the largest shell artifact assemblages (over 3000 specimens) from any site on the Western Gulf Coastal Plain, consisting of ornaments and tools (Dockall and Dockall 1996). The bone and shell artifact collections included some manufacturing debris, indicating that some items were made at the site. Shell artifacts included beads, adzes, edge-modified Sunray Venus, and hammers.

## PRESENCE OF UTILITARIAN OBJECTS IN TEXAS ARCHAIC CEMETERIES

Recently, Taylor (1995:663-699) has performed a tremendous service to Texas archeology by synthesizing and interpreting the massive amount of published and unpublished information on mortuary items in Archaic cemeteries in Texas. For the present brief study, knapping implements are grouped as a class of utilitarian artifacts.

A number of burials at Morhiss (41VT1) included clusters of utilitarian items as grave associations (Duffen n.d.; Taylor 1995:689). Burial 139 (adult male) included three clam shells, a bone flaker or awl, four flint flakers, and shell bead blanks. Burial 39 (adult male) had a bone awl, an antler flaker, an antler ornament, a shell necklace, and two stones with pigment. Burial 50 (young adult male) at Morhiss included worked shell, drilled shell, 50 columella beads, and an antler flaker. A series of probable "tool kits" were recorded with some of the other burials at Morhiss. Burial 61 (adult indeterminate) grave associations included five gouges.

Taylor (1995:689) identified an interesting and possibly significant difference in utilitarian grave associations between the earlier mineralized human skeletal remains (largely represented by fully flexed and bundle burials) at Morhiss and the later non-mineralized skeletal remains (dominated by flexed and extended interments). The earlier mineralized interments were characterized by a predominance of various types of lithic implements, including dart point fragments, stemmed drills, keeled scrapers, gouges (presumably Guadalupe bifaces), a chopper, and manos. The later burial group included dart points, a blade, and flakes. Additionally, this later group also included a number of bone needles, awls, flakers, and billets (see Taylor 1995:689). Both groups had burials with "knives," "scrapers," and asphaltum.

Of the major mortuary sites along the West Gulf Coastal Plain and adjacent regions summarized by Taylor (1995:689-691), namely: Olmos Dam (41BX1), Blue Bayou (41VT94), Ernest Witte (41AU36), Rudy Haiduk (41KA23), Rodd Field (41NU29), and others, the presence of various utilitarian implements was not as prevalent as encountered at Loma Sandia (41LK28). In particular, Loma Sandia is noted for the abundance of stacks of lithic implements associated with some burials, especially Tortugas points, Lange points, and distally beveled implements. Rudy Haiduk, Morhiss, and the Rio Salado Burial, all located within or directly adjacent to South Texas, had burials with associated stacks of utilitarian lithic and bone/antler/shell implements. Taylor (1995:691) considered this as a distinctive trait of southern Texas mortuary sites. From the available data, these clusters of utilitarian goods seem to be primarily associated with adults, more commonly adult males.

## OSTEOLOGY AND PATHOLOGIES OF BURIAL 119

Field descriptions of Burial 119 indicated a male buried in a fully extended position in an east-west orientation, head to the west and facing south. Unfortunately, little of this individual could be recovered due to the extremely fragmented and poorly preserved nature of the remains. No skull or teeth were curated, nor were any thoracic or arm elements. Skeletally, this burial is represented solely by the portion of the right ilium bearing the sciatic notch and auricular surface, a portion of the left femoral diaphysis, portions of both tibiae, and the distal ends of both fibulae. In addition, the proximal and medial phalanges of the right fifth digital ray of the hand were recovered, as were the proximal and distal phalanges of the right first toe.

The sex determination as male was based solely on the narrow width of the sciatic notch as well as the preauricular sulcus, which appears as a groove of ligament attachment rather than as a groove of pregnancy (see Houghton 1974). Age estimations were based only on the condition of the auricular surface following Lovejoy et al. (1985). Using this technique, age was estimated for Burial 119 at 35-44 years old. This is based on characteristics of the auricular surface, including coarse granulation and reduced billowing. Slight changes were observed in the apex of the auricular surface and some microporosity was evident.

Medical disorders were limited to bone fusions. The proximal and distal phalanges of the right fifth digital ray of the hand were fused together, as were the proximal and distal phalanges of the first ray of the right foot. The proximal and medial phalanges of the hand fifth ray were fused together at a right angle (Figure 2), with a subsequent disuse atrophy of the shaft of the medial phalanx. Wasting from lack of use may be seen as recently as a few weeks after disuse (Steinbock 1976:261). The nature of the fusion suggests a traumatic origin. Ortner and Putschar (1985:69) noted that the fracture of adjacent joints can result in fusion occurring with comminuted fractures and callus formation over the joint. The origin of the injury cannot with certainty be associated with knapping activities.

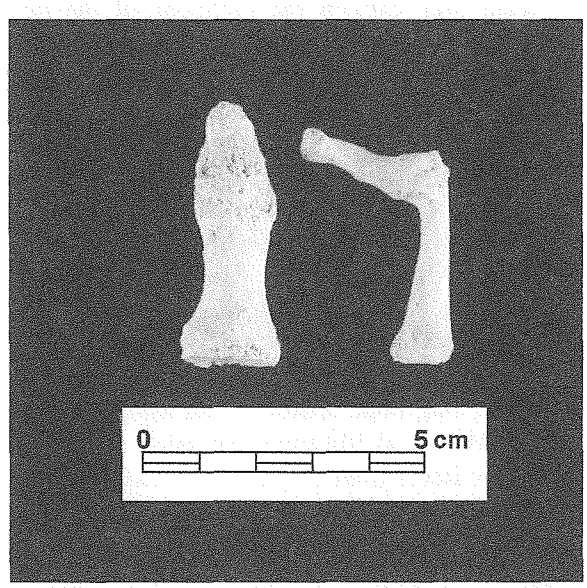


Figure 2. Left: Fusion of proximal and distal phalanges of right first toe; Right: Fusion of proximal and medial phalanges of the right fifth finger.

The proximal and distal phalanges of the right first toe are fused together, but not misaligned (see Figure 2). Therefore, it is harder to attribute to trauma. It is possible that it represents a congenital union of two phalanges. This usually results when a joint fails to differentiate and, when seen, is typically identified in distal phalangeal joints of the toes (Resnick and Niwayama 1988:3560). In this instance, a case of congenital symphalangism is inferred based on the presence of a "smooth osseous contour" (Resnick and Niwayama 1988:3560) between the joints.

## DESCRIPTION OF THE BURIAL 119 BURIAL ASSOCIATIONS

Schiffer (1987:41) noted that an individual's personal items technically become obsolete upon death. Those items that are not interred with the individual or destroyed in funerary rituals are available to be reused or laterally recycled, generally through inheritance.

The personal artifact inventory of mobile hunter-gatherers is limited by the frequency of moves. Thus, survivors may not necessarily be in a position to take on personal items of the deceased. Therefore, the death of an individual in these groups may result in little reuse or recycling as personal items are destroyed or interred. This concept may explain the inclusion of the items with Burial 119. This is assuming that all grave goods associated with Burial 119 were that individual's personal property. It is just as plausible to assume that none or only a portion of the items were personal property, which would lead to entirely different interpretations. To approach this topic would require a detailed mortuary analysis of the Morhiss site, well beyond the scope of this paper.

Elements of the assemblage include antler artifacts, lithic debris, a flaked uniface, a sandstone abrader, long bone artifacts, and asphaltum. The Texas Memorial Museum accession number for the lot of items from Burial 119 is TMM 7-1-830. All artifacts, including the asphaltum, were covered in red ocher. Field notes indicate that the lump of asphaltum was placed near the right hip. There is no other information in Duffen's (n.d.) notes relating to the relative position of these artifacts. A knife and bone needle are also mentioned as having been embedded in the mass of asphaltum but could not be located for analysis. The final grave inclusion was a "mass of Mexican persimmons" (Jackson 1939:5). Presumably seeds made up the mass, but this was not made clear in the description. It is also not clear as to whether the seeds or fruits were charred. Burial 119 was the only individual excavated in which grave associations were covered in red ocher, possibly denoting the distinctive status of this individual.

### Antler Billets

The assemblage of antler billets (n=5) was composed of one complete and four fragmentary specimens (Table 1 and Figure 3). All billets were entirely coated in red ocher making examination of use-wear at the distal ends difficult. The complete billet is well-smoothed at the base, perhaps from prehension during use. The distal end is extremely worn and smooth, exhibiting a slight use-bevel. Fragments all retain intact distal ends with well-developed bevels and smooth surfaces.

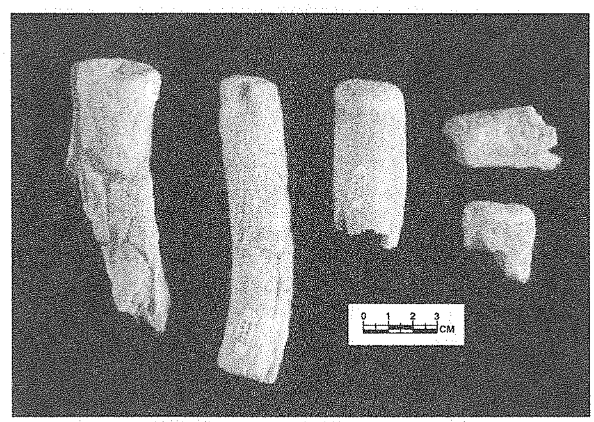


Figure 3. Antler billets included as grave goods with Burial 119.

### Antler Tine Pressure Flaker

Ocher staining is present on the proximo-medial portion of the one tine (Figure 4 bottom). A slight amount of rodent gnawing is present at the tip. The base of the tine has a remnant of an incised groove that indicates it was cut by the groove and snap technique. The fracture surface at the base has been abraded to remove sharp

**Table 1. Dimensions of Antler Billets Associated with Burial 119**

| Artifact No. | Distal Diameter | Length | Medial Diameter | Condition |
|---|---|---|---|---|
| 2671a | 2.7 | 6.4 | 2.8 | Complete |
| 2671d | 2.3 | 12 | 2.3 | Fragmentary |
| 2671g | 3.1 | 10.7 | 2.4 | Fragmentary |
| 2671h | 2.8 | 3.0 | 2.8 | Fragmentary |
| no number | – | – | – | Fragmentary |

All dimensions are in centimeters

edges. The tip displays a bevel that may be associated with use of the implement. Dimensions: Length=14.1 cm; Basal Diameter = 1.5 cm; Medial Diameter = 1.5 x 1.1 cm; Distal Tip Diameter = 0.5 x 0.5 cm.

### Antler Punch Fragment

In addition to antler billets and pressure flakers, the kit included a single distal fragment of an antler punch for indirect percussion (Figure 4 top). This specimen is also entirely stained in ocher except for the broken end. The working end is quite rough, irregular, and blunted from heavy use such as would occur during indirect percussion.

### Uniface

The flaked uniface was manufactured by soft hammer invasive flaking on the dorsal surface of a secondary cortex macro-flake (Figure 5). Both dorsal and ventral surfaces were covered in red ocher. The cortex is stream battered and the material is identical to other chert types observed in the Morhiss collections. Flake dimensions are: Length = 9.2 cm; Width = 5.1 cm; Thickness = 1.6 cm.

Another small proximal flake fragment was also recovered from the burial but has no red ocher or use wear. It may have been incidentally incorporated into the grave fill.

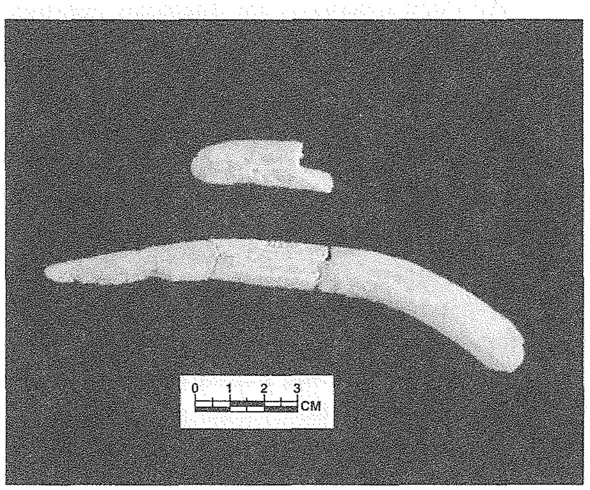


Figure 4. Top: Fragmentary antler tine punch; note blunted end; Bottom: Reconstructed antler flaker. Both were included as grave goods with Burial 119.

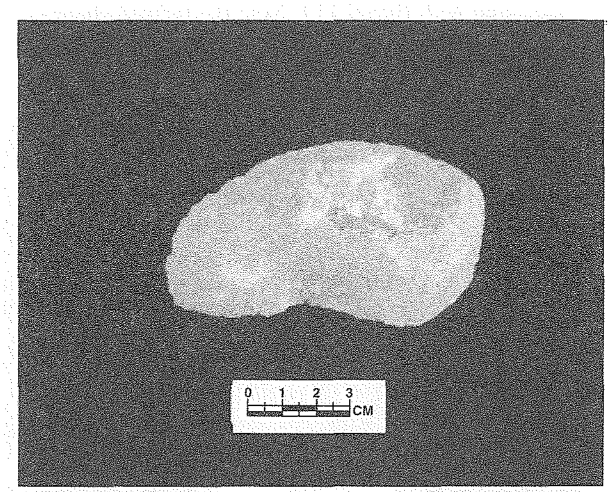


Figure 5. Dorsal view of secondary percussion flake with retouch along the right dorsal margin (at top of photo). Specimen is oriented with the proximal end at the left in the photograph.

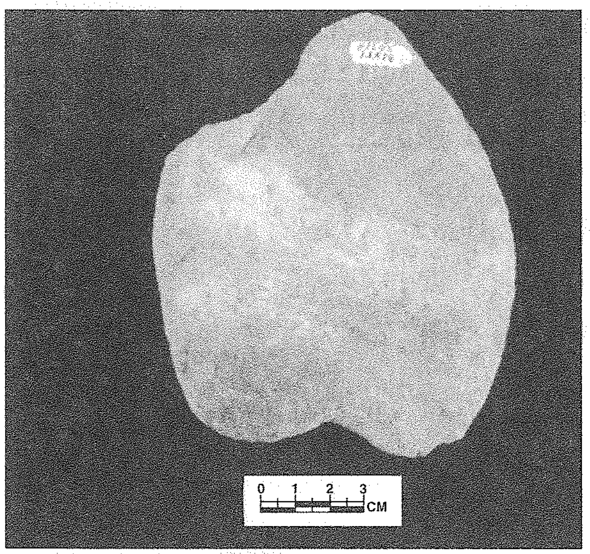


Figure 6. Sandstone abrader recovered with Burial 119.

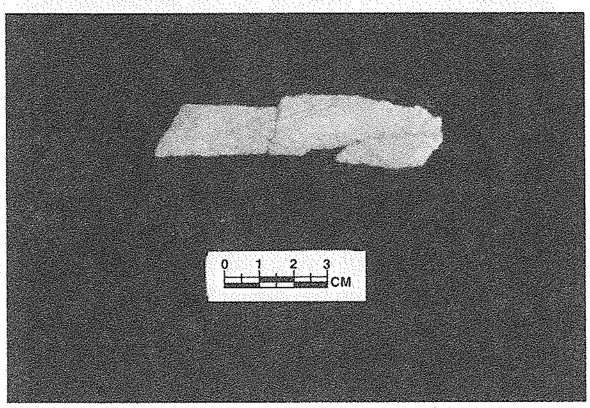


Figure 7. Incised long bone implement fragment associated with Burial 119. Note the incised chevron or zig-zag design across the face of the fragment.

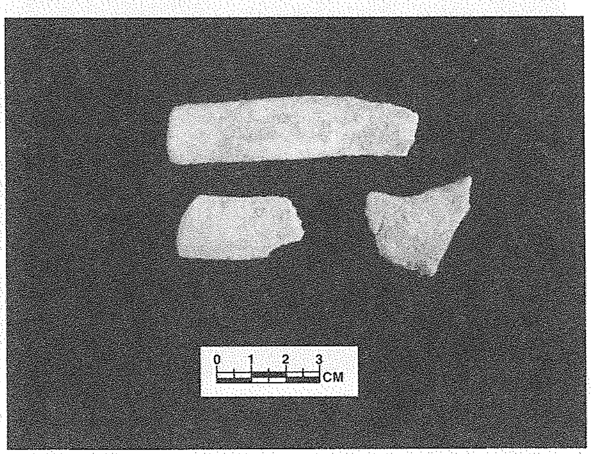


Figure 8. Undecorated fragments of split long bone implements from Burial 119.

### Sandstone Abrader

A single sandstone abrader was included in the kit (Figure 6). The raw material is a coarse-grained gray-brown sandstone. It is roughly oval in shape with a longitudinal groove on one surface from use, possibly as a biface edge abrader or to maintain the shape of billets and punches. Both surfaces are coated in red ocher. Dimensions: Length = 12.8 cm; Width = 10.1 cm; Thickness average = 2.1 cm.

### Incised Long Bone Implement Fragment

This fragment represents a probable long bone cortical fragment or split metapodial implement. The condition is very fragmentary but it is ocher-stained on the exterior incised surface. Cancellous interior material is not present. The outer cortical surface displays a deeply incised design characterized by discrete zones of encircling chevrons or zig-zag lines (Figure 7). Each zone is created by three incised lines. The design on this fragment compares favorably to similar designs observed on other split metapodial implements from Morhiss and other Archaic mortuary sites in the region (Hall 1981, 1988). Dimensions: Length = 8.3 cm; Width = 1.7 cm; Thickness = 0.5 cm.

### Unincised Split Long Bone Implement Fragments

All three specimens are fragments, representing the proximal ends of this implement type (Figure 8). These fragments represent either unincised bone implements or unmodified fragments of decorated bone implements (see Hall 1981). Red ocher covers both surfaces of each fragment except for the fracture surface at the ends. The proximal end of each artifact is well-smoothed by abrasion and forms a distinct beveled surface. The interior has also been abraded smooth and the cancellous material removed by scraping. There is no decoration. The blanks for these and similar implements seem to have been split metapodials of medium-sized artiodactyls, perhaps deer.

### Asphaltum

A large mass of asphaltum (contained in two small boxes numbered 2671; the artifacts discussed above were also in these numbered boxes) was included with Burial 119. It is estimated that between 800-1000 grams are present along with traces of red ocher. Unfortunately, the mass of asphaltum was recovered in a large number of small angular fragments. A knife (2673) and bone needle (2672) discussed earlier were embedded on the surface of the mass and it seemed that the asphaltum had been contained in a "skin pouch" (Duffen n.d.).

## COMMENTS ON OCHER STAINING

The presence of ocher on the surfaces of the antler billets and other grave inclusions with Burial 119 is potentially significant because it may indicate the symbolic treatment of utilitarian mortuary items. During analysis of the artifacts it was concluded that the ocher had been applied after being combined with some type of liquid. Traces of ocher can be observed deep into surface concavities of the antler and bone artifacts and the sandstone abrader. It is possible that it was rubbed into the surface in powder form.

## COMPARISONS WITH OTHER KNAPPING IMPLEMENT SETS FROM TEXAS AND THE MIDCONTINENT

Sometimes, researchers have attributed variability in technology to differences in subsistence (Binford 1980; Bettinger 1991), primarily assigning hunter-gatherer groups to either forager or collector. There is also some indication that social complexity may be in part related to patterns of subsistence and settlement (Binford 1980:17). But, as Thomas (1983) has demonstrated for Great Basin hunter-gatherer groups, the collector-forager dichotomy need not be associated with dramatic differences in social organization, complexity, or technological organization.

Irrespective of the causes of technological, social, and complexity differences, one cannot deny those observed between Texas and the Midcontinent. Previous research has shown that the Midcontinental region was the locus of a complex series of social, cultural, and technological changes (Charles 1995; Hall 1981:285-288; Jeffries and Butler 1982:19-24; Goldstein 1980; Griffin 1983). Data and research for much of Texas indicates that, to varying degrees, prehistoric groups were characterized by an egalitarian hunter-gatherer lifeway. Exceptions would include areas where Native groups were practicing agriculture or had formative-chiefdom level social structures.

Bousman (1993:76-78) has emphasized the idea that manufacture/maintenance tools were not used and repaired in the same manner as weapons and other tools. His discussion is couched in terms of a forager/collector dichotomy. It is also probable that social complexity and technological organization differences can influence patterns of use and maintenance of manufacturing implements and kit composition. Mortuary and cache contexts provide one means of examining toolkit differences and how these implements were used and discarded. Comparative data from the Midcontinent and Texas are used here to briefly examine potential differences that may be related to social complexity and technological organization broadly characteristic of these areas.

Comparisons can be made between Burial 119 from Morhiss and similar mortuary assemblages from Texas (Appendix 1). Other comparative data for the Midcontinent are obtained from Seeman (1985:Appendix 1.1). The examples from Texas are not meant to be exhaustive but probably represent the general range of variability observed among such mortuary assemblages interpreted as knapping toolkits or personal kits containing some knapping implements. There is probably considerable variability in what different analysts would consider to represent such kits and what artifacts should be present, hence the variability among examples in Appendix 1. One way of examining differences is to consider the presence/absence of particular artifact types probably associated with knapping (Table 2), and the proportion of each artifact type among both combined samples. The analysis does not include any other artifacts present within the burial because of the focus on knapping implements.

The sample sizes from Texas and the Midcontinent are too small to attempt analysis by time period or various statistical methods. It is also assumed for the sake of this preliminary analysis that both samples are broadly comparable. Based on this analysis, there are some differences that can be observed between the two areas.

Regarding Texas, various flaking tools of bone and antler are the most common implement

**Table 2. Presence/absence, Counts, and Percentage of Selected Artifact Types Associated with Knapping Activities Represented in Mortuary or Cache Contexts from Texas and the Midcontinent**

*(Data calculated from Seeman 1985)*

| Artifact Type | Combined Texas | | Combined Seeman (1985) | |
|---|---|---|---|---|
| | Count | Percent | Count | Percent |
| Hammer/hammerstone | 6 | 26 | 14 | 35 |
| Billets/drifts | 7 | 30.4 | 22 | 55 |
| Flakers/tines | 13 | 56.5 | 22 | 55 |
| Abraders/whetstones | 7 | 30.4 | 28 | 70 |
| Punches | 2 | 8.7 | 2 | 5 |
| Shaft straightener/wrench | 1 | 0.2 | 7 | 17.5 |
| Ocher | 6 | 26 | 10 | 25 |

Counts represent the number of individual burials/caches with each artifact type

represented. Interestingly, they are more common than billets of bone or antler, but billets are as common as abraders or whetstones. Midcontinent toolkits are equal in proportions of billets and flaking implements, followed in abundance by abraders and whetstones. It may be significant that punches are better represented in Texas toolkits than Midcontinent examples, but this may also be related to the difficulty in identification of punches, and possible confusion with blunted antler and bone flaking implements. Shaft straighteners and shaft wrenches (potentially functionally similar artifact types) are much more common in Midcontinent toolkits, with the only Texas example being the Late Paleoindian double burial from Horn Shelter No. 2 (Redder 1985). The equivalent presence of ocher as either lumps, stained rocks, or on the surfaces of artifacts probably indicates the general use of this material in a mortuary context and it is not considered to be associated with the presence or absence of knapping implements.

The observed differences in composition between the combined samples may be ultimately related to a greater degree of specialization and status associated with the manufacture and repair of stone tools and weapons in Midcontinental Woodland and Mississippian societies than among Texas hunter-gatherers and agricultural groups. Although there are similarities in the types of knapping tools included as grave goods between Texas and Woodland/Mississippian groups, there is a trend for the latter to be more specialized in terms of the abundance of certain artifact types, most notably shaft wrenches/straighteners and abraders/whetstones. A greater representation of shaft wrenches and abraders/whetstones in association with other types of knapping tools could arguably indicate a greater co-occurrence of these artifact types among Midcontinent burials and toolkits. If we consider this association to represent a true trend in burial practices and knapping technology in this region, then the association of other implements not directly related to knapping but instead with the manufacture and repair of perishable portions of weapons sets further supports this hypothesis (see below).

Additional artifacts were also included with knapping implements in burials from both Texas (Table 3) and the Midcontinent. Again, although we are limited by sample size and the obvious problems with differences in artifact identification, there are some trends that are provocative regarding potential regional differences. These limitations have made it necessary to use broad artifact categories based on function, irrespective of raw material differences. The objective was to identify potential trends in functional types between the two sample groups. Commonalities exist in the presence of various types of ornaments and chert drills. Small flake tools such as burins, spokeshaves, and gravers are

**Table 3. Presence/absence, Counts, and Percentage of Selected Artifact Types Represented in Mortuary or Cache Contexts from Texas and the Midcontinent**

*(data calculated from Seeman 1985)*

| Artifact Type | Combined Texas | | Combined Seeman (1985) | |
|---|---|---|---|---|
| | Count | Percent | Count | Percent |
| Projectile points | 9 | 41.0 | 27 | 67.5 |
| Bifaces | 5 | 22.7 | 14 | 35.0 |
| Endscrapers/scrapers | – | – | 7 | 17.5 |
| Unifaces | 2 | 9.1 | – | – |
| Modified flakes | 2 | 9.1 | – | – |
| Knives | 2 | 9.1 | 8 | 20.0 |
| Drills | 2 | 9.1 | 4 | 10.0 |
| Flakes/debitage | 3 | 13.6 | 16 | 40.0 |
| Awls (various materials) | 5 | 22.7 | 16 | 40.0 |
| Long bone tool/pin | 4 | 18.2 | – | – |
| Cores | 1 | 4.5 | 7 | 17.5 |
| Bladelets | – | – | 4 | 10.0 |
| Burin/graver/spokeshave | – | – | 5 | 12.5 |
| Adze/celt/axe | – | – | 11 | 27.5 |
| Ornaments | 8 | 36.4 | 16 | 40.0 |
| Incisors/mandibles | 4 | 18.2 | 20 | 50.0 |
| Fishhook | 1 | 4.5 | – | – |

Counts represent the number of individual burials/caches with each artifact type

more common among Midcontinent burials with knapping tools. If these types of small flake tools can be linked to woodworking or other similar tasks, then hafted, unhafted, and in situ incisors and small mandibles may also be included as similar implements. A greater abundance of these implements among Midcontinent burials may indicate that knapping toolkits were more extensive and oriented toward the manufacture of a wider array of artifacts of stone and perishable materials. Seeman (1985:18) suggested that such artifacts could have included bow staves, atlatls, and arrow/dart shafts and foreshafts. There is a trend for those burials described by Seeman (1985) to have a wider array of artifacts coupled with a greater numbers of these same artifacts, and he uses this evidence to foster arguments for specialized toolkits, craft specialization, and the status of the deceased individual.

The Texas data (see Appendix 1) do not exhibit the variability and numbers observed in Seeman's sample. All things being equal, this could argue for a less specialized repertoire of tools employed by hunter-gatherer groups in Texas, or conversely it could be indicative of differences in discard rituals between these regions. Texas burials that exhibit the greatest similarity to those from the Midcontinent in terms of artifact variability and numbers include the Rudy Haiduk site (Mitchell et al. 1984) in Karnes County, Alex Justiss (Bell 1981) in Titus County, and Tyson (Tom Middlebrook, 1997 personal communication) in Shelby County, but overall the Texas sample does not have the uniformity of composition exhibited by burials included in Seeman's (1985:Appendix 1.1) data. This hints at a greater degree of craft specialization or status associated with knapping and related activities among Woodland, Mississippian, and Protohistoric groups than most Archaic and Late Prehistoric groups in Texas.

Unlike associated knapping implements from Texas, Midcontinent associations appear to represent sets of specialized implements for the manufacture/maintenance of a range of artifacts associated with hunting technology. Midcontinent toolkits may have been designed for more replacement of parts in weapons systems while those from Texas, in general, seem to have been designed for a greater degree of parts repair rather than components replacement.

The overwhelming majority of Texas and Midcontinent knapping toolkits examples are associated with adult males (Table 4). This suggests that knapping implements are more frequently associated with adult males than with adult females. Reasons for inclusion of knapping implements in the graves of deceased females may be the result of other unidentified social factors operating beyond the male/female division of labor and are not addressed here. The general trend seems to be for inclusion of knapping implements in mortuary context to be age and sex specific.

## INFERENCES REGARDING TECHNOLOGICAL ORGANIZATION BASED ON MORTUARY ASSOCIATIONS

We are all to varying degrees familiar with the growing debate involving reliable and maintainable toolkits and similarly oriented technologies (see Bleed 1986; Bousman 1993; Hayden et al. 1996; Nelson 1991; Torrence 1983, 1989). Although issues are always much more complex than they appear initially, Bleed's (1986:739) discussion of maintainable and reliable technologies does provide some indication of what may be expected in such technologies. One of his key characteristics of reliable weapons systems includes a generalized repair kit with sufficient raw materials and tools to effect any repair. Manufacture and maintenance are frequently the responsibility of specialists. While maintainable weapons systems are manufactured and maintained by the user, repair and use co-occur, and the emphasis is on the overall ease of repair with a less complex repair kit.

Subsistence and mobility strategies also can influence the time and energy available for tool manufacture or repair, and as a result influence the composition of tool manufacture and repair kits (Bettinger 1991:69; Bousman 1993:73; Binford 1979, 1980; Torrence 1983, 1989). Ultimately, the composition and orientation of tools and toolkits are governed by a series of constraints (Hayden et al. 1996:11-14) that include the task(s) to be performed; raw materials available; available technology (also skill); and socio-economic concerns (mobility, transport, labor, and storage). All of these factors influence the design of the tool or weapon, along with use, maintenance, and repair strategies.

Another potential variable that may be important is that as the time and effort invested in tool manufacture and maintenance increases so too does the use-life of that tool (see Shott 1989). This would be indicated by the number and variety of different tool types associated with stone tool manufacture/repair and weapons design and manufacture.

**Table 4. Sex of Individuals Associated with Knapping Implements in Mortuary Context**

| Sex | Combined Texas | | Combined Seeman (1985) | |
|---|---|---|---|---|
| | Count | Percent | Count | Percent |
| Male | 12 | 54.5 | 26 | 65 |
| Female | 2 | 9.1 | 4 | 10 |
| Indeterminate | 5 | 22.7 | 10 | 25 |
| Isolated/unknown | 3 | 13.7 | — | — |

It is proposed here that the overall toolkit and mortuary data from Texas fit very well within the parameters of forager group toolkits associated with low production costs where manufacture and repair co-occur. The suggested toolkit and technology are broadly generalized, and emphasize ease of repair and replacement as a part of their design (see Hayden et al. 1996). A major part of the generalized toolkit would probably be a variety of expedient short use-life implements that would not be curated or interred in mortuary contexts. This may account for the overall similarity of types of manufacture/maintenance implements from mortuary and cache contexts in Texas. Data from the Midcontinent (Seeman 1985) are strongly suggestive of a different set of strategies and social factors influencing the design and composition of maintenance toolkits and technology (as judged from mortuary context). This is reflected in greater numbers and varieties of manufacture/maintenance tools associated with burials from the Midcontinent. If these toolkits do represent more specialized tool associations, then it may be hypothesized that the components of the toolkits were also more functionally specific as compared to the more generalized Texas examples. In this light, the tool association of Burial 119 at Morhiss may represent only a portion of the maintenance/manufacture technology and not a specialized knapping kit. When making inferences regarding the function or role of technological items in mortuary or cache context, it is necessary to consider the items that may be absent, the overall technological system of which they were a part, and the probable social framework.

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## APPENDIX 1

**Sites in Texas with Associated Burial Goods Inclusive of Stone Knapping and Maintenance Implements**

| Site Number | Name | Age | Sex | Associations | Reference |
|---|---|---|---|---|---|
| 41BQ46<br><br>Paleoindian | Horn Shelter No. 2 | —<br>— | Male<br>Male | 4 modified turtle shells, 2 antler billets, 2 sandstone abraders, red ocher, long bone tool, bifacial knife, antler shaft wrench | Redder 1985 |
| 41SV60<br><br>Late Prehistoric | Lemens Rockshelter | 35-45 | Male | 3 chert bifaces, hammerstone, antler awl, 2 antler punches, 2 antler pressure flakers, 2 possible pressure flakers, 2 deer ulna flakers, 1 deer ulna tool, 1 shell scraper, 1 Scallorn arrow point | Smith 1994 |
| —<br><br>[Unknown age] | Hollis Roberts Mound 1 | Adult and Infant | Female; Indet. | 3 antler pressure flakers, 3 deer ulna flakers, 1 abrading stone, 1 chert uniface, 1 bifacial drill | Ray 1933 |

**APPENDIX 1** *(Continued)*

| Site Number | Name | Age | Sex | Associations | Reference |
|---|---|---|---|---|---|
| Shackelford County<br>[Unknown age] | — | — | — | 1) 3 freshwater shells, 2 deer ulna tools, 1 snake skeleton (minus skull) | Forrester 1951 |
| | — | — | — | 2) 1 antler tine pressure flaker, 3 deer split radii, 1 awl, polished deer radius, 1 deer ulna flaker | |
| 41HR80<br>Late Prehistoric | Harris County Boy's School | 25-35 | Male | compound fishhook barb, 3 flageolets, 6 bone dice, incised bone awl or pin, 4 ulna tools, 1 possible ulna tool, 4 deer ulna tool fragments, 1 antler flaker, 2 antler projectile points, 1 antler debitage, 40 drumfish teeth, 16 shell beads | Aten et al. 1976 |
| 41KA23<br>Archaic | Rudy Haiduk | Middle-aged | Male | 13 Marcos points, 5 corner-tang bifaces, 2 drills, 16 biface fragments and preforms, hammerstone, 2 abrading stones, 7 ironstone pellets, gorget, quartz crystal, 4 pebbles, deer antler sections, deer antler tines | Mitchell et al. 1984 |
| —<br>[Unknown age] | Horseshoe Ranch Caves | — | — | 2 sinew bundles, rawhide strip, 3 deer antler flakers, limestone hammer-stone, 4 chert bifaces, 10 uniface flake knives, 11 rabbit mandibles, pigment, Mountain Laurel seeds, mussel shell, perforated turtle carapace | Shafer 1986 |
| 41BX1<br>Archaic | Olmos Dam | 17-25 | Male | chert biface, chert biface fragment, chert core, 2 chert cobbles, ground ocher, bone awl, 21 deer antler halves, 4 bone beads, 1 conch pendant, 4 columella dangles, shell pendant fragments, freshwater mussel, grinding slab | Lukowski 1988 |
| 41VT1<br>Archaic | Morhiss | Adult | Male | 1) B. 139—3 clam shells, broken boneflaker or awl, 4 flint flakers, shell bead blanks | Duffen n.d., Taylor 1995 |
| | | Adult | Male | 2) B. 39—bone awl, antler flaker, antler ornament, snake necklace, 2 stones with pigment | |
| | | Young Adult | Male | 3) B. 50—worked shell, drilled shell, 50 columella beads, antler flaker | |
| 41TT13<br>Late Prehistoric | Alex Justiss | — | — | 14 deer ulnae, 1 worked long bone, 2 beaver teeth incisors, 1 antler fragment, 1 deer mandible, 15 modified flakes, 8 silicified wood fragments, 2 dart points, 8 Talco and Maud preforms, 1 hematite tool or pigment stone. | Bell 1981 |

**APPENDIX 1** *(Continued)*

| Site Number | Name | Age | Sex | Associations | Reference |
|---|---|---|---|---|---|
| 41CP5<br>Late Prehistoric | Tuck Carpenter | — | Male? | Burial 19: Cache by left wrist—21+cm long chert biface, ferruginous sandstone abrader, 3 hematite fragments, flakes and chips, petrified wood fragment, green pigment, fragments of two deer ulnae | Turner 1978, 1992 |
| 41SY92<br>Late Prehistoric | Tyson | 18 mo. | Subadult | Vertically arranged set of 6 deer ulna flakers and two beaver teeth near right side of infant, 2 chert pebbles, unifacial arrow point, flakes, 6 shell artifacts including notched shell point | Tom Middlebrook, 1997 personal communication |
| 41NU29<br>Archaic | Rodd Field | young adult | Female | 1 small ovate dart or arrow point, 4 dart point fragments, 1 biface, 1 biface fragment, 1 modified flake or point, 2 utilized flakes, 3 unmodified flakes, 1 battered pebble, 1 hammerstone, 2 smooth pebbles, 4 resin balls | Taylor 1995 |
| 41VT94<br>Archaic/ Late Prehistoric | Blue Bayou | adult | Male | Burial 24—2 mussel shell pendants, 1 bone awl, 1 left deer antler, 1 right deer antler, 1 antler fragment (note: all antler minus tines). | Huebner and Commuzzie 1992 |
| 41GV66<br>Proto-historic | Mitchell Ridge | 30-40 | Male | Feature 65—3 bone points, 1 antler billet, 1 chert drill, iron nails/tool fragments | Ricklis 1994 |
| | | | — | Feature 65A—1 antler billet, 1 engraved bone pin, 1 spatulate bipointed tool, 1 iron spike, 67 small glass beads, 1 glass mirror fragment, fragments of a bird bone whistle | |
| 41LK28<br>Archaic | Loma Sandia | | | Feature 165—3 Tortugas points, 6 unmodified flakes, 1 chert hammerstone, 1 quartzite hammer-stone, 1 grinding slab, 1 mano, 1 antler billet, 1 conch shell, 4 marine pendants | Taylor 1995 |
| | | | | Feature 133—1 Tortugas point, 1 quartzite hammerstone, 1 flake, 1 billet, 2 pieces of deer antler | |

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# A Summary of Processes Affecting Archeological Sites in Artificial Reservoirs

*Andrew F. Malof*


## ABSTRACT

Site inundation dynamics are examined through a comparison of the processes affecting submerged and intermittently submerged sites in artificial reservoirs. To enhance the limited data base, an experimental design involving the quantification of features and artifact displacement is proposed.


## INTRODUCTION

Cultural resource management is increasingly involved with the evaluation of sites tied to either future or existing reservoirs. As the number of reservoirs increase, so do the number of sites impacted by their construction or existence. Reservoirs present a complex set of circumstances effecting archeological resources. All levels are impacted: the macro- or regional scale, the meso- or site scale, and the micro- or artifact scale.

The premier study to date is the National Reservoir Inundation Study (NRIS) conducted by National Park Service personnel in the late 1970s. This report is primarily a summary of their findings, as well as an attempt to make the results regionally significant.

## THE NRIS STUDY

Beginning in 1976, the National Park Service instituted the NRIS (Lenihan et al. 1981). The project was geared towards better understanding how to best manage inundated archeological resources (Lenihan et al. 1981:v). Two problems were addressed: first, the prediction of effects from impending inundation on existing archeological resources, and, second, the mitigation of those situations (Lenihan et al. 1981:17). Four categories of impact were recognized. The first was mechanical, which includes the "physical erosion and depositional processes associated with any large body of water." The biochemical factors require examining the new ecosystem formed after initial filling. Human factors include increased artificial impacts on archeological resources, both directly, through greater access, and indirectly, through an increase in wave action caused by boat traffic. Various miscellaneous factors are also included, such as changes in the floral and faunal components of a location, and the resource may be lost to research through inundation or submergence below silt deposits (Lenihan et al. 1981:18-19).

These factors combine to produce a wide array of situations that must be considered when examining a reservoir, whether potential or existing. The NRIS considered impacts at three different levels of archeological resources, loosely categorized in the macro-, meso- and micro-scales. In short, four types of processes are operating on three levels of resources. The biochemical processes are most important during initial filling, as an equilibrium is soon established, barring major changes in other variables. The biological community is obviously vastly altered, as terrestrial communities are supplanted by aquatic ones. Chemical processes are evident as water reacts with substrates; however, these too become stabilized in time. The miscellaneous and human-induced factors are difficult to control. Of primary importance to the majority of extant reservoirs are the mechanical processes.

These consist primarily of wave action and current, erosion, and sedimentation.

## MECHANICAL PROCESSES

These processes include the effects of waves and their by-products, currents. Also of importance is slope failure or slumping, saturation of lake bed deposits, and siltation (Lenihan et al. 1981:18). The most drastic of these impacts is wave action and current at the lake/shore interface

### Regional Impacts

The long-term effect of a man-made reservoir is that it will eventually fill completely with sediment, and thus become a vast floodplain (Lenihan et al. 1981:82). Archeological sites once accessible will be buried under tons of overburden, effectively sealing them from any additional research. They will be lost as surely as if they had been destroyed. In a system of lakes, as seen along the Colorado River in Central Texas, inundation will create an entirely new dynamic, reconfiguring the entire basin from pre-dam conditions. This will have profound effects on interpreting sites that may be re-exposed during periods of low water, with concomitant loss of information regarding settlement patterning and land and resource use.

### Site Impacts

There are four main variables that will determine the extent of impacts to sites in reservoirs (Lenihan et al. 1981:91-92). One variable is the make up of the reservoir. Its area, its depth, the type of watershed it is in, its orientation, and climatic variation all combine to produce differing effects. Next it must be considered where in the reservoir the site is located. Sites at the shoreline will receive more wave impact. Sites in deeper water will be subject to greater siltation. Another factor is the geologic and environmental history of the site. Sites on unconsolidated material will be subject to greater erosive forces. Slope, orientation, and types of vegetation will also be factors. Finally, the type of site and types of features in sites will be differentially more able to withstand destructive forces. For instance, it is hypothesized that the pavement of a basin hearth will be more stable than a simple surface-laid ring hearth (Malof 1996:72).

### Artifact Impacts

Artifact impacts are dependent upon the class of artifact. Perhaps most important is the effect of wet-dry cycling upon various types of artifacts (Lenihan et al. 1981:143). Ceramics, bone, pollen, and shell are all affected to varying degrees. Lithics, although not directly subject to chemical or physical changes due to wet-dry cycling, may often have their attributes altered. Use wear may be obscured, or even produced, by movement through and across ground surfaces (Will and Clark 1996:514). Mechanical impacts on artifacts are therefore most pronounced at the fluctuating shoreline.

## BIOCHEMICAL PROCESSES

Biologically, the previously terrestrial ecosystem becomes aquatic (Lenihan et al. 1981:19). This can include micro- and macro-faunal and floral changes. Chemical changes are induced as well, as water is superimposed and mixed with existing strata.

### Regional Impacts

The main concern is that the environment will be completely changed. The result is that unless a full physical and biological inventory is performed before inundation, the comparative and physical data base commonly used to reconstruct ancient geomorphology and plant and animal communities will be lost.

### Site Impacts

Biochemical impacts are discriminatory in their effects, and impact soil chemistry and stratigraphy (Lenihan et al. 1981:117). Elemental concerns are primarily carbon, nitrogen, phosphorous, sulfur, and calcium. It is well known, for example, that concentrations of phosphorous can be an indicator of living surfaces, as it is the by-product of organic waste materials, and when found in large concentrations indicates human refuse. When soils are inundated, leaching and redistribution of phosphates can occur, with the resulting loss of associated information. It is interesting, however, that carbon remains suitable for C14 dating, as charcoal does not appear to be tremendously affected by inundation (Lenihan et al. 1981:179). Other organic remains, though, are subject to destructive microbial action until an equilibrium is reached, often when anaerobic conditions begin to prevail.

### Artifact Impacts

Impacts to artifacts are also class-dependent, and further complicating matters is the environment within which they are found (Lenihan et al. 1981:147). Bone, for instance, may dissolve in acidic conditions often found in anaerobic environments. Wood, seed, and pollen are all variably affected by the chemical constituents of their respective matrices. In general, alkaline conditions are more conducive to preservation than acidic conditions. Ceramics appear to reach an equilibrium, with the most obvious effects being pitting and fading of pigment. Low-fired ceramics may dissolve completely, while hard-fired ceramics maintain a great degree of integrity. Lithics, not surprisingly, show little evidence of change due to biochemical processes. Presently unknown, however, is the potential for changes in trace element composition. The NRIS study was limited to a 20 year sample. Personal observations indicate some lithics may take on a distinctive orange and black patina in a 50 year reservoir, but that evidence is not conclusive, as there was no comparative sample.

## HUMAN PROCESSES

The primary impact is related to the increased access to archeological sites (Lenihan et al. 1981:19). This can be a direct impact, through land use and collecting, or indirect, as in the result of increased wave action due to boat wakes.

### Regional Impacts

These impacts can be relegated almost entirely to the same category as physical impacts. Human-induced perturbations produce the same types of disruptions. Increased wave action disrupts sites, as does intentional and non-intentional disruption of sites. Loss of site information leads to the loss of regional archeological information.

### Site Impacts

These again range from the obvious looting or collecting at sites, disruption of features for fire rings or other, more esoteric uses, to changes in land use patterns (Lenihan et al. 1981:130). Once remote areas may now be used for all terrain vehicles, hiking or biking trails, or camp sites. Many of these activities can adversely affect sites.

### Artifact Impacts

Selective collection of artifacts is the most obvious impact (Lenihan et al. 1981:173). Once collected, they are gone from the record, and associative information is lost. Pollution may effect chemical values of soil matrices, and so also differentially affect preservation and dating.

## MISCELLANEOUS PROCESSES

These are described as a multitude of impacts, from new floral successional regimes, changes in faunal habits, and loss of site accessibility (Lenihan et al. 1981:19). These are primarily a combination and function of the other factors under consideration.

### Regional Impacts

Again, these impacts are related to site destruction. Once the site has been altered, it can no longer be easily incorporated into the larger regional outlook.

### Site Impacts

One example is the introduction of mussels to newly inundated sites (Lenihan et al. 1981:133). When water levels recede, these exposed mussel beds are raided by raccoons, who create extensive damage burrowing for this food source. The burrowing of the mussels themselves may create mixing in subsurface deposits. Other problems occur with new successions of plant species. Salt cedar can establish itself in shallow water, and completely cover or destroy sites (Lenihan et al. 1981:136). These all create problems in interpreting the archeological record.

### Artifact Impacts

Artifacts in freshly exposed soils are subject to a variety of faunal impacts (Lenihan et al. 1981:174). They may be damaged by cattle, or burrowing animals may dislodge and damage them. Rodents are known to gnaw on bone and antler. Loss of vegetation due to submergence allows the redistribution of artifacts and features. Encroaching invasive species may alter soil profiles, and contribute to the disruption of artifact context and associations.

## MITIGATION CONCERNS

Ideally, a reservoir will be inventoried prior to its filling. Sites will be recorded during survey, and assessed for intact stratigraphy, diagnostics, and other indicators of research potential for information on prehistoric or historic lifeways. Added to these assessments should be the long-term preservation potential for the individual site. For instance, in the case of Lake Limestone in East Central Texas, out of 62 sites, 11 were chosen for excavation (Mallouf 1979). These sites were located exclusively in the deep water river channel in areas (with one exception) of low impact potential. The exception was located at the upstream side of the dam base, where construction activities would have destroyed the site. The sites chosen for excavation, however, were all located along the edges of the pre-dam river bed, and contained considerable archeological information. This selection process, surely a painful one, meant that many sites located on the edges of the soon-to-be reservoir were not excavated, and therefore were subject to more intense processes of mechanical impacts. The issue is complicated: should priority be given to excavate sites that are to become relatively stable over those with possibly a lower information potential, but subject to greater degradation? If preservation is factored into the equation, these choices may become easier.

Once a reservoir is established, which many were prior to the enactment of antiquities laws, it must be realized that a certain amount of damage has been done. That information destroyed or skewed by inundation must be taken into account by the archeologist. In many cases, where reservoirs are subject to fluctuating levels, sites are documented or re-documented during periods of low water. Some of these may be exposed for the first time in years, and it is vital that the archeologist recognize the possible impacts upon them.

The most important processes affecting sites in fluctuating water basins are the mechanical. One is left with the problem of determining how much of the site has been left intact. In some cases, it appears that previously unrecognized features are now eroding out of new cut banks. At the Grelle site (41BT1) in Burnet County, during a recent low water event, a number of hearths were seen on the river's edge (Lower Colorado River Authority [LCRA] 1998). The site had been extensively excavated in the 1930s. These hearths were therefore a new addition to the record of the site. This same low water event exposed new features at 41TV1794, also along the Colorado River (LCRA 1998), and a series of surface hearths and middens at 41TV209, at the south end of Lake Travis (Malof 1996). Or did it? Etchieson and Couzzourt (1987:8-10) noted that dissolution of underlying strata combined with erosion created "new" features at Lake Meredith in the Texas panhandle. In a 50 year reservoir such as Lake Travis, it is entirely possible that varied rates of deflation have caused deposits from dissimilar deposits to collapse to a common plane, whereupon they are subsequently reburied under sediment, only to become re-exposed, providing the appearance of an intact feature.

Only through experimental and experiential research will this equation be clarified. This can be accomplished through several means. Will and Clark (1996) conducted an experiment in Maine where they produced an artifact assemblage and placed it upon the fluctuating bank of a natural lake. They determined that artifacts would redistribute themselves, typically upslope and in the direction of current forces (Will and Clark 1996:515). They noted artifacts tended to cluster around more permanent fixtures, namely large embedded stones, and created the illusion of new artifact clusters (Will and Clark 1996:516). Smaller artifacts, such as flakes, became entirely displaced, and further skewed the record (e.g., Lenihan et al. 1981:113). Unfortunately, dynamics affecting sites and assemblages are as varied as site locations, resulting in an almost infinite number of variables. It is for this reason that experimental designs should be implemented with as much frequency as possible. For instance, the Maine experiment involved an established natural lake subject to icing some five months of the year. The lake bed was formed of gravels and cobbles (Will and Clark 1996:511). This is dramatically different from typical conditions in Central Texas, for instance, where icing is virtually nonexistent, and shorelines tend to be formed of deep alluvial deposits.

This site-specific set of circumstances requires differing sets of research parameters. Ideally, a separate data base would be available for each site location. This is obviously not possible. In lieu of this complete data base, a partial one must be established. As it grows, more information will be available for a variety of site locations.

Some of this work has already begun. At 41BT305, on the shore of Lake Buchanan, a part of the Colorado River chain of highland lakes, a representative selection of exposed hearths has been carefully mapped by a transit (LCRA 1998). Although Lake Buchanan is not normally subjected to wide fluctuations in water level, the study area is on a low enough slope to enable exposure at minor variations. When these features are once again exposed, they can be remapped, and any movement will be documented. Similarly at 41TV209, on the southern portion of Lake Travis, also part of the Colorado River chain of lakes, a series of hearth features has been drawn, photographed, and tied to a central datum (Malof 1996). Re-exposure will add information to sites situated in similar topographic surroundings.

Site documentation in similar circumstances should include these types of data, so as to quantify feature and artifact movement through time. Realistically, it is seldom that minor sites receive this type of long-term attention, but if priorities are shifted, valuable information may be gained that can be applied to more significant archeological sites.

## SUMMARY

The processes affecting submerged sites are variable and complex. Mitigation includes recognizing factors affecting soon-to-be submerged sites, recently exposed sites, as well as long submerged sites. These factors include all levels of the archeological record. Regional settlement pattern studies are affected by site preservation, and site interpretation is affected by artifact preservation. Differential preservation on one level affects the systemic interpretation of all others. In order for such sites to be fully understood, a regional data base must be established. This will only be accomplished through experimental design and careful documentation of existing sites. Publishing such efforts may help to substantially increase the amount of knowledge to be gained from otherwise disturbed sites, and therefore add significantly to the archeological resource base.

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# Task Selection of Lithic Raw Materials in the Northern Rio Grande Valley, New Mexico

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## ABSTRACT

The relationship between type of lithic material and task use is not always readily discernible.Technological, functional, and availability considerations are clearly a significant component of raw material selection and utility. Usually, particular raw materials are utilized and procured preferentially over other available materials because they exhibit certain beneficial characteristics evident in tool production and/or utility. The lithic tool assemblages of Pot Creek Pueblo (TA1-Mound Roomblock Unit 4, dating ca. A.D. 1250-1325) and the proximal Cerrita pithouse site (ca. A.D. 1100) of the northern Rio Grande region of New Mexico provide the rare potential for investigating behavioral selectivity in the procurement and use of a wide variety of local and exotic raw materials. Overall, both assemblages exhibit similar lithic task selection patterns, with most of the exotic materials significantly occurring in projectile points or occasionally fine bifacial forms. Further, the data suggest trends in specific material morphological patterning in projectile points that appears to be due to artifact scavenging and possible cultural/functional selectivity differences between locally available and exotic lithic materials.

## INTRODUCTION

The significance of the types of lithic material from which a variety of tools are manufactured and recovered from archeological sites is not always readily apparent. Technological and functional considerations are clearly a crucial component of lithic raw material selection and use. Presumably, particular materials are utilized (and procured) preferentially over other available raw materials because they exhibit certain beneficial characteristics evident in tool production and/or utility. In addition to these considerations, it is also feasible that the utilization of one particular material over another may be incidental to, or a combination of, technological factors, and utilization may also reflect particular aspects of accessibility, social factors, and possibly even random events. The ca. A.D. 1250-1325 lithic tool assemblages of Pot Creek Pueblo (TA1-Mound/Roomblock Unit 4; see Wetherington 1968; Woosley 1980, 1986; Crown 1991; Crown et al. 1996; Adler 1996a, 1996b, 1997), and the nearby settlement of the Cerrita pithouse site (dating ca. A.D. 1100; Woosley 1980, 1986) of the northern Rio Grande region of New Mexico are considered in this paper because they offer the rare potential for a high degree of behavioral selectivity in the procurement and use of a wide variety of local and exotic lithic raw materials.

## METHODS

In an effort to assess potential patterns of material selectivity within and between the lithic tool assemblages of Pot Creek Pueblo (focusing on the TA1-4 lithic assemblage) and the Cerrita site lithic collection, SPSSX Crosstabs procedures were run to investigate the relationship of the major representative raw materials evident in the four basic tool classes (points/drills, bifaces, unifaces, and cores). These four artifact classes were selected because they succinctly characterize particular behavioral traits associated with lithic material functional and economic utility and tool production.

Generally, projectile points reflect hunting-piercing (and possibly some cutting) activities that maintain the potential to carry significant stylistic information based on their flexible morphological character. Bifaces are often more morphologically and functionally generalized lithic forms that allow for specific implement production through technological reduction. Unifacial flake tools are usually oriented toward hunting-cutting-butchering tasks and scraping activities that are often more casually manufactured. Cores, although often not tools per se, reflect the primary stages of cobble reduction used in the production of expedient and informal flake tools. Cores generally represent a less structured and informal technology that is not particularly oriented toward lithic conservation, instead representing a lithic waste-generating technological strategy. The presence of significant quantities of cores suggests that lithic procurement is relatively easy, along with the ready access to a lithic raw material, whether by exchange of whole cobbles or cores (indirect access) or by direct access and transport.

## PATTERNS OF PREHISTORIC LITHIC MATERIAL SELECTIVE UTILIZATION

Geological sources of lithic raw materials from which implements and tools are manufactured are often known to have a unique and fairly specific distribution within any given geographical region. Various lithic materials exhibit variable physical properties that have the potential to affect their suitability and utility for task-specific tools as well as their utility in particular types of manufacturing processes. Lithic tool manufacturing and use strategies are expected to vary according to several considerations:

(1) spatial availability of materials in relation to the spatial availability of other lithic and nonlithic resources; i.e., can a particular material or set of materials be obtained while procuring other resources within a particular exploitation-resource extraction strategy (Binford 1979; Carmichael 1983; Gould and Saggers 1985; Perttula 1984);

(2) suitability of particular materials for task-specific functions; that is, the physical characteristics of various materials that impose constraints on their technological reduction and use as tools (Cameron 1984; Chapman 1977; Kerley and Hogan 1983; Schutt 1983);

(3) availability of alternative suitable lithic material resources (Perttula 1984);

(4) distances to lithic material resources (Cameron 1984; Newman 1994; Perttula 1984; Winters 1984); and

(5) frequency and/or density of material(s) moved via exchange relationships (Cameron 1984; Munson and Munson 1984; Perttula 1984; Vehik 1990).

A number of past studies have illustrated prehistoric patterns in lithic material task selectivity (Cameron 1984; Dick 1965; Doyel 1991; Parry and Christenson 1987; Perttula 1984). A variety of past experimental studies have shown that the physical characteristics of certain silicious materials impose restrictions on the number and variety of reduction strategies and techniques of tool manufacture through which the materials can be successfully rendered into practical tools (Carmichael 1983; Chapman 1977; Peter and McGregor 1987, 1988; Winters 1984). The reduction and production techniques of tools vary according to the internal fine-grained consistency or "glassiness" maintained by a particular raw material. Criteria of parent material size, shape, "softness," amount of cortex, presence of disconformities, and fracture quality (e.g., the presence of "bedding" planes) all affect the quality—and hence the suitability—of a particular material for certain physical tasks.

High-quality cherts and other lithic materials were widely exchanged during many prehistoric (and historic) periods throughout North America. As in many examples, various materials were selected to serve special purposes or functions within a prehistoric culture. Preferential material selection reflects the fulfillment of technological, functional, and possibly ceremonial-religious and/or status-related needs in prehistoric economies. The specialized role of preferential material selection should be reflected in the differential utility of the material in comparison to more readily available and locally accessible lithic materials.

## THE LITHIC MATERIALS OF TA1-4 AND CERRITA: LOCALLY AVAILABLE LITHIC MATERIALS

### High Quality Cherts

Workable chert cobbles of excellent quality are readily accessible within 2 km of the TA1-4 and Cerrita settlements (Figure 1; the two sites are approximately 0.5 km apart). Cobbles and gravels of high-quality chert occur on the ridges and slopes of the Tres Ritos Hills above and around Pot Creek Pueblo and the Cerrita pithouse site (Newman 1994:492). The cherts are predominantly derived from the Mississippian Tererro Formation, although they also occur within the underlying Espiritu Santo Formation (Baltz and Read 1960; Sutherland 1963a), and within the overlying Pennsylvanian La Posada Formation (Sutherland 1963b). The cherts generally occur as gray, black, and white banded nodules up to 25 cm in maximum dimension. Gray and white banded chert lenses up to 1-2 m long and 25 cm thick occur near Ponce de Leon Springs, about 1.6 km north of the Cerrita site (Baltz and Read 1960:1757). Various gray cherts occur as rounded nodules representing up to 5 percent of all nodules within the Macho Member of the Tererro Formation; as large irregular masses (up to a meter in size) of secondary chert within the Manuelitas Member of the Tererro Formation; and as infrequent scattered chert nodules within the Cowles Member of the Tererro Formation (Sutherland 1963a:28). White to light gray chert occur in nodular beds up 30 cm thick within the Pennsylvanian La Posada Formation.

### Quartzites

Quartzite boulders, cobbles, and gravels are common along the ridges and slopes above the Cerrita site. These quartzites are predominantly derived from the lower quartzite member of the Precambrian Ortega Formation (Montgomery 1963). The quartzite is typically massive, translucent, and gray to white in color. Occasionally, it can be as

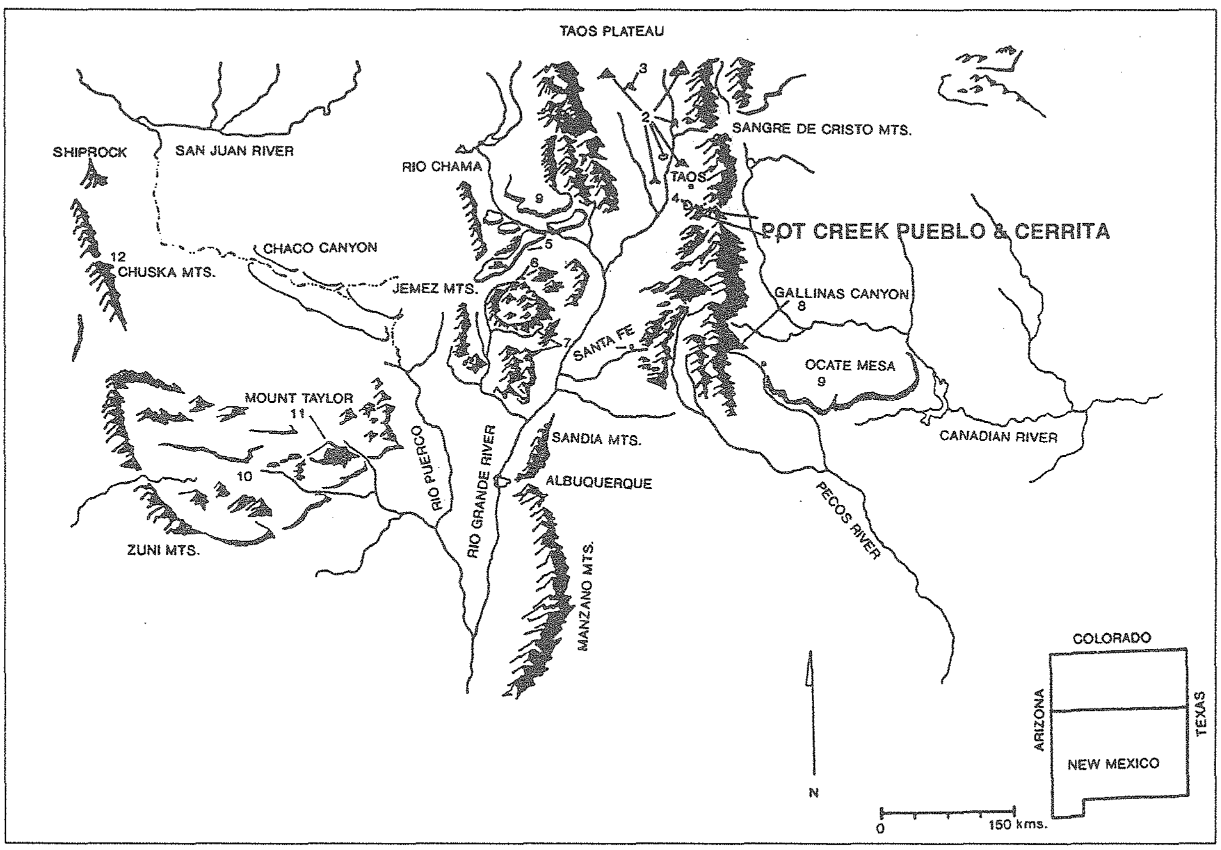


Figure 1. Sources of lithic material identified in this study and the location of Pot Creek Pueblo and the Cerrita pithouse site: 1= Chert, Quartzites, Shales; 2= Rhyodacites; 3= No Agua Mt. Obsidian; 4= Rhyolite Tuffs; 5= Cerro Pedernal "Chalcedony"; 6= Polvadera Peak Obsidian; 7= Cerro Toledo Obsidian; 8= Gallinas Canyon "Brown Chalcedony"; 9= Dakota-Morrison Red and Gray Orthoquartzites; 10= Zuni Mts. "Leopard Chert" (Chinle Chert); 11= East Grants Ridge Obsidian; 12= Washington Pass Chalcedony.

white as vein quartz; uncommonly, the quartzite is mottled or streaked with iron oxide, shaded a smoky gray-black, or at times, a pale blue-green. They are remarkably pure, generally composed of 98 percent quartz with a medium to coarse grain size (grains on the order of 1 mm in diameter). The quartzite tends to have a homogeneous, fused appearance, rendering grain outlines invisible megascopically (Montgomery 1963:10). Alhough the fracture quality is rather poor, and the knappability rather restricted, the material can suffice for effective unifacial flake tools in many instances.

### Olive Drab and Black Shales

Pennsylvanian Magdalena Formation micaceous olive-gray-green shales (Stark and Dapples 1946:1143-1144) occur locally and are readily available on the slopes and ridges behind the Cerrita site. The rock usually occurs as relatively thin (2-10 cm thickness) slabs or slab fragments, although occasional irregular boulders (up to 20 cm in diameter) of the material were observed to occur (as "float") during a lithic material sourcing survey. The rock is characteristically banded or streaked by numerous minute black shaly laminae (of variable thicknesses), within a dense, massive, and compacted indurated sandy matrix that may grade into a shaly sandstone. The rock also exhibits a distinctive reddish-brown cortex or weathered surface, which often fills the interior fractures of the larger material blocks and block fragments, and inhibits its conchoidal fracture quality. The breakage pattern of individual "slab units" is of conchoidal fracture, but the laminar structure and density of the rock restricts this quality.

The "inhibiting" nature of the rock appears to have restricted its use for tools to simple, informal, and expedient unifacial flake tools and scraper planes. A better quality homogeneous black shale or slate is also available locally in limited quantities, and this material was utilized for a wider range of lithic implements. These include various bifaces and a limited number of projectile points.

## EXOTIC LITHIC MATERIALS

### Rhyodacite

Six spatially discrete rhyodacite sources are scattered over the Taos Plateau. Four of the sources provide a uniform, fine-grained, phenocryst-poor, black to very dark gray rock (Newman and Nielsen 1987:263). The remaining two sources exhibit more coarsely textured versions of the rock.

The high-quality rhyodacite is available at Cerro Negro Mt. (just east of Arroyo Hondo), an unnamed deposit east of Cerro Montoso (central Taos Plateau), San Antonio Mt. (the northwest Taos Plateau), and Ute Mt. (northeast Taos Plateau). The coarser versions of the rock are available at Tres Orejas Mt. (southern Taos Plateau), and Guadalupe Mt. (just west of Questa). Rhyodacite is readily identified macroscopically, with a glassy, fine-grained ground mass that breaks with a clean conchoidal fracture, occasionally exhibiting sparse phenocrysts. Rhyodacite occurs at the sources as nodules (up to boulder size) and gravels scattered over the surface and in buried deposits. The rhyodacite sources are not apparently affected by any substantial fluvial or erosional actions, nor do they appear to contribute to mixed gravel deposits in the area. Cerro Negro Mt. is the nearest high-quality rhyodacite source to Pot Creek Pueblo and the Cerrita site (Newman 1994:493; Newman and Nielsen 1987).

### Brown Chalcedony

In addition to the locally available cherts, the Manuelitas Member of the Tererro Formation also occasionally contains a chalcedony. The closest known exposures of this material occur in Gallinas Canyon northwest of Las Vegas, New Mexico. In the vicinity of Pot Creek Pueblo and the Cerrita site, the Manuelitas (and the Cowles) Member has been truncated by the extensive downcutting associated with the development of the Taos Trough (Chapin 1981). The material (chalcedonite) exhibits excellent zoning with both solid and previously fluid inclusions within the chalcedonic matrix. The rock is usually a mottled red or red-brown to peach in color, translucent in some areas, and often has cortex on one or more surfaces, indicating the rock is most often available as pebble gravels or in thin seams (Newman 1994:493).

### Cerro Pedernal "Chalcedony"

The Cerro Pedernal material occurs within the bedded Pedernal Chert Member of the Tertiary Abiquiu Tuff Formation (Smith 1938). The rock is available on the slopes of Cerro Pedernal Mt., San Pedro Mt., at a number of other exposures along the northern limits of the Jemez Mts., and in the Chama River Valley (Bryan 1938, 1939; Smith 1938; Church and Hack 1939). Chalcedonic deposits have been followed for 32 km westward from Cerro Pedernal and Mesa de Grulla to San Pedro Mt. by Church and Hack (1939).

The material exhibits considerable variation in color from white to gray through translucent or black, with pinks, browns, yellows, and reds also fairly common. It can often be spotted, banded, streaked, or mottled with several colors evident. The matrix exhibits recurrent small to moderate open cavities and cracks in conjunction with occasional spherulites and small clusters of granular quartz. The material is of excellent fracture quality, and was used to produce a wide variety of lithic tools (Newman 1994:493).

### Dakota-Morrison Orthoquartzites

The Dakota-Morrison material is part of two extensive geological units outcropping in several areas in northern New Mexico and adjacent states. The nearest available source for Pot Creek Pueblo and the Cerrita site is apparently in the Chama Valley around Mesa de Viejos, not far from the sources for Cerro Pedernal material. Muehlberger's (1967) descriptive geological type section for the Cretaceous Dakota Formation and the underlying Jurassic Morrison Formation is located about 600 m west of the intersection of Willow Creek and the Rio Chama in Chama Gorge. Ocate Mesa, east of Las Vegas, New Mexico, is apparently an equally available source.

The Dakota material is predominantly derived from the upper and lower sandstone units of the Dakota Formation, separated by a middle claystone unit (which is apparently not present in all exposures). The orthoquartzite is usually light gray to gray-orange in color on a fresh surface, and weathers to a pale orange-red to brownish-orange color. The rock is massive, with grain size ranging from very fine at the top of the unit to medium fine at the base of the upper unit (Muehlberger 1967:74). The sub-angular to sub-rounded quartz grains of the rock are completely cemented by silica and are clearly visible macroscopically, giving the material a distinctive and readily identifiable appearance. The orthoquartzite fracture quality is usually excellent due to the high silica content, and consequently the rock was useful for a wide range of lithic tools (Newman 1994:494). The Morrison Formation material found at Pot Creek Pueblo and the Cerrita site is more frequently of a red/red-brown quartzite, that may not be evident in all exposures of the unit.

Jurassic Morrison Formation materials have a fairly wide geographical distribution similar to that noted for the siliceous materials of the Dakota Sandstone, which it often underlies (Dane and Bachman 1965). Archeologically, the rocks have been noted in lithic assemblages at least as far north and as early as the Paleoindian Hanson site in Wyoming (Frison and Bradley 1980), while also apparently a common raw material in Chaco Canyon sites and related areas (Cameron 1981; Powers et al. 1983).

The Brushy Basin Member is the main geological unit of the Morrison Formation of interest here, exposures of which exist from the Four Corners region into the Chama Basin on the basis of lithological similarity and stratigraphic position (Gregory 1938; Craig 1955; Cameron 1981). The unit is predominantly composed of variegated claystone with variable quantities of silt and sand. Conglomeratic sandstone lenses are also common, and include pebbles of deep red, green, white, black, and yellow colors, all varying from opaque to translucent in hand specimen appearance.

The chalcedonic beds are widely distributed and this Jurassic middle unit and key stratigraphic zone has been documented in Colfax County, New Mexico (Wood et al. 1953), Mora County, New Mexico (Bachman 1953), western Kansas (Merriam 1955), the Nebraska panhandle (McKee et al. 1956), southern Wyoming (Pipiringos 1953), the Raton Basin, Colorado (Johnson and Stephens 1954; Oriel and Mudge 1956), central Utah (Stokes and Holmes 1954), and eastern Colorado (Duce 1924; McLaughlin 1954; Ogden 1954). In Baca County, Colorado, McLaughlin (1954:94) notes "the most distinctive beds in the Morrison formation are thin layers of red chert lying beneath the limestone...The amber to red quartz and chert form irregular nodules....and were formed in place." In western Kansas, Merriam (1955:34) commented that the "chert is white to pink, some having a blue tinge, generally translucent, and shows conchoidal fracture...some of the chert is chalcedonic." In eastern Colorado, Ogden (1954:914) notes that flesh-colored to vermillion chalcedony is ubiquitous in irregular rounded masses; this unit has been referred to as the "welded chert" because of the resemblance of the weathered surface to the rounded metallic beads that result from welding. The unit may contain beds of nearly pure carnelian or may include geodes up to 2 inches in inside diameter, lined with gray agate, drusy quartz, and calcite crystals.

Where Jurassic rocks of the middle unit have been differentiated from the immediately preceding and following formations, a variety of names have been employed, predominantly the Sundance, Ralston, Wanakah, and Todilto, and less commonly the Summerville and Curtis formations (Oriel and Mudge 1956:22). Glenn and Chipman (1964:35) mention that "agate" may be found in the gravels of the San Juan River channel as well as in the gravels of its higher terraces. The gravels contain white, gray, blue, and transparent chalcedonic "agate" in variable shades, patterns, and color bands. Patterns include brown or black spots or bands, green to blue-green coloring or inclusions, and various dendritic, "mossy," or "tube" designs (Glenn and Chipman 1964:35). It is possible that these deposits derive from the Bayfield Gravel and/or the Bridgetimber Gravel of Atwood and Mather (1932). They note that the Bayfield Gravel has "a great variety of rocks and minerals...represented. Quartzite of a bluish tint, milky-white quartz, dark-red jasper, chert, flint, greenstone, and basalt are the most common" (Atwood and Mather 1932:84). Regarding the Bridgetimber Gravel, Atwood and Mather (1932:90) indicate that "the smaller pebbles include in addition quartz, chert, flint, and jasper."

### Polvadera Peak Obsidian

Polvadera Peak obsidian originates in the Polvadera Group, which encompasses intermediate volcanic formations of the basalt-andesite-dacite-rhyolite association, predominantly located in the northern areas of the Jemez Mts. west of Santa Fe, New Mexico. The obsidian derives from the El Rechuelos Rhyolite, found in five small scattered rhyolite domes and a small pumice cone in the northern Jemez Mts. (Smith et al. 1970). The Polvadera Peak obsidian unit occurs as a small, isolated volcanic dome adjacent to the intersection of El Rechuelos Draw and Polvadera Peak, 1.8 km southwest of Polvadera Peak.

The obsidian is usually a murky, smoky gray due to ubiquitous whitish phenocrysts within the glassy matrix. The obsidian is usually easily identifiable in archeological lithic assemblages. Polvadera obsidian occurs primarily as small pebbles and cobbles, although larger nodules have been noted. The obsidian-bearing unit is apparently restricted to the obsidian dome itself and its immediate environs and does not occur in gravels or alluvial/colluvial deposits at lower elevations along the northern fringe of the Jemez Mts. (Baugh and Nelson 1987; Newman 1994:494; Newman and Nielsen 1985).

### Obsidian Ridge (Cerro Toledo) Obsidian

Cerro Toledo obsidian derives from the Cerro Toledo Rhyolite of the Tewa Group, the most recent and Pleistocene volcanic unit of the Jemez Mts. This group also includes the Bandelier Tuff, Cerro Rubio Quartz Latite, and the Valles Rhyolite. The Cerro Toledo Rhyolite contains frequent pebbles and nodules (up to 25 cm diameter) of obsidian within a lithophysal, gray lithoidal rhyolite matrix (Smith et al. 1970).

Cerro Toledo obsidian is usually translucent to opaque black, occasionally containing small quartz and sanidine phenocrysts. Opaque greens and browns have been noted, and banded obsidian nodules have been found within the deposits (Newman 1994; Newman and Nielsen 1985). There are three main known spatially discrete source areas: the volcanic domes of the Sierra de Toledo Mts. of the Sierra de Toledo Caldera on the northeastern edge of the Valle Grande; Rabbit Mt. on the southeastern rim of the Valles Caldera; and the Rabbit Mt. Rhyolite-derived avalanche deposits (i.e., obsidian-bearing rhyolite tuffs and tuff-breccias; see Smith et al. 1970) of several of the ridges and canyons of the Pajarito Plateau. The avalanche deposits include the obsidian deposits of Obsidian Ridge (Newman and Nielsen 1985), the obsidian deposits of Bland Canyon (Warren 1979:57), Pueblo Canyon (Bailey and Smith 1978:194), and the scattered obsidian deposits of the high mesas along White Rock Canyon (Warren 1979:57).

### Zuni Mts. "Leopard Chert"

One of the sources of this yellow, brown, and black-spotted chert is Oso Ridge in the Zuni Mts.

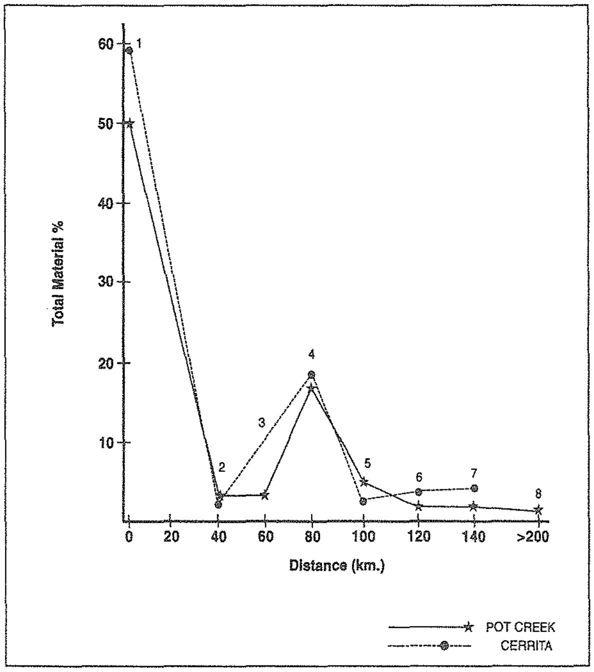


Figure 2. Total lithic material representative percentages within the Pot Creek Pueblo Mound/Unit 4 and Cerrita site assemblage by material source distance: 1=Chert; 2=Rhyodacites; 3=Gallinas Brown Chalcedony; 4=Cerro Pedernal; 5= Dakota-Morrison; 6=Polvadera Peak Obsidian; 7=Cerro Toledo Type Obsidian; 8=Zuni Mts. "Leopard" Chert (Chinle Chert).

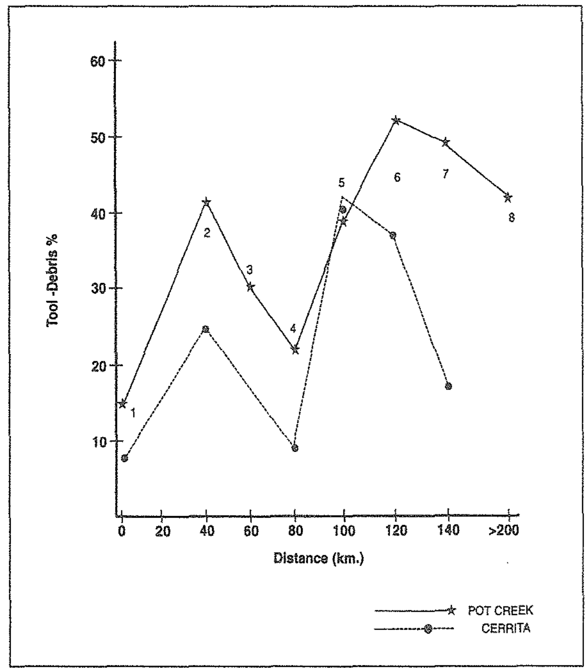


Figure 3. Tool-debris ratio percentages within the Pot Creek Pueblo Mound/Unit 4 and Cerrita pithouse site assemblages by material source distance. 1=Chert; 2=Rhyodacites; 3=Gallinas Brown Chalcedony; 4=Cerro Pedernal; 5=Dakota-Morrison; 6=Polvadera Peak Obsidian; 7=Cerro Toledo Type Obsidian; 8=Zuni Mts. "Leopard" Chert (Chinle Chert).

(see Figure 1). The rock is more commonly known as "Chinle Chert," and it occurs in many lithic assemblages in northwestern New Mexico and Chaco Canyon (Cameron 1981; Powers et al. 1983).

## Rhyolite Tuffs

Pink and gray water-laid rhyolite tuff cobbles and fragments that are part of the Tertiary Picuris Tuff (Cabot 1938), have been exposed in a number of areas in and adjacent to the Picuris Range. The closest and most accessible deposits are located in Arroyo Miranda, the next valley west of the Rio Grande del Rancho Valley and the Pot Creek Pueblo and Cerrita sites. The rock is easily identified in hand specimens, being a deep reddish-pink to medium gray in color, and often having fairly large dark gray rhyolitic lenticular inclusions that inhibit the material's fracture quality. A reconnaissance survey of this source area in the Arroyo Miranda identified numerous quarry-workshop areas scattered along the valley floor where nodules and fragments of the material can be obtained within the alluvium.

## THE TA1-4 AND CERRITA MATERIAL TASK SELECTION ANALYSES

Figures 2 and 3 illustrate the major high-quality lithic materials evident in the TA1-4 and Cerrita lithic assemblages. In terms of overall material representation, TA1-4 and Cerrita are very similar in that the local cherts and the exotic Cerro Pedernal material represent the two most common lithic materials in the two assemblages. By tool-debris ratio percentages, Figure 3 indicates that TA1-4 and Cerrita are again very similar with the exotic rhyodacites, obsidians, Dakota-Morrison materials, and Zuni Mountains "leopard chert" (found only at Pot Creek Pueblo) exhibiting high frequencies of tools compared to debris. Cerrita has a considerably lower percentage value for Cerro Toledo obsidian artifacts. The local cherts and the exotic Cerro

Pedernal material represent most of the materials within the respective tool assemblages, with the other materials having a roughly equal percentage representation. The TA1-4 tool assemblage does have a higher percentage of Dakota-Morrison material tools, while the Cerrita assemblage does not contain brown chalcedony or Zuni Mountains "leopard chert" tools (see Figure 3).

Formal tools are primarily made of more exotic lithic materials in the two site assemblages (Figure 4). Other than the absence of Brown Chalcedony and Zuni Mtns. "leopard chert" for the Cerrita site assemblage, the tool-debris profiles are very similar. The very low tool percentage for the Cerrita Cerro Toledo obsidian may be a product of the small sample size (n=2) of this particular obsidian at the site. However, there are comparable decreased percentage values for the Cerro Pedernal material in the two assemblages, indicating more debris is represented than tools (see Figure 3). This pattern is similar to that of the locally available cherts, suggesting an enhanced access to the Cerro Pedernal material.

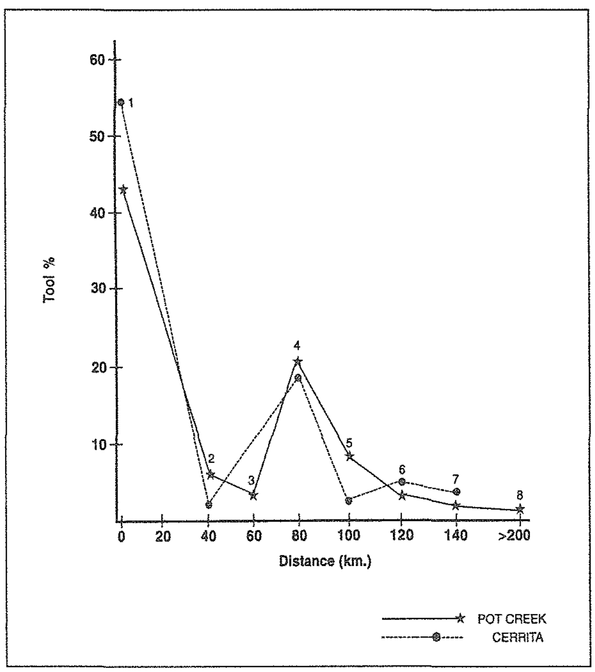


Figure 4. Tool material representative percentages within the Pot Creek Pueblo Mound/Unit 4 and Cerrita site assemblages by material source distance. 1=Chert; 2=Rhyodacites; 3=Gallinas Brown Chalcedony; 4=Cerro Pedernal; 5=Dakota-Morrison; 6=Polvadera Peak Obsidian; 7=Cerro Toledo Type Obsidian; 8=Zuni Mts. "Leopard" Chert (Chinle Chert).

In the chi-square analyses, I emphasize the analysis of the pattern of residuals (the difference between the expected and actual frequencies), as they illustrate where the statistical independence model breaks down. This approach amounts to comparing each observed frequency with its expected value to assess which cells contribute most to the chi-square statistic. Instead of using the obvious subtractive differences, Everitt (1977) and Reynolds (1977) recommend computing and using adjusted residuals whose values can be compared with percentiles of the normal distribution. Values greater than 1.64 (the 95th percentile of the standard normal distribution) suggest a significant discrepancy between the observed and expected frequencies (Reynolds 1977). Everitt (1977:47) however, recommends using the 5 percent standard normal deviate (values greater than $\pm$ 1.96) for a significant adjusted residual value. Everitt's (1977) $\pm$ 1.96 recommended value will be utilized in this paper. Values that are relatively large (greater than $\pm$ 1.96) point to "outliers" or frequencies that are far greater or smaller than they should be under the model of statistical independence. The benefit of this methodology is that by examining a model's fit cell by cell, the significant elements (cells) can be identified that contribute to the chi-square statistic and also deviate significantly from expected frequencies.

### Task Selection of Lithic Materials

The material selectivity analysis begins with the examination of the relationship between tool class and exotic (> 20 miles to lithic source) or local (< 20 miles to lithic source) lithic material of the Pot Creek Pueblo Mound/Unit 4 assemblage. This analysis is designed to evaluate patterns of lithic raw material selectivity based upon a general distance to source factor. In the material selectivity analysis, it is expected that cores of exotic materials will be minimally represented as they would be associated with primary reduction activities and more inefficient and wasteful lithic reduction technologies; primary lithic reduction would occur at the source or associated reduction location. Less obvious associations may include more exotic material bifaces due to material transport interests. This proposition is based on the assumption that generalized-form bifaces would be potentially more desirable for transportation, as the form maintains greater flexibility in later stage lithic reduction and tool production.

In a crosstabulation analysis of local versus exotic material unifaces, points, bifaces, and cores for the TA1-4 assemblage, a significant chi-square value (339.23; significance=.0000; n=3145 tools, 1463 exotic tools, 1682 local tools; points=125 local, 378 exotic; bifaces=330 local, 339 exotic; cores=432 local, 98 exotic; and unifaces=795 local, 648 exotic) indicates that as expected, cores are far more commonly represented by locally available lithic materials (exhibiting a high positive adjusted residual value [ARV] of 14.2), while projectile points are far more commonly manufactured from exotic materials (a high positive ARV of 14.0). Bifaces of exotic materials also exhibit a significant high positive ARV (2.4), while unifaces exhibit an insignificant adjusted residual (1.7) for the locally available materials.

It is interesting to note that nearly 26 percent of the exotic material tools are projectile points while 75 percent of the projectile points within the TA1-4 tool assemblage are manufactured of exotic raw materials. This is particularly significant due to the fact that the locally available cherts are of excellent quality for the manufacture and use as projectile points. This phenomenon indicates that the exotic materials were prefered for projectile points regardless of qualitative material-functional criteria or accessibility factors.

The same Crosstabs chi-square analysis was conducted on the Cerrita site tool assemblage with similar results (chi-square=81.57; significance=.0000; n=583 total tools; exotic materials=210 total tools, including 73 unifaces, 75 points, 41 bifaces, and 21 cores; local materials=373 total tools: 135 unifaces, 45 points, 46 bifaces, and 147 cores). The locally available raw materials (the cherts, Ortega quartzites, black and green shales, etc.) tend to occur as cores (with close to the expected ARV of 0.3 for unifaces), while exotic materials appear to significantly occur as projectile points (ARV=6.8) or other bifacial forms (ARV=2.3). Again, the exotic materials were apparently selected for, or procured as, projectile points or in some cases, bifaces. Thirty-six percent of the exotic tool materials occur as projectile points; furthermore, 62.5 percent of the projectile points within the Cerrita tool assemblage are manufactured from exotic materials.

In order to achieve a more detailed analysis of the particular relationship between individual raw material types and artifact class, an SPSSX chi-square Crosstabs program was again run with the lithic materials categorized into the major individual varieties of the TA1-4 assemblage. Table 1 illustrates the results with a chi-square=662.40 (significance=.0000). The obsidians (predominantly Cerro Toledo and Polvadera Peak), rhyodacites, and the Cerro Pedernal material are conspicuously represented by projectile points (with significant high positive ARVs between 6.9-11.3), suggesting functional selectivity of these materials for projectile point tool forms. This pattern is even more striking for the obsidians and rhyodacites in view of the fact that bifacial tool forms do not follow this high residual tendency, possibly because completed projectile points, but not bifacial blanks, were predominantly being introduced into Pot Creek Pueblo (Mound/Unit 4). The comparatively low frequencies of bifacial tool forms of the rhyodacites and the obsidians further suggests that primary projectile point manufacture mainly occurred at a location other than the Pot Creek Pueblo site area (TA1-4). This particularly appears to be the situation in regard to the obsidians. This phenomenon points to the fact that the obsidians and rhyodacites may have been procured (and/or scavenged from earlier archeological site deposits) in completed projectile point form, and/or manufactured off-site and brought as complete projectile point forms to the TA1-4 settlement.

In contrast, the Dakota-Morrison materials appear to be somewhat more widely represented within the various tool classes based on ARVs between 0.5-5.0 for unifaces, points, bifaces, and cores. However, the red quartzite (Morrison) variety has a distinct tendency toward bifacial tool forms, indicating either a functional selectivity (i.e., fulfilling a need for bifacial cutting tools) for the lithic material or perhaps more likely a transport/trade shape selectivity (i.e., efficient transport of staged bifaces as potential sources of raw material) for the material brought into the TA1-4 area of Pot Creek Pueblo. Bifaces represent generalized shapes (as a raw material "package") that are more convenient and practical for trade and transport than other types of cores or unmodified chunks of lithic material. The analyses indicate that Dakota-Morrison bifaces were primarily arriving at the TA1-4 settlement in completed form. This latter interpretation is further supported by the observation that a majority of the tool forms of the Dakota-Morrison material within the bifacial tool class are an ovate large, well-finished, bifacial "knife." The "green chalcedony" material

**Table 1. Chi-square Crosstabulation of Lithic Material Type by Tool Type for the Pot Creek Pueblo Mound/Unit 4 Assemblage**

| Rawmat | Count / Exp Val / Adj Res | Uniface | Point | Biface | Core | Row Total |
|---|---|---|---|---|---|---|
| Chert | Count | 656 | 124 | 270 | 295 | 1345 |
| | Exp Val | 618.6 | 215.9 | 286.3 | 234.1 | |
| | Adj Res | 2.7 | **-9.0** | -1.4 | **6.9** | |
| Chalcedony | Count | 304 | 170 | 145 | 55 | 674 |
| | Exp Val | 310.0 | 108.2 | 143.5 | 112.3 | |
| | Adj Res | -0.5 | **7.3** | 0.2 | **-6.7** | |
| Ortega quartzite | Count | 74 | 0 | 26 | 72 | 172 |
| | Exp Val | 79.1 | 27.6 | 36.6 | 28.7 | |
| | Adj Res | -0.8 | **-5.9** | **-2.0** | **9.1** | |
| Toledo Obsidian | Count | 35 | 37 | 8 | 6 | 86 |
| | Exp Val | 39.6 | 13.8 | 18.3 | 14.3 | |
| | Adj Res | -1.0 | **6.9** | **-2.8** | **-2.4** | |
| Rhyodacite | Count | 52 | 82 | 37 | 6 | 177 |
| | Exp Val | 81.4 | 28.4 | 37.7 | 29.5 | |
| | Adj Res | **-4.6** | **11.3** | -0.1 | **-4.9** | |
| Gray/Red Rhyolites | Count | 23 | 4 | 11 | 4 | 42 |
| | Exp Val | 19.3 | 6.7 | 8.9 | 7.0 | |
| | Adj Res | 1.1 | -1.2 | 0.8 | -1.2 | |
| Morrison Red Quartzite | Count | 40 | 7 | 32 | 3 | 82 |
| | Exp Val | 37.7 | 13.2 | 17.5 | 13.7 | |
| | Adj Res | 0.5 | -1.9 | **4.0** | **-3.2** | |
| Dakota Gray Quartzite | Count | 70 | 30 | 39 | 2 | 141 |
| | Exp Val | 64.9 | 22.6 | 30.0 | 23.5 | |
| | Adj Res | 0.9 | 1.7 | 1.9 | **-5.0** | |
| Black Shale | Count | 37 | 1 | 27 | 28 | 93 |
| | Exp Val | 42.8 | 14.9 | 19.8 | 15.5 | |
| | Adj Res | -1.2 | **-4.0** | 1.9 | **3.5** | |
| Green Shale | Count | 26 | 0 | 5 | 29 | 60 |
| | Exp Val | 27.6 | 9.6 | 12.8 | 10.0 | |
| | Adj Res | -0.4 | **-3.4** | **-2.5** | **6.6** | |
| Polvadera Obsidian | Count | 34 | 46 | 11 | 2 | 93 |
| | Exp Val | 42.8 | 14.9 | 19.8 | 15.5 | |
| | Adj Res | -1.9 | **8.9** | **-2.3** | **-3.8** | |
| Brown Chalcedony | Count | 44 | 1 | 22 | 12 | 79 |
| | Exp Val | 36.3 | 12.7 | 16.8 | 13.2 | |
| | Adj Res | 1.8 | **-3.6** | 1.4 | -0.4 | |
| Jasper | Count | 16 | 0 | 9 | 2 | 27 |
| | Exp Val | 12.4 | 4.3 | 5.7 | 4.5 | |
| | Adj Res | 1.4 | **-2.3** | 1.5 | -1.3 | |
| Leopard Chert | Count | 18 | 1 | 12 | 3 | 34 |
| | Exp Val | 15.6 | 5.5 | 7.2 | 5.7 | |
| | Adj Res | 0.8 | **-2.1** | **2.0** | -1.2 | |
| Green Chalcedony | Count | 12 | 0 | 13 | 3 | 28 |
| | Exp Val | 12.9 | 4.5 | 6.0 | 4.7 | |
| | Adj Res | -0.3 | **-2.3** | **3.3** | -0.8 | |
| Column Total | | 1441 | 503 | 667 | 522 | 3133 |

| Chi-square | D.F. | Significance | Min E.F. | Cells with E.F.<5 |
|---|---|---|---|---|
| 662.39705 | 42 | 0.0000 | 4.335 | 4 of 60 (6.7%) |

appears to closely parallel this, as bifaces of green chalcedony from the Morrison formation also are predominantly well-fabricated bifaces (high positive ARV=3.3). This also suggests transport/trade shape/morphology selectivity. As the green chalcedony exhibits no inherent characteristics different from the other chert or chalcedonic raw materials, this shape characteristic is probably not functionally related or determined.

The high positive ARV (3.5-9.1) associated with cores of the locally available materials (chert, Ortega quartzite, black and green shales) not surprisingly reflects easy source access and the production of primarily simple and expedient flake tools in the TA1-4 pueblo area. The relatively coarse-grained locally available Ortega quartzites are restricted to cores, simple flake tools, and crude bifacial implements. The more workable and higher quality local chert materials are more frequently used for a wider range of tools. The black and green shales were used the same as the Ortega quartzites (undoubtedly due to their inferior quality).

For comparative purposes, the Cerrita tool assemblage was subjected to the same SPSSX crosstabs chi-square procedure as the TA1-4 tool assemblage. The chi-square crosstabs values (Table 2) for the Cerrita tool assemblage do not exhibit a comparable diversity for lithic materials that had characterized the TA1-4 tool assemblage. However, it is also evident that the use of the various materials that Cerrita has in common with TA1-4 follows the same pattern.

To increase the sample size within particular material type groups for more reliable statistical analyses, the obsidians, the

**Table 2. Chi-Square Crosstabulation of Lithic Material Type by Tool Type for the Cerrita Pithouse Site Assemblage**

| Rawmat | Count / Exp Val / Adj Res | Uniface | Point | Biface | Core | Row Total |
|---|---|---|---|---|---|---|
| Chert | Count | 115 | 45 | 44 | 112 | 316 |
| | Exp Val | 112.4 | 65.7 | 47.8 | 90.1 | |
| | Adj Res | 0.5 | **-4.2** | -0.9 | **4.0** | |
| Chalcedony | Count | 41 | 32 | 27 | 19 | 119 |
| | Exp Val | 42.3 | 24.7 | 18.0 | 33.9 | |
| | Adj Res | -0.3 | 1.8 | **2.6** | **-3.4** | |
| Ortega quartzite | Count | 10 | 0 | 0 | 20 | 30 |
| | Exp Val | 10.7 | 6.2 | 4.5 | 8.6 | |
| | Adj Res | 0.3 | **-2.9** | **-2.4** | **4.8** | |
| All Obsidians | Count | 19 | 28 | 7 | 1 | 55 |
| | Exp Val | 19.6 | 11.4 | 8.3 | 15.7 | |
| | Adj Res | -0.2 | **5.8** | -0.5 | **-4.6** | |
| Rhyodacite | Count | 6 | 11 | 2 | 0 | 19 |
| | Exp Val | 6.8 | 4.0 | 2.9 | 5.4 | |
| | Adj Res | -0.4 | **4.1** | -0.6 | **-2.8** | |
| Gray/Red Rhyolites | Count | 1 | 0 | 3 | 0 | 4 |
| | Exp Val | 1.4 | 0.8 | 0.6 | 1.1 | |
| | Adj Res | -0.4 | -1.0 | **3.4** | 1.3 | |
| Dakota-Morrison | Count | 3 | 4 | 3 | 0 | 10 |
| | Exp Val | 3.6 | 2.1 | 1.5 | 2.9 | |
| | Adj Res | -0.4 | 1.5 | 1.3 | **-2.0** | |
| Black & Green Shales | Count | 9 | 0 | 1 | 13 | 23 |
| | Exp Val | 8.2 | 4.8 | 3.5 | 6.6 | |
| | Adj Res | 0.4 | **-2.5** | -1.5 | **3.0** | |
| Brown Chalcedony | Count | 3 | 1 | 1 | 1 | 6 |
| | Exp Val | 2.1 | 1.2 | 0.9 | 1.7 | |
| | Adj Res | 0.7 | -0.3 | 0.1 | -0.6 | |
| Column Total | | 207 | 121 | 88 | 166 | 582 |

| Chi-square | D.F. | Significance | Min E.F. | Cells with E.F.<5 |
|---|---|---|---|---|
| 139.30647 | 24 | 0.0000 | 0.605 | 17 of 36 (47.2%) |

Dakota-Morrison quartzites, and the black and green shale materials were combined into three different groups. The obsidians and rhyodacites again appear to be favored for projectile points, based on high ARV values (ARV=4.1-5.8). Cores are also again mainly restricted to the locally available materials (cherts, Ortega quartzites, and black and green shales). The Cerro Pedernal chalcedony appears to have been favored for bifacial implements based upon the significant positive ARV value (ARV=2.6). Though the chi-square significance is not highly reliable due to the large number of table cells with effective values less than 5 (47.2 percent), the expected values and residual values are enlightening.

For a further comparison of the selective utilization of various raw materials, the Pot Creek Pueblo Mound/Unit 6 tool assemblage was also examined with the SPSSX Crosstabs chi-square procedure. This detailed analysis of the selective use of different raw materials from another area of the Pot Creek Pueblo site assessed the general applicability of the utilization pattern evident at TA1-4 to the other settlement roomblocks, to consider the possibility that different roomblocks may have had differential access to exotic materials and/or differential material selective utilization patterns.

This analysis indicates that the utilization of the various materials at TA1-6 closely follow the patterns evident at TA1-4 and the Cerrita pithouse site. Again, given the large number of table cells with effective values less than 5 (27.8 percent), the chi-square statis-tical results may not be reliable, even though the expected frequencies and ARVs are important. The obsidians and rhyodacites (with significant ARV values between 5.1-7.4) occur in the tool assemblage (n=999; total exotic materials=286; total local materials=713) primarily as projectile points. In addition, an unexpected number of Dakota-Morrison material projectile points (ARV=4.6) are more clearly apparent within the TA1-6 lithic tool assemblage. The TA1-4 and Cerrita tool assemblages had hinted at this increased selectivity of the Dakota-Morrison material for points and bifaces with significant high chi-square ARVs , but the TA1-6 pattern is more clearly evident (with higher positive ARVs). The Cerro Pedernal material utilization is again somewhat more generalized with high positive ARVs for points

(ARV=2.6) and bifaces (ARV=2.8). The local materials are again conspicuously over-represented within the core and flake tool forms. The flake tools of local raw materials are also predominantly simple, expedient forms. These patterns follow the TA1-4 results, indicating that the lithic selective patterns and material access to these materials was similar throughout the Pot Creek Pueblo settlement and within the individual roomblock segments of the site. As such, there is no material access or utilization "hierarchy" within the Pot Creek Pueblo settlement.

The results of the various tool assemblage analyses indicate that the selective utilization of the diverse variety of available local and exotic materials was remarkably consistent. Part of this selective process was undoubtedly tied to the inherent properties and characteristics of the individual lithic materials themselves. It is not surprising to discover that the obsidians are selectively utilized for projectile points given their fine edge characteristics and high quality fracture control. The same situation characterizes the utility of the rhyodacites.

The Cerro Pedernal material presents a more difficult utilization pattern to interpret. Although it is an exotic, this lithic material occurs in greater frequencies and exhibits a less restricted range of utilization. There is a definite trend toward more frequent projectile point and bifacial tool forms, although the Cerro Pedernal material has no apparent inherent qualitative superiority or advantage over the abundant and locally available high quality cherts. The only significant qualitative difference between the exotic Cerro Pedernal material and the locally available cherts is the more durable and more dense structure of the Cerro Pedernal rock, which would provide longer lasting tools and tool edges. The tendency of the Cerro Pedernal material to be in projectile point or bifacial tool forms may be because projectile points are primarily manufactured of any exotic materials.

In regard to the other exotic materials, this trend toward points and bifaces may be due to economic procurement-trade factors given the scarcity of associated bifacial reduction and tool manufacturing debris. However, the associated lithic debris analysis (Newman 1997) indicates that the Cerro Pedernal material more closely approximates the local cherts in terms of technological factors and its overall frequency (i.e., as an indicator of procurement accessibility). As such, the tendency toward projectile point and bifacial tool forms may not necessarily be related to transport/trade procurement factors. It may be instead that as an exotic, the Cerro Pedernal material was more frequently selected for projectile points (and bifacial tools) than the equally suitable locally available raw materials. This phenomenon appears to reflect a situation where even more accessible exotic materials (based upon material frequency within an assemblage) were selected for projectile point forms even though the material may not exhibit any innate characteristic advantages or superiority. The patterns of selection of the exotic Cerro Pedernal material may be due in large measure to the significant incorporation of projectile point/bifacial tool forms through regular exchange relationships or fairly consistent logistical procurement during journeys associated with additional products—the"embedded" procurement of Binford (1979)—that brought materials directly into the TA1-4 tool assemblage.

It appears to be the case that significant quantities of bifacial blanks of Cerro Pedernal material were also incorporated into the TA1-6 area of Pot Creek Pueblo in view of the significantly greater than expected (high positive ARV=2.8) frequency of bifaces within the assemblage. Cerro Pedernal bifaces constitute 25 percent of all Cerro Pedernal tools, and 25 percent of the bifaces in the TA1-6 tool assemblage are of Cerro Pedernal material. This data probably reflect basic modes of Cerro Pedernal material import and tool production objectives, which also included completed projectile points, as evident from the TA1-4 projectile point data (high ARV=7.3) and the TA1-6 projectile point data (high ARV=2.6). This phenomena indicates an enhanced material access, perhaps as logistical direct procurement given the volume of points and bifaces of Cerro Pedernal material, while the high frequency and types of Cerro Pedernal debris suggests a more accessible procurement (e.g., possibly indirect or "down-the-line" exchange). External interaction is suggested as bifaces represent optimal morphological and functional "generalized lithic forms" that allow for specific lithic implement production through technological reduction. Given the high unexpected volume of bifaces noted within the TA1-4 tool assemblage, additional procurement factors appear to have been in effect. It appears that the Cerro Pedernal material was associated with enhanced accessibility within a regular and relatively high volume of raw material brought into the

Pot Creek Pueblo settlement, leading to a greater material form and technological variability. With the wide range and quantity of Cerro Pedernal material, conspicuous material waste does not appear to have been a concern of Pot Creek Pueblo occupants. Intense economic activity with the Rio Chama Valley appears to have been in place for TA1-4 and Pot Creek Pueblo occupants.

The locally available black shales are suitable for the production of projectile points and other bifacial implements, although it is characteristically a less durable and "softer" rock than the cherts. As such, use of the black shales was mainly restricted to crude bifacial implements, cores, and simple and expedient flake tools. The green shales, due to their tabular shape and inherently crude fracture qualities, were also restricted to crude cores and simple and expedient flake tools. The same poor fracture qualities of the relatively coarse-grained Ortega quartzites limited its use to cores, crude (and apparently expedient) scraper planes, and simple and expedient flake tools.

The Dakota-Morrison materials usually occur as projectile points or bifacial implements (primarily finely finished ovates and ovate fragments), although they are not found in any quantity (only at Pot Creek Pueblo, along with a few flakes from the Cerrita site). Given the relatively scant representation of Dakota-Morrison lithic material within the debris assemblage at TA1-4 (and in all of the analyzed debris assemblages), these tool forms probably reflect procurement-trade activities rather than being products of outright functional selectivity. This is particularly the case for the well-finished ovate bifacial tool forms because they represent optimal morphological and technological "generalized lithic forms." These forms maintain the flexibility for the production of a wide array of other specific tool forms. However, bifaces are not particularly efficient to transport in terms of exotic material conservation given the relatively high volume of material waste associated with bifacial reduction technologies in tool production (Newcomer 1971). In regard to the projectile points, the Dakota-Morrison quartzites lack superior qualities for the manufacture of, and use as, projectile points. Since the locally available cherts are of superior quality for the manufacture and use of projectile points, the significant number of Dakota-Morrison projectile points suggests that non-functional selective considerations were in effect.

The brown "chalcedonies" of the Sangre de Cristo Mountain Range generally occur in a variety of tool forms, but rarely as projectile points or finished bifaces. In part, this curious absence may simply be a product of their low frequency in the lithic assemblages. Additionally, flaws and fractures are common throughout the matrix of the rock, and it may have been avoided for the manufacture of projectile points or other tools requiring any kind of finely controlled flaking.

The Picuris Tuff (red and gray rhyolites) occurs in low amounts in most tool forms within the TA1-4 assemblage, most commonly as crude bifacial implements and simple and expedient flake tools. The occasionally large dark gray lenticular rhyolitic inclusions that regularly occur within the matrix of the rock inhibit very effective control in the production of lithic implements, precluding the consistent manufacture of finely made projectile points or finely finished bifacial tools. The Picuris Tuffs appear to have been introduced into the lithic assemblages through an informal procurement that was tied into other foraging activities in the vicinity of a source for the material (probably the Arroyo Miranda Valley just to the south of the Rio Grande del Rancho Valley).

The exotic green "chalcedony" (Dakota-Morrison) occurs only in low frequencies. Within the TA1-4 tool assemblage, the material appears to have been introduced primarily as finely finished ovate bifacial forms. As in the case of the Dakota-Morrison quartzites, the significant occurrence of the material in finely finished ovate bifacial form suggests that non-functional criteria, such as transport/trade considerations, affected the selectivity and particular form in which this exotic material occurs at Pot Creek Pueblo.

A quick review of the same analysis conducted on the 1980-1981 Mound 6 lithic artifacts indicates that the lithic use patterns discussed above are evident in other lithic assemblages from other areas of Pot Creek Pueblo. The exotic materials distinctly trend toward projectile point forms, while the local materials are significantly represented in the cores and simple flake tool forms.

## PATTERNING IN PROJECTILE POINT MATERIAL USE

Initially, a general crosstabulation analysis between local and exotic lithic material was performed on the TA1-4 projectile point assemblage (as it has the largest and most variable point sample of all the lithic tool assemblages) to assess the possibility of projectile point morphological patterning by raw material. The results indicate that point notching morphology (side-notched, corner-notched, and triangular) differs by exotic versus local material types in the TA1-4 projectile point assemblage (chi-square value=14.55; significance=.0007; sample sizes: total projectile point sample=351; exotic materials=271, side-notched=133, corner-notched=18, and triangular=120; local materials=80, side-notched=27, corner-notched=0, and triangular=53). The adjusted residuals for projectile points of exotic lithic materials (the obsidians, rhyodacites, Cerro Pedernal, and Dakota-Morrison) are high for notched styles, either side-notched (ARV=2.4) or corner-notched (ARV=2.4). Alternatively, the projectile points manufactured of locally available lithic materials tend to be triangular in shape (ARV=3.5). This same pattern is noted in the next largest projectile point sample from the TA1 Mound/Unit 6 excavations.

A more detailed attempt to define possible projectile point morphological patterns and relationships with the various lithic materials was undertaken with the detailed breakdown of the local and exotic materials into the individual raw material types in the assemblages. The TA1-4 results of the SPSSX crosstabs chi-square procedure are presented in Table 3.

**Table 3. Chi-Square Crosstabulation of Lithic Material Type by Projectile Point Morphology for the Pot Creek Pueblo Mound/Unit 4 Assemblage**

| Rawmat | Count / Exp Val / Adj Res | Side Notched | Tri-angular | Corner Notched | Row Total |
|---|---|---|---|---|---|
| Chert | Count | 27 | 56 | 0 | 83 |
| | Exp Val | 37.1 | 42.0 | 4.0 | |
| | Adj Res | **-2.5** | **3.5** | **-2.3** | |
| Chalcedony | Count | 57 | 61 | 4 | 122 |
| | Exp Val | 54.5 | 61.7 | 5.8 | |
| | Adj Res | 0.6 | -0.2 | -1.0 | |
| All Obsidians | Count | 26 | 21 | 11 | 58 |
| | Exp Val | 25.9 | 29.3 | 2.8 | |
| | Adj Res | 0.0 | **-2.4** | **5.5** | |
| Rhyodacite | Count | 38 | 27 | 2 | 67 |
| | Exp Val | 29.9 | 33.9 | 3.2 | |
| | Adj Res | **2.2** | -1.9 | -0.8 | |
| Dakota-Morrison | Count | 11 | 15 | 0 | 26 |
| | Exp Val | 11.6 | 13.1 | 1.2 | |
| | Adj Res | -0.3 | 0.8 | -1.2 | |
| Column Total | | 159 | 180 | 17 | 356 |

| Chi-square | D.F. | Significance | Min E.F. | Cells with E.F.<5 |
|---|---|---|---|---|
| 44.46927 | 8 | 0.0000 | 1.242 | 4 of 15 (26.7%) |

The adjusted residuals indicate that the obsidians (significant positive ARV=5.5) have a significant frequency of corner-notched projectile point shapes, comprising 65 percent of the corner-notched points within the sample and 19 percent of the obsidian points. The rhyodacites tend to be side-notched projectile point forms (ARV=2.2), with this form accounting for 57 percent of the projectile points manufactured of rhyodacite and 24 percent of all the side-notched point forms in the TA1-4 projectile point sample. Alternatively, the locally available cherts tend to occur in triangular projectile point forms (ARV=3.5, compared to -2.3 to -2.5 ARVs for side-notched and corner-notched forms). The Cerro Pedernal material projectile points and the Dakota-Morrison projectile points do not exhibit any particular morphological associations, and do not contribute significantly to the chi-square values.

An analysis of projectile point dimensional attributes (surface area analysis) indicates that the optimal projectile point size at TA1-4 was between 2.0 and 4.0 cm in surface area. For the TA1-4 point assemblage, Cerro Pedernal points tended to be generally smaller in surface area size than points of other materials. The TA1-6 projectile point assemblage (and the Cerrita site assemblage) showed that the obsidians also tended to be smaller in surface area size, possibly evidence for consistent morphological patterning. It is intriguing that the two different roomblock areas (and the Cerrita site) of Pot Creek Pueblo (TA1-4 and 6) had the same small size patterning for two different exotic material types, which may have economic, procurement, and/or morphological style implications. The question of geologically available raw material size is probably not a factor here, as both the Cerro

Pedernal material and the obsidians occur in a wide variety of sizes from pebble-gravels, through cobbles, to large nodules (and seams of material in the case of the Cerro Pedernal material). However, a far more detailed projectile point analysis than that presented here is required to establish this possibility.

## CONCLUSIONS

Overall, all the assemblages exhibit similar task selection of lithic materials, with most of the exotic materials occurring significantly in projectile point form (rhyodacites, obsidians, and Dakota gray orthoquartzites) or bifacial forms (late-stage manufacture Dakota-Morrison red quartzite, Dakota gray orthoquartzite, brown chalcedony-green chalcedony, and leopard chert). The Cerro Pedernal chalcedony is an anomalous exotic material among all of the lithic assemblages because it was used for tools in the same way as the locally available cherts. Cerro Pedernal materials appear to have been readily procured at Pot Creek Pueblo, and was far more accessible than any other exotic material, including the more proximal rhyodacite material. The main reasons for the increased accessibility of Cerro Pedernal material appear to have been an unencumbered direct access and/or the increased indirect access to the material through "down-the-line" exchange.

The locally available materials in the assemblages were used remarkably the same: the lower quality materials (Ortega quartzites, black shale, and green shale) generally occurred in core or simple unifacial flake tool forms indicative of primary core reduction technology and casual flake tool production. Although not apparent in the crosstabulation table analyses, the lower quality local material bifaces in the assemblages also tend to be crude early-stage bifacial forms, further indicating the primary reduction technological activities associated with these materials.

In terms of projectile point morphological patterning, the significant trend toward corner-notched forms for the obsidian projectile points appears to relate to the apparent habitual scavenging of projectile points from earlier archeological lithic assemblages within the Rio Grande del Rancho Valley and the Northern Rio Grande area by the occupants of Pot Creek Pueblo. Observation of the obsidian corner-notched projectile points (and most of the other corner-notched points as well) indicates these forms represent or approximate known Archaic period projectile points in morphology (although the recycling with heavy edge refurbishing has often resulted in arrow point size ranges for the obsidian projectile points). In addition, several of the obsidian corner-notched projectile points are well patinated, and some exhibit more recent retouching, suggesting that the obsidian corner-notched varieties were probably scavenged dart points from Archaic period sites encountered in the area by later Puebloan populations (probably hunting parties or similar foraging task groups). The lithic debris analyses (Newman 1997) are also pertinent in that they document the relative scarcity of obsidian debitage, and that minimal primary and secondary reduction activity and tool production was taking place at TA1-4 with the obsidian lithic materials. The introduction of significant numbers of complete obsidian projectile points (and probably other classes of tools) is compatible with the limited evidence for lithic reduction and modification debris. Furthermore, the incorporation of "older" obsidian into the TA1-4 lithic assemblage, and the wide-ranging nature of the available obsidian hydration dates (Newman n.d.; Ridings 1991), is understandable in view of the projectile point data morphological analysis.

The Cerrita pithouse site projectile point assemblage also had SPSSX crosstabs chi-square analysis. Unfortunately, the projectile point sample (n=121) for the site is comparatively small because of the restricted site size and the relatively short occupation. However, the obsidian projectile points also tend to be corner-notched point forms (with significant ARVs), indicating the same scavenging of earlier Archaic period obsidian artifacts as noted at Pot Creek Pueblo. Low artifact frequencies preclude any further reliable statistical evaluations or demonstrable morphological patterning of projectile point forms within and between the various lithic materials.

One of the most notable aspects of the tabulations for the analyzed assemblages is the conspicuous absence of definitive Plains-derived lithic material. Only five flakes from TA1-4 may be from the well-known and well-documented Alibates agatized dolomite source of the Texas panhandle (due to this extremely low frequency, these artifacts were tabulated as miscellaneous and not included within the current analyses). Definitive answers to the question of Plains-Pueblo interaction from the A.D. 1000-1350 period (the approximate occupation span of the Pot Creek Pueblo TA1-4 and TA1-6 assemblages; the Cerrita pithouse dates to A.D. 1000-1200) should probably not entirely rest upon an analysis of lithic assemblages alone. Nevertheless, it appears to be the case that in terms of lithic material exchange, and perhaps in terms of general economic interaction, relations between the eastern New Mexico and Southern Plains groups and Rio Grande del Rancho Valley populations were negligible.

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***Peyote: The Divine Cactus***, by Edward F. Anderson. 2nd Edition, University of Arizona Press, Tucson, 1996. xiii + 272 pp.

*Reviewed by* Carolyn E. Boyd

Anderson's second edition of *Peyote: The Divine Cactus* is, without doubt, the most comprehensive text available on *Lophophora williamsii*, the peyote cactus. For thousands of years humans have used peyote for its psychoactive properties, medicinal qualities, and as a sacrament. Although there have been numerous articles and books written on the subject, none are as thorough and accurate as this book. Anderson has presented a technical, yet clearly written discussion on virtually every aspect of this unique cactus and its significant relationship to Native Americans.

Anderson begins by providing the reader with a review of historical documents relating the earliest descriptions of peyote use in Mexico as recorded by the Spanish in the 1500s. He follows with accounts by explorers of the late 1800s and early 1900s, including Carl Lumholtz, R. M. Zingg, and W. C. Bennett, and more recent research conducted by P. Furst, B. Myerhoff, and S. Schaeffer. He has also provided condensed descriptions of peyote ceremonies conducted among Native American groups in Mexico, such as the Huichol and Tarahumara. These ceremonies are then contrasted with a newer form of peyotism that arose in the southern United States and spread rapidly throughout Indian reservations across the nation during the second half of the 19th century.

The author provides an excellent introduction into the controversy surrounding the origins of the modern peyote religion. This new form of peyotism differs significantly from the peyote complex of Mexico, as it contains numerous aspects of Christian symbolism and elements of traditional culture associated with Native American groups in the United States. He presents a brief discussion on various origin theories for the modern peyote religion. One of the theories Anderson addresses is that mescalism (the mescal bean medicine society) predates, and perhaps even led, the development of peyotism in the United States. The seeds of the Texas Mountain laurel (*Sophora secundiflora*), "mescal bean," have been utilized by some Native American groups in ritual contexts. It has been speculated that the mescal bean was employed as a hallucinogen in these rituals prior to the discovery of the psychotomimetic properties of peyote. Although Anderson presents a very fine discussion of the human utilization of the mescal bean, he failed to include an important reference regarding the alleged hallucinatory qualities of the seeds of *Sophora secundiflora*. Hatfield et al. (1977:374) provide an extensive discussion on this topic, concluding that there is no evidence that any of the mescal bean alkaloids are capable of directly inducing hallucinations. Mescal beans, however, do produce a variety of physiological effects, including nausea, vomiting, diarrhea, muscle paralysis, delirium, convulsions, insensitivity to pain, coma, and even death.

Another important reference not mentioned in Anderson's book is that of F. Ruecking, Jr. (1954). Ruecking describes ceremonies conducted by the Coahuiltecan Indians of southern Texas and northeastern Mexico during the early historic period (1528-1800) that involved the ceremonial use of peyote during the 1600s. He suggested that "peyote was first placed in a ceremonial setting by the Coahuiltecan peoples" and that "the peyote complex was diffused from the Coahuiltecan area to other groups of Mexico, who modified the original setting, and the modern peyote cult spread in much later times to the United States" (Ruecking 1954:337). Although I disagree with Ruecking's conclusions that peyote was first placed in a ceremonial setting by the Coahuiltecans, it is important to recognize that the ceremonial use of peyote was observed in the region during the 1600s, 280 years prior to the formalization of the modern peyote religion in the United States. The recent identification of peyotism in the 4,000 year old pictographs of the lower Pecos River region of southwest Texas and northern Mexico adds further questions as to the origin and antiquity of peyotism, both in Mexico and the United States (Boyd 1996, 1998a, 1998b; Boyd and Dering 1996).

Anderson's overview of the "divine cactus" also includes a detailed description of the peyote user's experience, the pharmacology of peyote, and its chemistry. His chapter entitled "The Peyote User's Experience" provides descriptions of experiences reported by Europeans and European immigrants, not the experiences of Native Americans utilizing peyote in a religious context. This is a very informative chapter for individuals interested in the psychotomimetic or hallucinogenic properties of the plant, but who do not wish to experience its effects first-hand. The chapter discussing the chemistry and pharmacology of peyote provides the reader with a clear understanding of the various alkaloids present in the plant, and the physiological effects associated with each of these alkaloids. It is very important to remember, however, that peyote is not used for recreational purposes among Native American groups. Peyote is both the prime sacrament whereby the participants in sacred ceremonies can communicate with God and an important medicinal plant. As Anderson states (p. 106), "Native Americans have discovered a wide range of products to serve as pharmacopoeia, and one of the most treasured substances in this 'medicine cabinet' of herbs and roots is peyote."

Included in *Peyote: The Divine Cactus* is an excellent discussion on the medicinal uses of the plant. Anderson presents not only the extensive medicinal uses of peyote by Native Americans in Mexico and the United States, but also the early uses of peyote by Anglo-Americans. His discussion emphasizes the therapeutic application of peyote and the lack of distinction between medicine and religion among many Native American groups.

Anderson's review of the botany of peyote is refreshing. It is well written and extremely informative. He covers at great length the botanical history of peyote, clarifying considerable confusion surrounding the botany of the cactus and plants commonly confused with peyote. This chapter also includes the biogeography and ecology of peyote, in addition to information on the evolution, cultivation, and conservation of this unique and controversial plant.

The concluding chapter of the book presents the legal aspects of peyote. Anderson covers the history of legislative efforts to control peyote use, beginning with the efforts by the Spanish Inquisition in the 16th century to prohibit its use among Native Americans in Mexico. He then brings the reader up to date on the most current laws regarding peyote use by indigenous and non-indigenous people. Anderson (p. 207) states that "it seems the use of peyote in Native American religious practices should be safe from persecution in the future." Based on recent communications I have had with members of the Native American Church, I am not as confident as Anderson. It seems that this will be a battle they must continue to fight in the courts throughout the years ahead. Although Anderson is optimistic about the increasing tolerance of Mexican and U.S. governments concerning the use of peyote by Native Americans, he is pessimistic about the long-term survival of natural peyote populations. Over-harvesting resulting from legal and illegal collection of the slow-growing cactus, and the destruction of peyote plants through root plowing to facilitate cattle-grazing, have severely threatened peyote populations in Texas. Anderson calls for protection of the cactus from illegal collection and the cultivation of new peyote populations.

Anderson has presented the reader with not only an excellent introduction to peyote and its cultural significance, but also has provided extensive references for individuals interested in further researching this remarkable cactus. *Peyote: The Divine Cactus* will be a valuable contribution to the libraries of not only archeologists and anthropologists, but also botanists, theologians, lawyers, pharmacologists, chemists, folklorists, and historians.

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***In Remembrance: Archaeology and Death***, edited by David A. Poirier and Nicholas F. Bellantoni. Bergin & Garvey, Westport, Connecticut, 1997. xv + 247 pp.

*Reviewed by* Joan E. Baker, Texas A&M University

This book, a learning and activity book apparently aimed at older grade-school-aged children, is intended to provide an introduction to the lifeways of Texas Indians. Author Zappler, art director Elena T. Ivy, and consulting editor Juliann Pool succeed admirably in their task.

Because this book is intended for children, the contributors have presented the information in the form of a coloring book. Aesthetically speaking, this book is remarkable. A glance at the full-color cover (a smaller version of the enclosed pull-out poster) gives the reader a hint of the artistic quality found throughout. Every page is lavishly illustrated with line drawings by Ivy, and even adults will find themselves turning back again and again, only to find new details with each examination. The cover (and hence the poster) is the best example of this. It incorporates the people and culture of multiple tribes in a composite "village" scene; hidden among the many figures and scenic elements are examples of motifs from the rock art of Texas.

Most of the rest of the pages are illustrated in a narrative fashion, in that the action portrayed in the drawing is followed closely by the text. Numerous visual elements added throughout the book keep this narrative approach from being boring. For example, on a page discussing the treatment of indigenous people by Europeans, Ivy has woven together several elements of post-contact life (e.g., missions, fur traders, guns) using an intertwined rosary. This creative approach can also be seen in a discussion of storytelling, where Ivy portrays a narrative within a narrative by simultaneously portraying the act of storytelling and the storyteller's tale. Miniature drawings of Texas in the upper left corner of each page include a shaded area depicting the relevant part of the state for the activities or people being discussed. This small but important touch provides context for each time period and indigenous group presented, as well as continuity. Given the beauty of the illustrations, it is s a pity that the pages are not perforated to better allow adequate display of completed artwork in the proper format (i.e., on the refrigerator).

Readers concerned with current political sensitivities will be relieved to know that the history and use of the term "Indians" is described on the first page of the narrative. This discussion is important because it provides a historical context for the use of the word, and presents an excellent opportunity for parents and teachers to embark on a discussion of historical circumstance and modern insight into the contact process. Additional crucial background to the study of indigenous groups is provided in a section on the arrival of the first Americans via the Bering Land Bridge. Again, the author's decision to include this information provides an important framework for beginning students.

Several games are included in the book, and range from shape recognition ("shadow matching") to word games (including a cross-word puzzle and a word-search). Creative activities include instructions for drawing a buffalo story hide, and making a woven mat and a medicine pouch. All of these activities and games are carefully planned to reinforce concepts presented in the text.

One minor criticism of the book concerns its discussion (or lack thereof) of gender-specific toolkits. Despite careful use of gender-neutral terms throughout the rest of the book, Zappler includes separate illustrations of women's and men's toolkits in his discussion of Archaic lifeways. Unfortunately, a prehistoric division of labor based on sex is not discussed at all in the text. While few anthropologists would deny that there are tools that are used more commonly by men or women, to present toolkits as static entities based solely on an individual's sex is oversimplified and misleading. Toolkits were presumably highly individualized and task-specific, and may have changed depending upon immediate and long-term needs. This illustration would provide an ideal opportunity to discuss traditional gender roles in prehistoric and modern times; however, the book itself falls flat in this area, leaving the task to teachers or parents. This flaw, however, is a relatively minor one that can be easily overcome by informed and involved adults.

Another curious point about the text is the pronunciation of certain tribal names. These are presented phonetically for the convenience of the reader; however, several of these pronunciations are quite unlike those typically heard in Texas parlance (e.g., HOR-na-da instead of hor-NA-da [Jornada]; ah-TACK-ah-pahns instead of a-ta-KAP-ans [Atakapans]). It is difficult to tell whether the forms presented by Zappler are idiosyncratic, regional, or indigenous pronunciations (or whether, as a non-Texas native, I have been maliciously misinformed). Again, this is a very minor point, but one which might cause some confusion should uninitiated readers attempt to enter discourse with a typical Texas archeologist.

A final critique concerns the lack of a preface or introduction. A preface would be aimed primarily at adults, but this seems appropriate for two reasons. First, adults typically provide the money to purchase children's books, and therefore often have a great deal of influence on the books their children read. Secondly, a brief introduction that provides further sources of information and discusses the goals of the book would encourage interaction between adults and children. Additionally, no information is given as to the target audience. As a whole, it is certainly appropriate for older school-aged children, but some of the projects could be easily modified for younger children. This kind of guidance would be helpful not only to parents, but to primary educators interested in using the book as an educational tool.

The merits of this book far outweigh its minor flaws. Zappler and colleagues do a very nice job of balancing informative text with beautiful illustrations, clearly described projects, and thoughtful games. My recommendation to potential buyers of this book is to buy more than one. Give them to sons, daughters, nieces, nephews, and neighbor's children. Don't forget to buy one for yourself, then go buy the biggest box of crayons you can find—you'll need them.

***The Useful Wild Plants of Texas, the Southeastern and Southwestern United States, the Southern Plains, and Northern Mexico***, Volume I, by Scooter Cheatum and Marshall C. Johnston with Lynn Marshall. Useful Wild Plants, Inc., Austin, 1995. xxi + 568 pp.

*Reviewed by* J. Phil Dering

Wow! This is just not another descriptive guide to useful wild plants. The organization, illustration, and readibility of the book guarantee it a place in the library of every professional or avocational botanist, archeologist, or anthropologist. Let me put it a different way: there is no other publication on economic plants that is more useful to archeologists working in south central North America. In fact, this work is superior to any comparable volume currently in print anywhere in the world.

What sets Cheatam, Johnson, and Marshall's work apart from the rest is its thoroughness. Volume I alone treats 86 genera, beginning with *Abronia* and ending with *Arundo*. Each species entry provides a physical description of the plant that refreshingly includes not only the floral parts but also the vegetative parts, especially the subterranean parts often overlooked by botanists. The text is accompanied by an excellent color photograph of the plant, a beautiful map illustrating its distribution, a discussion of common names and, of course, the economic application of each plant.

Information is quickly and easily accessible because each species treatment is formatted with notes and keywords in the margins. Another useful research tool is the very detailed index, that includes most of the common names known for each of the plants, providing a quick guide for readers working at any level of expertise. The authors explain how each plant is used for food, fuel, medicine, as a tool, and numerous other applications. Information on each plant is synthesized from multiple sources, including botany, ethnography, history, food nutrition and food technology, chemistry, and popular works on edible plants. A gold mine of information, the bibliography alone stands as an excellent source for the researcher. Discussions of the archeological literature provide a time depth for the use of the plants seldom noted in botanical publications. Characterizations of each species detail the use and preparation of each part of the plant, often including taste tests by the authors. The extensive discussion of medicinal uses is often accompanied by the chemical basis for its reported activity.

Consider, for example, the section devoted to *Agave*, that covers 35 pages and includes eight distributional maps and 13 color photographs. Detailed descriptions of the eight species of *Agave* growing in Texas contain a thorough presentation of synonmy, common names, habitat, and geographic distribution. Economic uses are also well-documented. The discussion of *Agave* preparation includes pit-baking the central stem or heart of the plant, baking pit construction, fuels used, time required for cooking, and rituals associated with cooking. Secondary processing is described in detail, including extracting and drying the pulp from the central stem and leaf bases, making the different kinds of dried pulp cakes, and cooking the pulp cakes. Several beverages composed entirely or partially of agave, including *aguamiel*, *tesguino*, *tiswin*, *sugui*, *mescal*, *mescal bacanora*, and tequila are discussed. Preparation of the emerging flower stalk and flowers, including the collection and consumption of nectar, is also presented in detail.

Uses noted for agave fiber include construction of rope/twine, netting, paper, textiles, belts, bags, roofing, walls, and lashings. Agave stalks are used for ramadas, walls, spear and arrow shafts, musical instruments, and fire drills. Agave pulp has even been pounded into armor. The authors also report several potential economic applications of agave: as a source of steroids, paint, waterproofing, and fuel; 24 medicinal uses of the genus are also described. Although many of these references extend to plants distributed beyond Texas and adjacent areas, they serve to round out one's understanding of the potential of the plants located within the immediate study region, many of which have been greatly understudied. Multiply this thorough coverage by 86 genera (over 250 species in all), and the reader gets a sense of the immensity of the book's undertaking.

Further, the volume invites the reader to enter the world of those who study and use plants. Discussions are often sprinkled with anecdotal details provided by the authors' personal experiments or field encounters with the plants. Many humorous accounts relate the preparation of plants and the many taste tests conducted by a panel of participants. Therefore, the book serves a dual role—both as an easily accessible reference, and as a very enjoyable casual read. Three cheers for the best effort on economic plants available today! I recommend that you add the book to your library and watch closely for the next volume.

*Tejano Journey, 1770-1850*, edited by Gerald E. Poyo. University of Texas Press, Austin, 1996. Illustrated by Jack Jackson, maps by Ana Carolina Castillo Grimm. xvi + 186 pp.

*Reviewed by* Sergio A. Iruegas

The chapters in this edited book were initially presented in March 1993 as papers in a St. Mary's University (in San Antonio) sponsored conference entitled "Tejano Identity, Resistance and Accommodation, 1770-1860." Designed to explore the Tejano journey as Spanish subjects, Mexican citizens, independent Texans, and citizens of the United States, the end result of the conference was a deeper awareness of the Tejano contribution to the settlement and development of *Nuestras Tierras Tejanas*.

Emphasizing a strong emergence within the last five years of pre-1860 Texas' Mexican American historical studies, the editor (p. xiii) states in the Introduction that: "The story of Tejano integration into the United States has traditionally been told from the perspective of Euro-American immigration to Texas and conflicts with Mexico; Tejanos themselves have been mostly absent from the story." Through their silence about local Tejano communities, most sources imply that Tejanos were irrelevant to the region's destiny. The truth, however, is that Tejanos influenced events significantly and acted out of their own traditions in diverse and complex ways to defend and promote their perceived interests. Poyo lays the foundation of the book's central theme in the first chapter ("Community and Autonomy") in describing the struggles of the *cabildo* of San Antonio de Bexar with the Spanish interim governor and the community's quest for autonomy and self preservation.

Throughout the book, the different authors relate how the Tejano residents exercised their autonomy and acted in their own best interest, while under the Spanish, Mexican, and Texas flags. For example, Andres Tijerina discusses the newly formed department of the state of Coahuila y Tejas in 1824, highlighting the development of coalitions between political leaders from these territories as a means to preserve their autonomy. Conversely, in separate chapters, Steven L. Hardin, Timothy M. Matovina, and Paul D. Lack explore the difficult decisions faced by Tejanos in the 1830s: join the separatist Texian movement, remain neutral, or fight against brothers and the mother country. Wanting autonomy to control their own destinies, many Tejanos lent their military expertise to the separatist cause. Others feared they would receive less respect for their autonomy and culture by the rebel Texians (mainly immigrant Anglo-Americans) and chose the lesser of two evils, siding with General Santa Anna.

The Tejano response to world events is another relevant theme explored in the first two chapters of the book (authored by Poyo and Jesus F. de la Teja, respectively). When Napoleon invaded Spain in 1808 and forced Carlos IV to abdicate his crown, the arrest of Spain's heir apparent, Fernando VII, led Tejanos to question their loyalty to a deposed King and instead act in their own best interest. Solidification of the town council autonomy was almost guaranteed when the Tejas provinces accepted the Constitution of 1824 that was established in Spain during the absent reign of Fernando VII. The government established under this constitution allowed the provinces in New Spain to elect local officials and send them to Mexico City to participate in a government that gave wide latitude for local decisions. The concept of a decentralized government permitted the Tejanos to control their own economic and personal destinies. When King Fernando VII regained his crown and abolished the mechanism that served the interests of the Tejanos, rebellion broke out in the provinces. This set the standard for local Tejano autonomy through Mexican and Texas independence that has lasted to the present day.

The Tejano journey documented in this book was mainly economic, specifically the cattle industry that developed in South Tejas after 1770, and the expansion of trade relationships between eastern Tejanos and the United States after the latter purchased the Louisiana territory in 1803. Archeologists interested in the historical archeology of Texas's Spanish Colonial period, the Republic of Mexico period, the Republic of Texas period, and the Early Statehood of Texas period will find this book fodder for the broader examination of the 18th and 19th century Tejano's place in the world as conceptualized in Wallerstein's (1974, 1980, 1989) World Systems Theory and the historic archeological theories discussed in *A Historical Archaeology of the Modern World* (Orser 1996).

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1989 *The Modern World-System III: The Second Era of Great Expansion of the Capitalist World-Economy, 1730-1840s.* Academic Press, San Diego.

***Establishing Exceptionalism: Historiography and the Colonial Americas. An Expanding World*, Volume 5.** Edited by Amy Turner Bushnell. Variorum, Brookfield, Vermont. xxv + 372 pp.

*Reviewed by* Joan E. Baker

Contrary to its title, *Establishing Exceptionalism*, a part of the "Expanding World" series, sets out to "disestablish exceptionalism" (p. xxiii) and lead researchers towards a new Pan-Americanism. This is a response to the common notion that one must take a regional perspective of the European influence in the New World because each region is the historical product of a unique set of circumstances. Considering the diverse nature of the native peoples of the Americas and the disparate origins of the colonial players, this outlook is not a surprising one. Bushnell, however, argues that historians have forsaken the forest for the trees. Her objective is to provide a broader framework by demonstrating social, ideological, and historical commonalities in European interaction in the New World. Paradoxically, she attempts to do this by presenting a series of articles that focus on particular colonial powers and regions. As Greene and Pole (p. 210) note in their chapter, and the reader is bound to discover on his or her own, the problem with using a regional approach—especially given the stated purpose of this book—is the difficulty of tying the separate observations together, particularly when each area is handled by a separate author.

The key to using this book as a research tool lies in understanding the meaning of the term historiography; otherwise, the hapless reader might be led to think that this book is about the history of the Colonial Americas. In fact, historiography is the study of the way in which history is written. This is a discipline heavy on theory, perception, and revision, and light on historical narrative. Given this knowledge, canny historical archeologists can use this book, and others like it, as a springboard for research design and analysis, as well as a sort of check on current perspectives in historical research.

Another factor to bear in mind is the nature of this compilation, for it is most certainly and unabashedly a compilation of 13 previously published articles rather than an edited volume of original research. This volume draws heavily from *The William and Mary Quarterly* and *American Historical Review*, and presents widely cited articles written by established researchers. This strategy makes the book akin to the photocopied packets of reading materials required by many college professors for undergraduate and graduate seminar classes. At times, the reader may wish that the book came with a syllabus, or better yet, an informed instructor. Bushnell's brief introduction, while providing a historical perspective of the discipline's changing climate, does little to tie the chosen articles together. Several of the chapters (e.g., Greene, Chapters 3 and 10; Rule, Chapter 2; Wood, Chapter 4) seem to be little more than collections of book reviews, while another (Weber, Chapter 12) is a retrospective on the life and career of a leading historiographer (James Bannon).

The order in which the chapters are presented is somewhat mystifying as well, since they do not seem to be organized temporally (e.g., by historical era or publication date), regionally, or by colonial power. Unfortunately, the book lacks coherence; it is more appropriately read as a series of independent articles, since that is their origin. Even this approach to reading can be a challenge, however, because the average archeologist is apt to lack the background needed to decipher references to long-standing debates in the field.

The organization of the book makes reading slow work, but at the same time, the value of this volume lies in the editor's penchant for articles that contain lengthy critiques of work by leading historical researchers. This puts a wealth of bibliographic data at the archeologist's or historian's fingertips. To her credit, the articles chosen by Bushnell touch on the full spectrum of European colonial powers (including England, Spain, the Netherlands, and Portugal) and other participants in the "settlement" of the New World (Native Americans, African and Asian immigrants). Thus, whether the reader's interest lies in Colonial Dutch America or early African-American history, *Establishing Exceptionalism* provides a starting point for a literature review.

Because each article has been reprinted from the original, the chapters retain the original font, headers, and page numbers, supplemented by new headers and page numbers. Some articles rely heavily on footnotes for bibliographic and supplemental information, while others have bibliographies at the end of the chapter. This lack of standardization eventually becomes distracting and can, at times, make it difficult to locate the desired information or citation.

Like many books directed toward specialists in a particular field, this book contains a fair amount of specialized vocabulary and code words. As anyone who has read an archeological site report knows, the use of excessive jargon does not necessarily mean that the theories expressed are poorly researched or ill-conceived, it simply makes the ideas contained therein less accessible. Greene's discussion of interpretive frameworks in American colonial history, for example, contains a description of the "core-periphery dichotomy" used to develop a "distance decay spectrum" of "Europeanness" (p. 255). Kicza talks about the utility of prosopography, while Greene and Pole (p. 211) refer to the gemeinschaft-gesellschaft model. In some cases, context provides the necessary definition, while in others, a good dictionary is a necessary tool. Occasionally, one is simply left to wonder. Ironically, Weber (p. 329) notes that "clear language [is] favored by most historians", as opposed to "the more recondite idioms of [non-historians'] disciplines."

With an eye to interdisciplinary research, several authors acknowledge archeological and anthropological contributions to history and historiography. Kicza, for example, notes that ethnohistorians have changed the shape and direction of social history in Latin America. He also points to work by the late Linda Schele and her colleague, Mary Ellen Miller, as an important and exceptional advance in the field of Mayan studies. Merrell's references to outdated dichotomies (e.g., civilization versus savagery) in his discussion of the American Indians' colonial experience will be familiar territory to anthropologists, as will his plea for increased attention to the important role of Native Americans in the development of the New World. In particular, Merrell points out the need for interdisciplinary research in this area, incorporating folklore, linguistics, and archeological studies. Weber echoes Merrell's sentiments concerning Native American perspectives in his criticism of Bannon's early work.

Also along anthropological lines, Lockhart presents a unique and somewhat surprising analogy in his description of the biographical technique. In it, he compares the use of ordinary people's life histories to the use of skeletons in physical anthropology, in that only a few of either are needed to draw meaningful conclusions. Physical anthropologists, however, might take exception to Lockhart's assertion that "a few skeletons are as good as several hundred"!

A few of the chapters are notable for the insights they provide into particular areas of colonial societies. For example, Kicza provides a shrewd, if brief, comparison of the character of Spanish-Indian interaction in Latin America and that of English colonialism in North America, as well as similar observations concerning slavery in the New World. Zavala makes an important point about the origins and elastic nature of similarities and differences in the people and cultures involved in the colonization of the New World. Commerce, language, religion, and legal systems in particular afford rich comparisons in Zavala's view. He is also the sole author to acknowledge the influence of Oriental trade routes and Asian immigrants on Spanish and Portuguese colonies. Weber uses his retrospective look at Bannon's career to provide valuable insights into several areas of Spanish colonialism. In particular, his discussion of the contextual meaning of the term "Borderlands" will be valuable to beginning students, focusing as it does on spatial and temporal aspects of the debate. Weber also uses critiques of Bannon's early and highly Eurocentric work to demonstrate changing viewpoints towards the impact of colonialism on Native Americans and the growth of the discipline as a whole.

Perhaps the most readable and interesting piece in *Establishing Exceptionalism* is the closing chapter, written by Altman and Butler. This chapter, written with the Quincentenary in mind, provides a kind of blueprint for holistic studies. It includes an excellent discussion of the social, economic, and biological reactions of indigenous populations to European contact. For example, the authors note that in the case of tribes from eastern North America, trade was an equal and voluntary process, in which Native Americans pitted European competitors against each other in order to advance their own interests. Altman and Butler also use examples from Cabeza de Vaca's narrative to explore the value of an emic perspective in explaining seemingly bizarre responses by indigenous peoples to the arrival of Europeans. Commerce, religion, ecological change, territoriality, and land use are among the topics explored by Altman and Butler. In closing, they offer many insights into the apparent success of Europeans at the expense of other groups in the Americas (including Africans and native peoples). This chapter is highly recommended for its easy style of writing, contemporary viewpoint, and skillful handling of North and South American history.

Despite the generally disjointed nature of the selected articles, a few central issues crop up repeatedly. A number of authors call for community histories. While acknowledging the contributions made by those using standard historical documents (e.g., colonists' reports to distant sponsoring governments), they point out that there is much to be gained by using individual and business records (e.g., diaries, trade inventories) in combination with more standard sources. This inductive technique will yield important information on rarely addressed issues, such as sex roles, parenthood, and the structure of households. In particular, increased attention to the role of "invisible" groups of people (e.g., slaves, servants, rural inhabitants, African Americans, and Native Americans) is necessary for an enhanced view of New World colonial history. This strategy also emphasizes the need to view the colonial experience in terms of trans-culturation rather than acculturation (see Greene, Chapter 10).

Another common thread in this book is the criticism of New England-centered models of European colonialism. As Greene and Pole (p. 213) put it, "[W]e will have to move beyond an appreciation of regional differences to an emphasis upon important similarities that in themselves served as important underlying unities that make it possible, indeed necessary, to conceive of these separate regions as parts of a larger...[colonial] world." Fortunately, several of the chapters contain comparisons and categorizations of the different colonial regions and/or governments. This is useful for those who wish to gain a perspective on the "exceptionalism," or lack thereof, of the colonial Americas.

Finally, the consensus of the authors seems to be that two primary factors drove colonialism. First, the colonists were in pursuit of material benefit through the exploitation of natural resources. Often, of course, these "natural resources" included members of an indigenous or imported population. The second driving force was the desire to create a society similar to the one left behind, albeit without some of the more disagreeable aspects of the original. The success or failure of a colony in these pursuits depended upon a number of factors: social, environmental, political, cultural, and economic, to name a few. Some of these factors were unique to a given situation, others were common to all such endeavors, and still others were conditional. Not surprisingly, the interactions between these elements of success provide ample material for theoretical debate.

This book can be useful to historical archeologists and other non-historiographers interested in colonial history, but it requires diligence, patience, and a healthy attention span. While this book may be invaluable to historiographers as a compilation of the classics, it does little to make the field approachable to outsiders.

*Of Bison and Man,* by Harold P. Danz. University Press of Colorado, Niwot, 1997. 231 pp.

*Reviewed by* Doug Land

In his book, *Of Bison and Man*, Harold Danz has done an admirable job of addressing one of America's most beloved and little understood wild animal, the American bison. Almost entirely lost to extinction in the late 1800s, the great herds of buffalo, as most observers tend to refer to them, made a tremendous comeback with significant assistance and dedication from preservation resource managers like Ron Thiel of Wyoming, the many National and State Parks, and the author. Harold Danz was himself a long-time National Park Service employee and former executive director of the American Bison Association, and who better to write about the Bison?

For those interested in American archeology and the study of Indian cultures, Mr. Danz inserts novel ideas, such as: to know the bison is to know the Indian. Although his information on the emergence of Early Man in the Americas is somewhat out-dated, part of that story is eloquently laid out as it relates to their hunting of Bison. Mr. Danz also discusses the cultural beliefs of some of the tribes. For example, he describes how Yellow Haired Woman helped the Cheyenne learn to plant corn, and introduced them to the hunting and practical uses of bison in the early days of starvation. He describes how the Great White Buffalo stood as "Big Medicine" for many Indians. Some folktales were so sacred and so secret that the medicine man felt obliged to offer a prayer asking for forgiveness before he began.

The behavioral habits of bison are quite fascinating, particularly when they are confronted by natural adversaries and catastrophic situations, including attacks by wolves and grizzly bears, and danger from fires, blind stampedes, river crossings, blizzards, and lightening strikes. The bison, however, could pretty well take care of himself. The author reports, as an example, an Indian witness to a fight between a large bull bison and a fierce grizzly bear, concluding: "Even after the bear was dead, the bull would gore the carcass and sometimes lift it clear of the ground on his horns. He seemed insane with rage, and notwithstanding the fact that most of the skin was torn from his head and shoulders, appeared to be looking around for something else to fight" (p. 71).

Even though the bison's power is astonishing, man proved to be their only real threat. Mr. Danz describes that episode in great detail. This book takes the reader through the experience of the Bison slaughter, tells the reader how the bison survived, addresses today's status of the bison and management of the remaining herds, and gives the author's thoughts on where this wonderful resource is going in the future.

Each chapter is well balanced as to technical information and is well researched, especially for the astute student of the past 300 years of American history. Mr. Danz carefully intertwines written observations of the many early travelers that came into contact with bison during that period. For the general reader, information is easy to comprehend, well thought out in construction, and written to a level that is neither too detailed nor too complex.

In short, *Of Bison and Man* is a welcome addition to the mounting subjects and collection of material associated with Plains anthropology/archeology and the real-life history of America and its people. Mr. Danz tells it like it was, with no holds barred. This book is highly recommended for all types of readers, especially those interested in American Indian culture, the mountain man/fur trade period, wildlife management, and Western romantics. Mr. Danz lists many excellent references for further reading and study.

*Learning About Texas Indians*, by Georg Zappler. Texas Parks and Wildlife Press, Austin, 1996. 48 pp. + pull-out poster.

*Reviewed by* Joan E. Baker

This book, a learning and activity book apparently aimed at older grade-school-aged children, is intended to provide an introduction to the lifeways of Texas Indians. Author Zappler, art director Elena T. Ivy, and consulting editor Juliann Pool succeed admirably in their task.

Because this book is intended for children, the contributors have presented the information in the form of a coloring book. Aesthetically speaking, this book is remarkable. A glance at the full-color cover (a smaller version of the enclosed pull-out poster) gives the reader a hint of the artistic quality found throughout. Every page is lavishly illustrated with line drawings by Ivy, and even adults will find themselves turning back again and again, only to find new details with each examination. The cover (and hence the poster) is the best example of this. It incorporates the people and culture of multiple tribes in a composite "village" scene; hidden among the many figures and scenic elements are examples of motifs from the rock art of Texas.

Most of the rest of the pages are illustrated in a narrative fashion, in that the action portrayed in the drawing is followed closely by the text. Numerous visual elements added throughout the book keep this narrative approach from being boring. For example, on a page discussing the treatment of indigenous people by Europeans, Ivy has woven together several elements of post-contact life (e.g., missions, fur traders, guns) using an intertwined rosary. This creative approach can also be seen in a discussion of storytelling, where Ivy portrays a narrative within a narrative by simultaneously portraying the act of storytelling and the storyteller's tale. Miniature drawings of Texas in the upper left corner of each page include a shaded area depicting the relevant part of the state for the activities or people being discussed. This small but important touch provides context for each time period and indigenous group presented, as well as continuity. Given the beauty of the illustrations, it is a pity that the pages are not perforated to better allow adequate display of completed artwork in the proper format (i.e., on the refrigerator).

Readers concerned with current political sensitivities will be relieved to know that the history and use of the term "Indians" is described on the first page of the narrative. This discussion is important because it provides a historical context for the use of the word, and presents an excellent opportunity for parents and teachers to embark on a discussion of historical circumstance and modern insight into the contact process. Additional crucial background to the study of indigenous groups is provided in a section on the arrival of the first Americans via the Bering Land Bridge. Again, the author's decision to include this information provides an important framework for beginning students.

Several games are included in the book, and range from shape recognition ("shadow matching") to word games (including a cross-word puzzle and a word-search). Creative activities include instructions for drawing a buffalo story hide, and making a woven mat and a medicine pouch. All of these activities and games are carefully planned to reinforce concepts presented in the text.

One minor criticism of the book concerns its discussion (or lack thereof) of gender-specific toolkits. Despite careful use of gender-neutral terms throughout the rest of the book, Zappler includes separate illustrations of women's and men's toolkits in his discussion of Archaic lifeways. Unfortunately, a prehistoric division of labor based on sex is not discussed at all in the text. While few anthropologists would deny that there are tools that are used more commonly by men or women, to present toolkits as static entities based solely on an individual's sex is oversimplified and misleading. Toolkits were presumably highly individualized and task-specific, and may have changed depending upon immediate and long-term needs. This illustration would provide an ideal opportunity to discuss traditional gender roles in prehistoric and modern times; however, the book itself falls flat in this area, leaving the task to teachers or parents. This flaw, however, is a relatively minor one that can be easily overcome by informed and involved adults.

Another curious point about the text is the pronunciation of certain tribal names. These are presented phonetically for the convenience of the reader; however, several of these pronunciations are quite unlike those typically heard in Texas parlance (e.g., HOR-na-da instead of hor-NA-da [Jornada]; ah-TACK-ah-pahns instead of a-ta-KAP-ans [Atakapans]). It is difficult to tell whether the forms presented by Zappler are idiosyncratic, regional, or indigenous pronunciations (or whether, as a non-Texas native, I have been maliciously misinformed). Again, this is a very minor point, but one which might cause some confusion should uninitiated readers attempt to enter discourse with a typical Texas archeologist.

A final critique concerns the lack of a preface or introduction. A preface would be aimed primarily at adults, but this seems appropriate for two reasons. First, adults typically provide the money to purchase children's books, and therefore often have a great deal of influence on the books their children read. Secondly, a brief introduction that provides further sources of information and discusses the goals of the book would encourage interaction between adults and children. Additionally, no information is given as to the target audience. As a whole, it is certainly appropriate for older school-aged children, but some of the projects could be easily modified for younger children. This kind of guidance would be helpful not only to parents, but to primary educators interested in using the book as an educational tool.

The merits of this book far outweigh its minor flaws. Zappler and colleagues do a very nice job of balancing informative text with beautiful illustrations, clearly described projects, and thoughtful games. My recommendation to potential buyers of this book is to buy more than one. Give them to sons, daughters, nieces, nephews, and neighbor's children. Don't forget to buy one for yourself, then go buy the biggest box of crayons you can find—you'll need them.

*Expanding Archaeology*, edited by James M. Skibo, William H. Walker, and Axel E. Nielsen. University of Utah Press, Salt Lake City, 1995. viii + 249 pp.

*Reviewed by* G. Lain Ellis

This three-part volume on behavioral archeology publishes papers from a 1992 Society for American Archaeology symposium, plus papers invited afterward. Part I, along with the editor's introduction, takes stock of 20 years of behavioral archeology. The theme in Part I is to summarize what behavioral archeology is, correct misunderstandings, and celebrate its successes and prospects. According to the editors, the principles of behavioral archeology are: (1) all inferences in archeology explicitly or covertly invoke laws (the Hempelian proviso); (2) sociocultural phenomena can be studied without reference to or invocation of mental (i.e., intentional) states (the Skinnerian proviso); and (3) archeology studies the relationships between behavior and artifacts in all times and all places (the universal proviso). A chapter by Jefferson Reid elaborates on these principles and the overarching research strategies within which to apply them. In a useful discussion, Reid emphasizes that although studying formation processes is indispensable, it is not to be pursued for its own sake, but as a precursor to reconstructing behavior. However, Walker et al. note that the diversity of examples of behavioral archeology in the present volume is broad, so the Walker et al. and Reid chapters in turn raise the question (as Alison Wylie does in Part III) of whether behavioral archeology actually is a distinctive archeology. If the principles need not be included in a behavioral archeology, the answer is no (as Michael O'Brien and Thomas Holland note in Part III). Because there is too much to talk about in the volume as a whole, I will focus here on the distinctiveness issue because it is the volume's *raison d'être*.

In a chapter on the demise of the early electric car, Michael Schiffer analyzes behavioral archeology's ability to pursue social theory and history where the latter is construed as an ideographic rather than nomothetic enterprise. Schiffer notes that early gas and electric cars had performance properties making the former better for rural owners and touring urbanites, but the latter better for use in purely urban settings. Although Schiffer invokes a "Swiss army knife" principle and an "Imelda Marcos hypothesis" to show that gas cars generally were better for families that could not afford two cars, these devices count as laws only if we use the term "law" in the loosest of inappropriate ways. Moreover, a footnote in Schiffer's data table shows that his analysis depends entirely on assumptions about how people at the time judged a car's performance properties. Thus, if Schiffer's case is plausible (and it is), it is plausible despite violating the Skinnerian proviso, if not also the Hempelian one.

William Rathje's chapter on his ongoing garbage project rounds out Part I. Rathje has developed some principles of waste, among them Parkinson's law of waste: the amount of garbage disposed expands to the volume of the receptacles used to dispose it. Probabilistic laws such as these are problematic. The fact that my wife and I use a 90 gallon trash bin to discard about 25 loosely packed gallons of garbage a week confirms the law because our behavior is consistent with it. But, we do not obey the law, and it does not explain our behavior despite our confirmatory role. In fact, Rathje's study violates the Hempelian proviso unless the "laws" governing trash disposal in societies with trash-collecting specialists actually are laws and actually apply in all places and all times, both of which are highly dubious (as Randall McGuire notes in Part III). More interestingly, Rathje has shown that self-reported beliefs about trash conflict starkly with the actual content of landfills. Rathje takes this fact to show that: (1) archeology has the potential to contribute directly to public policy (something it should do more often), and (2) this potential follows from archeology's capacity to put beliefs to a test of their accuracy. But the latter is a definitively non-Skinnerian enterprise. Thus, Rathje's study, like Schiffer's, achieves what success it achieves by abandoning central behaviorist provisos.

Behaviorist case studies in Part II show where behavioral archeology is going: "Architectural

Performance and the Reproduction of Social Power" (Axel Nielsen); "Ceremonial Trash?" (William Walker); "The Clay Pot: An Exploration of Women's Technology" (James Skibo and Michael Schiffer); "The Estimation of Prehistoric Values: Cracked Pot Ideas in Archaeology" (Louise Senior); "Ceramic Reuse Behavior among the Maya and Wanka: Implications for Archaeology" (Michael Deal and Melissa Hagstrum); and "The Analysis of Domestic Reuse in Historical Archaeology" (Douglas Wilson). However, as with the Schiffer and Rathje studies, the behaviorist provisos are scarce here.

Three case studies deal at least partly with ideological matters that usually would be considered problematic for behavioral archeology. Of these, only Nielsen's sustains a close affiliation with the Skinnerian proviso. He argues (correctly; see Ellis 1998) that any archeological study of meaning or symbolic content must start with inferences from artifacts to behavior before it can move to the intentional side of the equation. But, he also argues that the intentional realm is too epistemically muddy to get much out of studying it. Walker presents a conceptually and empirically intriguing case that sacred artifacts are used and discarded in what he calls a "singularized" path distinct from secular artifacts. The pattern seems convincing enough to serve as a middle-range device for archeological analysis, but it starts with a fundamental violation of the Skinnerian proviso. By starting with documentation of how self-professed Catholics, Jews, Muslims, and others discard what they *regard* as sacred objects, his case is front-loaded with a distinction based on intentional states (see Putnam [1975] for a historically decisive analysis concluding that behaviorism in psychology must fail because it cannot escape intentional states). At the other end of the scale, Senior shows that some kinds of pots are repaired more frequently than others. Although she undoubtedly is right that this follows from the higher value of some kinds of pots relative to others, she directly implicates an intentional state as the cause of different repair rates, the ultimate Skinnerian sin. Moreover, even if it is true that type $x$ pots are more valued than $y$ pots, this statement is accurate only because it is nearly devoid of content. If we do not know what the value was, we do not know much about the cause, and to discover this requires another betrayal of the Skinnerian proviso.

The Hempelian proviso also fares poorly in the case studies. For the life of me, I could find no existing laws being invoked or new laws being developed. The patterns of reuse developed in Wilson's chapter are law-like only because they express definitional rather than empirical relations, just as Schiffer's (1976) early legislative acts expressed definitional relations between the elements of lithic technologies and archeological records containing lithics (Salmon 1982). While Deal and Hagstrum provide an important set of interpretive caveats on the relationship between the systemic effects of ceramic reuse and the formation of archeological assemblages, their data do not support basing laws on their ethnographically documented patterns. In an examination of 37 classes of reuse among nine groups, no class of reuse occurs in at least 50 percent of the cases. Even in a much larger cross-cultural sample, a recurrence pattern of less than 50 percent is hardly the stuff of laws, even statistical ones. The Skibo and Schiffer chapter fares better because its claim that we can identify female potters is based on broad ethnographic foundations. However, to say that potters at site *S* were female because pottery making was organized at a household level invokes not a law, but a correlation referring only too *and to nothing more than* a pattern. As classical empiricists, positivists, and statisticians since Hume have noted, a correlation is only a correlation, and correlations alone do not weigh much.

If the chapters in Parts I and II represent behavioral archeology as a distinct archeology, that distinctiveness does not rest on the Hempelian and Skinnerian provisos, and expanding archeology to include last week's garbage under the universal proviso does not fill the gap. Wylie's (1981; Ellis 1998) analysis of law-finding and law-testing in archeology shows that Binfordian and Schifferian positivist rhetoric masks an anti-positivist practice that emphasizes the identification of causes that explicate the content of the archeological record to explain the systemic, and other, processes that make the record what it is when we dig it up. While this volume is poor in the application of behaviorist principles, it nonetheless is rich in cause-finding exercises. The behaviorists claim to be distinct from the processualists, but neither cause-finding nor the provisos distinguish them.

Part III of the volume is a collection of non-behaviorist papers presenting, well, non-behaviorist takes on behavioral archeology. McGuire ("Behavioral Archaeology: Reflections of a Prodigal Son") argues that behavioral archeology is an approach in which method has been elevated to the level of theory. Thus, the behaviorist method of reconstructing behavior is a large-scale tool. Wylie ("An Expanded Behavioral Archaeology: Transformation and Redefinition") echoes this, and suggests that behavioral archeology is virtually completely detached from its original premises other than its commitment to reconstructing behavior as the first step toward interpretation. Charles Orser asks the empirical question "Is There a Behavioral Historical Archaeology?", and answers no because most historical archeologists have largely ignored the behaviorists. The reality of historical practice is that historians (like Binfordians and behaviorists) are cause-finders, and few historical archeologists have shared (and, thus, been distracted by) the behaviorists' interest in laws, an interest that McGuire notes has gone unfulfilled in any event. Hence, at the level of practice, behavioral archeology is not distinct from, say, a Collingwoodian historical approach because this too is predicated on finding behavioral evidence from which to infer the purposes that play causal roles guiding action. This is, of course, not to say that behavioral, processual, or historical archeologists investigate the same aspects of the past. It is to say that once behavioral archeology is exposed as little more than a directive to find behavioral causes, it can be attached to any theoretical program, just as radiocarbon dating can be used in any theoretical program. Distinctiveness fades even further.

O'Brien and Holland ("Behavioral Archaeology and the Extended Phenotype") and Alan Sullivan ("Behavioral Archaeology and the Interpretation of Archaeological Variability") do not share behavioral archeology's optimism that behavior can be reconstructed, let alone that such reconstruction is a necessary first step in archeological interpretation. In both cases, the authors say that behavioral reconstruction is plagued by problems of equifinality that cannot be overcome. However, as Wylie argues, this emphasis on equifinality is itself overdrawn, and not matched by any assurance that the O'Brien/Holland and Sullivan alternatives are not similarly afflicted once one adopts their overly skeptical epistemic standards.

The O'Brien/Holland case is especially interesting from an epistemic perspective (Wylie's take on this is insightful). Having coupled their selectionist approach to a highly skeptical stance, they must redefine the subject matter of archeology. Whereas Binford (1962) changed the subject by redefining cultures as adaptive systems, and the behaviorists redefined it anew by (allegedly) sidestepping culture altogether, O'Brien and Holland redefine adaptations as sets of artifacts. Thus, in their selectionist world, human beings are something apart from adaptations, occupying a black box in which their unreconstructable thoughts and behavior are responsible for the creation of adaptations. Ironically, then, the O'Brien/Holland approach is more Skinnerian than behavioral archeology in its original or contemporary forms. As Wylie notes, Skinnerian behaviorism rejected talk about intentional states on methodological grounds related to what could be directly observed rather than on a rejection of the existence of intentional states. Similarly, in the O'Brien/Holland approach, we avoid both behavior and intentionality because they are too remote from observation. Since the only thing we can talk about with a very high level of security is artifacts, they restrict the scope of archeology accordingly.

This is not a book for the methodologically innocent or indifferent reader. Nor is this a good introduction to behavioral archeology because it assumes the reader does not need a program to tell who the essentialists, reconstructionists, and selectionists are. That said, there is good reading here nevertheless. Schiffer's discussion of the electric car is good history even if it is bad behaviorism. Walker's discussion of the life history of sacred objects is (to me) fascinating. The ceramic chapters contain useful analytical insights. The notes to McGuire's engaging chapter contain an important, if condensed, sociology of post-mentalist/prepostprocessual archeology. Finally, Wylie once again shows her special talent as a summary commentator who has much to teach us.

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*A Place Called Grand Canyon: Contested Geographies*, by B. J. Moorehouse. University of Arizona Press, Tucson, 1996. viii + 202 pp.

*Reviewed by* Velicia R. Hubbard

As tourists, many of us have visited the place called Grand Canyon, and those of us who have surely considered the realms of the natural wonders of the world. B. J. Moorehouse has done her research well, and it is evident that she has had a long-standing interest in natural resource management. She combines in *A Place Called Grand Canyon* a lively interest in politics, culture, and environmental science with a curiosity about the evolution of America's highly distinctive landscapes. She discusses how the lands and resources of the Grand Canyon have come to be divided in many ways and for many different reasons, from the time of Native Americans, to Western expansion, to the present-day. Her story exposes how dynamic the geographical boundaries of the region really are, regardless of the indelibility of the ink that traces them on maps.

The author reminds the readers to consider the past boundaries of the park and how it involves five Indian reservations, and is also managed by three Federal agencies and by the states of Utah and Arizona. This has truly produced a "geographic mosaic," and a bureaucratic nightmare. Moorehouse then wants us to grasp three geographical concepts (derived from Michael Foucault) that form the framework of study. The first two are absolute space (and its boundaries) and relative space. Absolute space functions as a container, an area within which certain ideas and behaviors dominate. An area that supports multiple definitions—used either simultaneously or at different times—is termed relative space. Representational space is the third concept, and was defined to represent symbols, values, experiences, histories, and traditions (that can be intangible and unquantifiable) that give someone or some group a sense of attachment to that location or "place." Plainly, the frontier is closed, and the human race needs to learn how to share the spaces that we have created, and also how to make decisions as well as manage resources so that the maximum number of future options remain open.

In a nutshell, the Grand Canyon is in Arizona and Utah, and is 277 miles long, 10 miles wide, and 4,000 feet deep. It takes in five of the seven life zones and three of the four American deserts. The Hopi Indians have lived there for thousands of years.

By the 1820s, American trappers began working the area, but it was the Mormons who were the first Anglo-Americans to settle at the Grand Canyon. They did so without knowing that the Hopi, Havasupai, Haulapai, and Paiute peoples considered it home. In 1861, Lt. Joseph Christmas Ives led an expedition to the Colorado River, and published a report where he states that he saw no value in the landscape! Other early explorers such as John Wesley Powell, along with cartographer Francois Emile Matthes, and painters and photographers visited the Grand Canyon and brought their visual images to the world. With the creation by the United States of Indian reservations in the area, much of the Grand Canyon (including important religious sites) was excluded; for the indigenous people, the places of subsistence at the Grand Canyon became places of resistance. For newcomers, the spaces of the unknown would reaffirm the American dream.

Federal ownership of the Grand Canyon took hold in 1908 when it was declared a National Monument, and in 1919 it became part of the National Park system. With federal ownership came tourism, and the hope that government control over the natural resources would eliminate impacts and abuses to the land caused by logging, mining, and livestock grazing. The indigenous people's place in the landscape was all but overlooked, even though the Havasupai were allowed use of the park lands for traditional purposes. After many arguments and lawsuits, the Havasupais were able to gain 2540 acres for their reservation and control of a critical portion of the waters of Cataract (Havasu) creek, but this did nothing to help the tribe's self sufficiency. They were forced to accept $1.2 million for 2,257,728 acres instead of receiving more lands for their people.

*A Place Called Grand Canyon* should be of interest to readers concerned with the history of land management in the U.S. West, to historians new to the area, and to those who hope that the future of the Grand Canyon as an ecological refuge can be sustained under renewed and vigilant federal stewardship. A statement made by President Theodore Roosevelt in 1908 when he declared the park a National Monument is as relevant now as it was then: "[the Grand Canyon}...is an object of unusual scientific interest, being the greatest eroded canyon in the U.S., and it appears that the public interest would be promoted by reserving it as a National Monument."

***Projectile Technology***, edited by Heidi Knecht, 1997. Plenum Press, New York. xvii + 408 pp.

*Reviewed by* Steve A. Tomka

This volume is the product of a symposium held at the 59th Annual Meeting of the Society for American Archaeology in Anaheim, California, on April 20–24, 1994. The goal of the symposium was to bring together different methodological approaches and interpretive frameworks currently used for exploring projectile technologies. The 15 papers in the volume cover a long temporal span, extending from the Middle Paleolithic to the ethnographic present, discuss examples from five continents, and include experimental, ethnoarcheological, and archeological examples.

The book is divided into five parts. Part I consists of two papers that provide a comprehensive review of the history of research on projectile technologies and of the available literature on the use of projectiles in ethnographic and ethnohistoric records. Chapter 1, written by H. Knecht, is an extremely useful review and compilation of previous research on projectile technology. The presentation summarizes archeological, experimental, and ethnoarcheological research concerned with understanding variability in projectile weapons and the projectile tips themselves. The exhaustive list of references will be of great use to any archeologist interested in further pursuing the topic. Chapter 2 (C. J. Ellis) discusses the factors that influence the use of stone projectile tips as reflected in the ethnographic and ethnohistoric record. Although Ellis' data base is severely biased in favor of North American examples, some South American and Australian examples are also included. The author addresses such useful topics as the relative effectiveness of stone points; conditions under which points are used as knives; the use of poisons on tips; and the conditions under which thrusting and throwing spears would be employed. While the conclusions of the paper will not surprise most archeologists, it is interesting to note the number of instances of both spears and the bow and arrow being used among ethnographic groups. These examples, and others gleaned from the Texas ethnohistorical literature, fuel the likelihood that arrow and some dart point types were contemporaneous. This probability challenges traditional notions of site integrity that tend to be based largely on projectile point type homogeneity.

Part II's four papers deal with understanding the implications of variability in the technical, functional, and design elements of archeological projectile point collections. Chapter 3 (by J. J. Shea) builds a strong argument for the appearance of stone-tipped spears during the Middle Paleolithic (ca. 80,000–100,000 B.P.) in Africa and southwest Asia. The contribution is significant in that while the presence of complex hunting equipment is generally accepted for the early Upper Paleolithic (ca. 25,000-35,000 B.P.), its origins have not been securely traced to the Middle Paleolithic. The paper is a good example of the methodological challenges of identifying projectile point use on very expediently manufactured Levallois points. In addition to methodological contributions, Shea also provides an interpretive framework for the conditions under which Middle Paleolithic hominid groups would have found it advantageous to shift from wooden spears to stone-tipped weapons (e.g., increased reliability).

Chapter 4, by B. Finlayson and S. Mithen, provides an example of the utility of micro–wear analysis to identify tool function and, more importantly, to contribute to the definition of site function. Their analysis focuses on microliths from the site of Gleann Mor on Islay, an island off the west coast of Scotland. Traditional perspectives of microliths have assumed that they are components of projectile points. Therefore, sites with large proportions of microliths were assumed to be hunting camps. Through systematic use–wear analysis, the authors are able to demonstrate that wear diagnostic of projectile use is present on only a small fraction of the microliths. Variation in the use of microliths occurs not only between morphological types but also within them, indicating a more complex use history than traditionally assumed. The redefinition of microliths as components of generalized tools suggests a reconsideration of the idea that sites with numerous microliths are hunting camps. The common practice of categorizing tools into functional groups based on form, the multi-functional nature of some point types, and the possibility that some triangular points may have functioned primarily as knives highlights the importance and utility of employing similar use-wear based research strategies in Texas archeology.

Chapter 5 (by A. Christenson) discusses the potential functional meaning of unnotched and side-notched triangular arrow points in North America. The discussion goes beyond the traditional typological issues (e.g., point styles made by different groups) to suggest that arrows tipped with these points would have distinct killing powers. However, following an exhaustive analysis of 89 stone-tipped arrows collected by J. W. Powell between the late 1860s and 1870s, Christenson is forced to conclude with some frustration that no clear-cut explanation accounts for the formal variability in point types noted in the sample. For those readers that expect a show down between functional and stylistic perspectives, the paper does not deliver because the author a priori dismisses the latter explanation and focuses on searching for the explanation in the functional realm. Nonetheless, the perspective employed is one that can infuse new research directions and interpretive outlooks to many projectile point typologies.

In Chapter 6, C. Bergman and E. McEwan provide a detailed discussion of Asian composite bow design. In addition to focusing on the Asian designs, however, they also provide a useful discussion of the changes in bow designs through time and the technological advantages of different designs. This discussion, together with their consideration of the factors that led to the development of sinew-reinforced bows in North America, are two of the more interesting parts of the paper. Hard core bowers also will find the discussion of bow construction details and design features extremely helpful.

Part III contains four chapters that rely on experimentation to aid the interpretation of variability in prehistoric projectile technologies. The chapter by J-M. Geneste and S. Maury (Chapter 7) is a study in the design and implementation of an experimental research program for the study of a specific research issue: the process of production and use of Solutrean projectile points from Western Europe. The extensive comparative collections developed as part of the experimental studies of point manufacture, use, and maintenance are invaluable additions to present and future archeological research. They conclude that documentation of experimentation efforts provide archeological references relevant to each stage of archeological reasoning, which should motivate other archeologists to undertake similar systematic experimental research programs.

H. Knecht's second contribution (Chapter 8) explores the influence of raw materials on the design, manufacture, performance, durability, and maintainability of projectile points made of bone, antler, and stone. The results indicate that stone points can be made more quickly than points of bone or antler. While the latter two materials make more durable points, stone points are more lethal due to their sharp edges. Due to the location and nature of the breaks, however, bone and antler points are more maintainable than stone points. Antler points are more durable than bone point. These conclusions provide a strong foundation for constructing testable hypotheses regarding various strategies of technological organization among hunter-gatherers in general, and Native American inhabitants of North American specifically.

In Chapter 9, P. Cattelain discusses whether Upper Paleolithic and Mesolithic hunter-gatherers of Europe used bows or spear throwers. The research question is not unlike the distinction Americanist archeologists have faced in attempting to distinguish between dart points and arrow points. The research method is also similar in that Cattelain chooses to study a world-wide sample of projectile weapons from European museums and private collections. One of the useful contributions of the paper is the review of the spatio-temporal distribution of the different weapon systems, and their comparison in terms of performance (throwing distance and accuracy). Contrary to some recent perspectives, Cattelain concludes that hunting strategy is not dependent on the weapon employed. Environmental factors, prey choice, and the purpose of the hunt seem to affect weapon choice. The sobering conclusion from his analysis is that simple morphological and metric criteria cannot be employed with certainty for de facto classification of most Paleolithic projectile tips as dart or arrow points. Since the point is only one component of the composite system, many point designs can be employed, as long as the projectile is kept in balance.

In the last chapter of this section, J. Pokines and M. Krupa (Chapter 10) diverge from traditional typological discussions of self–barbed antler points, and explore the possible function of these points during the Solutrean and Lower Magdalenian in Cantabria, in northern Spain. The authors employ a multi–dimensional research strategy integrating the reconstruction of regional salmon resources, the archeological distribution of self–barbed points in late Upper Paleolithic sites, ethnohistoric examples of barb point use, and replication experiments.

Part IV consists of four chapters that exemplify the utility of ethnoarcheological perspectives in the study of projectile technologies. In Chapter 11, P. B Griffin discusses variation in arrow design among three groups of Agta of northeastern Luzon, in the Philippines. Agta bow hunting focuses on wild pigs, deer, monkeys, and a number of smaller game. Both single and multi–component arrows are used. Some differences do exist in the stylistic attributes (e.g., form) of points manufactured by the three groups. Griffin focuses on explaining formal variability in general rather than inter-group variation in point designs. The study indicates that a broad range of factors condition arrow choice, including prey species, prey size, the condition of the animal, forest context, season, weather conditions, and the availability of personnel, dogs, and arrows. Overall, it appears that the probability of a successful kill is one of the main factors conditioning arrow choice. These factors suggests that arrow manufacture costs are relatively high and game densities are high enough to allow hunters this low risk behavior.

Chapter 12, written by R. D. Greaves, examines the multi-functional use of bows and arrows within the technological organization of Pumé hunters of Venezuela. While Pumé bows and arrows are designed to be able to capture the largest prey package available, most of the time their use exhibits a great degree of situational flexibility ranging from digging sticks, to cutting tools, spears, and clubs. Bows and arrows were used for a greater range of tasks as the length of the hunting trips increased. This pattern may have been influenced by the number of tools that could be carried under conditions of high mobility. Interestingly, at the same time, the use of knives and machetes tended to become increasingly more narrow. Overall, the study demonstrates that the use of multi–functional and/or specialized tool kits is conditioned by mobility patterns and resource acquisition strategies, and this is not apparent in differences in their formal characteristics. This conclusion should concern archeologists seeking to differentiate specialized and generalized tools and tool kits based on formal attributes.

L. Bertram (Chapter 13) compares the hunting strategies and weapons employed by the Kua of the eastern Kalahari and the Hadza of Tanzania. Both groups use bows and arrows as the preferred poison delivery systems. Nonetheless, there are significant differences in the size of the weapon systems and their killing power. Bertram concludes that the type and structure of the vegetation present in the two regions conditions the hunting strategies employed, and that these strategies in turn affect the design of the weapon systems utilized.

Chapter 14, by R. Hitchcock and P. Bleed, is a discussion of spear and arrow use among San hunters of the Kalahari. They summarize the conditions under which the two weapon systems are employed and the advantages and disadvantages of each system and hunting strategy, while noting that hunting with simple projectile systems is characterized by high failure rates. Often, the difference between success and failure depends on the individual's stalking skills rather than his weaponry. It is true, however, that once game is encountered, spears and bows and arrows have different potentials for bringing down the prey and recovering it successfully. Significantly, Hitchcock and Bleed observe that the choice as to which weapon system to use is conditioned by the hunter's knowledge, experience, and the estimated benefits compared against the costs of using each system.

Part V, the last section of the volume, consists of a summary paper by M. Nelson. She provides an overview of the volume's significant contributions and emphasizes the utility of design theory in understanding aspects of technological organization.

Overall, *Projectile Technology* is a significant contribution to middle-range theory building. With its thematic focus, regional breadth, and wealth of perspectives, it should be considered necessary reading by archeologists interested in interpreting the meaning of the seemingly endless variability in weapons technology and projectile point forms present in the archeological record. While many of the papers emphasize that the real world is more complex than our theoretical concepts, the multitude of perspectives should serve to provoke new directions in projectile point research in Texas.

*The Karankawa Indians of Texas: An Ecological Study of Cultural Tradition and Change*, by Robert A. Ricklis. University of Texas Press, Austin, 1996. xii + 222 pages.

*Reviewed by* John E. Dockall

*The Karankawa Indians of Texas* is organized to provide an introductory overview of Karankawa prehistory and adaptation, and concludes with convincing interpretations of their strategies for adapting to increasing European colonial influence. Chapter 1 summarizes the lifeways, geographic limits, and the various groups included under the rubric of "Karankawa." This discussion amply sets the stage for the remainder of the book.

Chapter 2 is devoted to an in-depth characterization of the central part of the Texas Gulf Coast. Ricklis' discussion of the environment is resource-oriented rather than merely providing an environmental profile. Marine and terrestrial faunal and floral resources are presented within spatial and temporal limitations, along with what these limits may have meant for Karankawa subsistence and settlement.

A brief synopsis and history of Rockport phase archeology and material culture is provided in Chapter 3. The distinctiveness of the Rockport assemblage lies in the ceramics: Rockport Plain, Rockport Incised, Rockport Black-on-gray, and Rockport Crenelated. The spatial distribution of these ceramic types has been used to define the limits of the Karankawa homeland. Associated seasonal indicators, including fish otoliths, and shellfish, were effectively used (see Chapters 4 and 5) to define Karankawa setlement and subsistence.

The heart of Ricklis' book is Chapters 4 and 5, in which the archeology, material culture, and seasonality evidence are brought to bear on understandings of Karankawa lifeways. Ricklis provides data and interpretation for the use and exploitation of coastal marine and inland resources. The principal lines of evidence include site size, thickness of the cultural deposits, faunal remains, and artifact variability. The variability resulted in the identification of Group 1 (shoreline) and Group 2 (inland prairie margin) sites of the Rockport phase. Seasonality data indicates that shoreline sites were primarily occupied during the fall and winter where fish and shellfish were exploited. Prairie margin sites were less intensively utilized, mainly during the spring-summer exploitation of inland medium-large mammal resources.

The patterning and assemblage differences between Group 1 and Group 2 sites are robust and enabled the author to place them within a framework of Karankawa adaptation. Chapter 6 outlines and details the patterns of seasonal exploitation along the central coast of Texas. One of the most important aspects of the Karankawa adaptive strategy defined by Ricklis was the balance achieved between resource exploitation and economic risk. These factors were incorporated into the Karankawa lifeway through a series of seasonal settlement shifts and population fluctuations in accord with resource availability. Significant also is the chronological indication that this type of adaptive system was in place from the Archaic to the Early Historic period. Inherent flexibility of the system later enabled the Karankawa to remain culturally and adaptively resilient to Spanish territorial incursions.

Chapter 7 documents the dynamic nature of changing Karankawa adaptive strategies during the Spanish Colonial period. Ricklis compares the archeological data to 17th and 18th century Spanish and French ethnohistoric observations. The result of Ricklis' comparative study is the clear definition of the continuance of a bilobed settlement system in operation prior to European contact.

The influence of increasing European contact and settlement are discussed in detail in Chapter 8. Even with the increasing presence of European interlopers, the Karankawa lifeway apparently changed little during the 18th century. The author is thorough in including 18th century observations of disease among the Karankawa and the subsequent population decline from 1685 to 1850.

The establishment of a series of Spanish missions along the central coastal area presented the Karankawa with both problems and possibilities. Chapter 9 addresses the growing conflict between the Karankawa and the Spanish. Historic records indicate that confrontation and conflict characterized the initial establishment of missions in the region. But beginning in the last decade of the 18th century, there was a change in the nature of the relationship between the Spanish missions and the Karankawa.

By the late 1700s, the perceptions of the Karankawa about the Spanish missions had become one of practicality, and the missions became an integral part of Karanakawa subsistence/settlement strategies. This tenuous but significant relationship is explored in Chapter 10 via detailed inquiries and discussion of historic observations by Spanish chroniclers. Further support for this inference is taken from documented accounts of the arrival and departure of various Native groups at the missions of Espiritu Santo, Rosario, and Refugio.

Ricklis also provides in Chapter 10 a succinct synthesis of changes within the Karankawa adaptive system from prehistory, to the decades of Spanish missions, and into the 19th century. At the culmination of Spanish and later Anglo-American influences it is perhaps most significant that, despite the introduction of such new variables, traditional Karankawa identities and perceptions of themselves were essentially intact. Ricklis' volume has demonstrated that in some cases, Native reactions to foreign cultural intervention and impacts can be ameliorated by Native groups. The key to Karankawa stability was the recognized necessity for cultural interaction—in this case the presence of Spanish missions as key links in the traditional settlement/subsistence system—and the successful integration of these new elements into the traditional cultural system.

Additionally, Ricklis provides information in Appendix A that details the geographic and chronological characteristics of Rockport phase ceramics. The use of Rockport phase ceramics as symbols of cultural boundaries is explored via attributes of surface treatment with asphalt and the abundance of bone temper, as well as the variability of these traits at Late Prehistoric sites along the Texas Gulf Coastal Plain. Appendix B elaborates on the methodology and techniques employed by Ricklis to establish seasonality based on fish otoliths, *Rangia cuneata*, and *Crassostrea virginica*.

This book can easily be considered a turning point in our attitudes and understandings of Native Americans in Texas. Ricklis has provided a lucid and rational treatment of the archeological and ethnohistoric data pertaining to the Karankawa. The result of this blending of data sources is a coherent picture of Karankawa prehistory, lifeways, adaptations, and the consequences of European contact. *The Karankawa Indians of Texas* will be a welcome addition to the libraries of all Texas archeologists, both professional and avocational. It is a very straight-forward and well-researched presentation of historic documents, chronicled observations, and solid archeological field work.

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