Tumacacori Plaza Excavation 1979

Historical Archeology at Tumacacori National Monument, Arizona

by
Lee Fratt

National Park Service
U.S. Department of the Interior
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x
ABSTRACT

Excavations conducted at Tumacacori National Monument, Arizona, in 1979 recovered data that would have been destroyed by the installation of an underground drainage system in the Franciscan mission plaza and adjacent to the west wall of the mission church. This system was designed to aid in the stabilization of the historic structures.

This report describes the surprisingly intact stratigraphy of the excavated area. Features and deposits were grouped into four areas of associated deposits and into four time periods ranging from ca 1750 to the present. Indigenous and nonindigenous artifacts are described and related to studies of the development of transportation and communication and of Hispanicization conducted at nearby Tubac Presidio. The floral and faunal remains recovered are described and discussed. Information on site function and building sequence was also obtained.

The project demonstrates the potential for additional archeological research at Tumacacori.
INTRODUCTION

Archeological excavation was conducted at Tumacacori National Monument from September 24 through November 4, 1979. The purpose of this project was to recover data from an area where an underground drainage system was to be installed. Tumacacori National Monument is located in the Santa Cruz River Valley between Tucson, Arizona, and the Mexican border town of Nogales (Fig. 1). The monument preserves the ruins of the Spanish frontier mission San Jose de Tumacacori. In addition to the mission complex, the monument also includes a visitor center and residences built in the 1930's (Fig. 2).

The Setting

Mission Tumacacori, situated on the west side of the Santa Cruz River at the upper end of the river terrace, is located at the edge of the river's flood plain, about 3,300 ft. above sea level. Here, the Santa Cruz River Valley is bordered on the east by the Santa Rita and San Cayetano mountains and on the west by the Tumacacori mountains (Fig. 1). The monument's environment is extremely arid, and its vegetation is characteristic of the lower Sonoran Desert (National Park Service 1975:5). However, the mission sits in a transition zone, where the desert-scrub grasslands and juniper-pinyon woodlands characteristic of higher elevations meet (List of Classified Structures Team 1976:3). This situation, together with the nearby riparian zone of the Santa Cruz River, means that diverse animal and plant life, as well as land suitable for irrigation, were available to mission residents.

Tumacacori's position, about one-quarter mile from the river's flood channel, together with the already established native settlement of San Cayetano on the river's east side, sparked the Jesuit missionaries' interest in the area. The early Spanish explorers and missionaries used the Santa Cruz River Valley as a route northward into Pimeria Alta, and Tumacacori eventually became part of a system of Spanish missions and settlements that spread along the river and its tributaries (Shenk 1976:2, 4) (Fig. 1).
Fig. 2: Existing Monument Development
The Project

Excavation

The excavation consisted of four one-meter-wide trenches totaling 65 meters in length. The trenches were labeled A, B, C, and D. Trenches A, B, and C extended the length of the proposed drainage system, and Trench D served as a test trench, excavated in an attempt to associate the exposed stratigraphy with an architectural feature (west nave transept). The drainage system, intended to aid the preservation of the mission ruins, was to be installed adjacent to the Franciscan church's west nave wall extending south and southeast across the mission plaza (Fig. 3).

Excavation was preceded by a magnetometer survey and systematic surface collection. The purpose of the magnetometer survey was to locate possible underground deposits in the vicinity of the mission ruins. We hoped that the surface collection would yield information about origin of surface material as well as indicating which areas of the plaza probably contained subsurface deposits. Both studies indicated that there were underground deposits in the plaza, and the presence of some of these deposits was confirmed by excavation.

Despite the fact that the site has undergone more than fifty years of disturbance resulting from vandalism and structural preservation, the excavated area proved to be relatively intact. The stratigraphy exposed was both complex and deep. Stratigraphic features were grouped into four areas of associated deposits and into four time periods ranging from the mission period (beginning about 1750) to the present. No evidence for prehistoric or protohistoric occupation of the site was found in the tested area. Piman Indian, Spanish, Mexican, Oriental, and Anglo artifacts of the eighteenth to twentieth centuries were recovered as well as faunal and floral remains. The deposits' stratigraphic relationships, artifact date ranges, and information from the site's documentary history were combined to form an apparent or suggested depositional history for the area excavated.

The archeological excavation, confined to the area directly affected by the drainage system's installation, was a test of the mission plaza's archeology. Data and artifacts recovered were taken to the
PLAN MAP of the TUMACACORI DRAIN EXCAVATIONS - 1979

SCHEDULE
Contour elevations = N + 99,000 cm. above sea level
Contour interval = 20 cm.
(N = Map contour elevation)

EXPLANATION
Surface collection boundary
Excavation areas
Datum
Topographic base map revised from Hewitt and Thornton - 1977

Fig. 3
Western Archeological and Conservation Center in Tucson for processing, analysis, and curation. All field notes, maps, and photographs are on file in the Center's archives.

Archeological investigation at Tumacacori began in 1918 and has almost always been conducted in association with preservation and stabilization of the aboveground ruins (Clemensen 1977:57-66; Shenk 1976:66, 76). The main purpose of past projects has been to obtain information about mission architecture. Therefore, these projects and their reports have stressed architectural data instead of stratigraphic and artifactual data (Shenk 1976:68-69). Since archeological data on Tumacacori are lacking, the main purpose of the plaza excavation was to collect information about the archeological resources of the area to be excavated and to evaluate their potential for yielding information. Basically, we wanted to determine what deposits, features, and artifacts were present in the area excavated and whether or not they would yield significant information about the site.

Areas of the mission affected by the plaza excavation were the west nave wall of the Franciscan church and the Franciscan mission plaza (Fig. 4). Reports indicated that the area adjacent to the west nave wall was badly disturbed, having been previously excavated. Although we knew that most of the deposits had been destroyed and that recovery of artifacts was unlikely in this area, we hoped that some intact deposits would show up in the trench wall profiles and that a depositional sequence, information on function and use of this area, and data on mission construction could be obtained.

The plaza is located south of the church's front entrance (Fig. 4). Originally, it was bordered on the north by the church and convento south wing and on the west and south by a neophyte village. This reported Indian village forming the plaza's west boundary was excavated by Beaubien in 1934-35 (Fig. 5). Any possible structures to the south have been affected by construction of the monument's visitor center (Fig. 2; Shenk 1976:38, 72). However, records showed that no formal or extensive excavations in the plaza itself had been previously conducted (Shenk 1976:72). Test excavations conducted by Brewer in 1951 and by Barton in 1979 suggested that intact mission period deposits were present elsewhere at the site (Brewer 1951; Barton n.d.), indicating that there was a good possibility that such deposits were present in the plaza.
Fig. 4: Ground Plan of Tumacacori Mission
(modified from Tovrea 1935).
In anticipation of finding intact mission period deposits as well as providing a framework for data recovery, we formulated these objectives. Of primary importance was determining a depositional sequence for the area excavated. Although many large and small excavations have been conducted at Tumacacori, such information is not included in any of the reports of these projects. (An exception is Michael Barton's report of his 1979 excavation in Barton n.d.). Artifacts also have been recovered from the site for many years; however, in most cases their archaeological context is absent or, at best, very unclear. Determination of a depositional sequence would be dependent upon the presence of subsurface features and deposits and relatively undisturbed stratigraphy continuing over some distance, as well as upon the recovery of datable cultural material having definite contextual association. As mentioned earlier, the stratigraphy exposed and the cultural material recovered were ade-
quate to allow determination of a stratigraphic sequence for the area excavated.

Secondly, we wanted specific information about plaza function within the mission community. We hoped to obtain data about when the plaza was used, who used it, and for what purpose. Of particular interest was determining if it was used primarily by the neophytes or by the missionaries and whether its use changed over time. Information on who used the plaza was derived from determining who was most likely to have used the artifacts recovered. Functional analysis of artifacts and identification of deposits and features provided information on plaza function. These studies showed that the plaza was apparently used by both Indian neophytes and Spanish missionaries and that plaza function did change over time. The data further suggest that it was used for garbage disposal during construction of the Franciscan mission, but not after that complex was put into use. Study of plaza function also yielded some information on the mission's construction sequence.

Finally, we wanted to increase our knowledge of the site's cultural history by reconstructing past lifeways at the mission. Historic-sites archeology adds the dimension of documentary history to archeological investigation. The archeologist identifies and interprets archeological and architectural features and analyzes artifacts in terms of function, technology, and style. Archeological data are then combined with information from the documentary record to reconstruct past patterns of adaptation and behavior.

Excavation results were viewed in relation to studies of the development of transportation and communication and of acculturation of the Spanish frontier that were conducted at nearby Tubac Presidio. The frontier missions were mechanisms of acculturation; their primary purpose was to Hispanicize the Indians. This manifested in their material culture (Shenk and Teague 1975:15, 164). Implications of the acculturative mechanisms of missionization, discussed by Deetz (1963) in relation to the California mission system, and of mestizaje, discussed by Deagen (1973) in relation to the Florida presidial system, were evaluated in terms of conditions on the Sonoran Spanish frontier. Changes in the composition of the Indian material cultural assemblage, an increase in the number of Spanish objects recovered, and examination of the document-
tary record suggest that both missionization and mestizaje were active mechanisms of acculturation at Tumacacori.

However, study also showed that other factors, such as frontier supply, affected the nature and degree of Hispanicization at the mission. Transportation and communication networks determined the availability of non-Indian items and thus, the extent to which Spanish culture could be introduced and accepted by the native population. Although analysis of the Tumacacori assemblage showed a general increase in the amount and variety of non-Indian artifacts through time, these imported items were generally scarce and difficult to obtain.

Excavation results also yielded information on the mission residents' subsistence, food preparation, and food consumption. Data indicate that domestic animals such as sheep and cattle were an important food source, and that crops such as wheat, barley, and corn were raised. Indigenous ceramics were used for cooking, food consumption, and storage; however, nonindigenous ceramics apparently were used exclusively for food consumption and as ceremonial accoutrements.

The Tumacacori plaza excavation showed that much potential for significant archeological research remains at the site. Future investigations will add to our knowledge and understanding of the Spanish period in southern Arizona.
Chapter 1
SITE CHRONOLOGY

Tumacacori's history has been the subject of many works. Two books in particular deal with the mission's history in detail: *Franciscan Tumacacori, 1767-1848* and *Friars, Soldiers, and Reformers*, both by John Kessell (1972; 1976). Another of Kessell's works, *Mission of Sorrows*, includes information on Jesuit Tumacacori (Kessell 1970). In addition to these excellent works, *Tumacacori's Yesterdays* (Jackson 1951), *The Chronology of Tumacacori National Monument* (Rensch 1951), and *The Tumacacori Story* (Rose and Russell 1934) also deal with the history of the site. Information about Tumacacori as a national monument may be found in *San Jose de Tumacacori: An Archeological Synthesis and Research Design* (Shenk 1976), *Historic Structure Report: A History of the Anglo Period* (Clemensen 1977), and in the *Southwestern Monument Monthly Reports* (National Park Service Southwestern Monuments 1902-1956). Since these works present a thorough and detailed historical account of Tumacacori, only a chronological listing of major events with emphasis on construction sequences is given below:

1691 First recorded visit of Padre Kino to rancheria Tumacacori (San Cayetano), reported to be on east side of the Santa Cruz River.

1697 Adobe structures built at San Cayetano. The rancheria was a *visita* (a community visited at fairly regular intervals by a priest from a nearby mission) of Mission Guevavi.

1706-1732 Regular visits by padres to San Cayetano cease.

1732 Northern Pimeria Alta missions refounded with San Cayetano again a *visita* of Mission Guevavi.

1751 Pima revolt.

1752 Tubac Presidio established on west bank of Santa Cruz River.

1753 Inhabitants of rancheria San Cayetano relocated to west bank of river. New site named San Jose de Tumacacori. Still a *visita* of Mission Guevavi.

1757 Jesuit mission built at Tumacacori.

1761 or 1762 Sobaipuris relocated to Santa Cruz River from San Pedro River. Tumacacori gets some members of this group.
1767 Jesuit missionaries expelled from Pimería Alta by decree banishing
the order from all lands held by the king of Spain.
1768 First Franciscan missionary (Fray Gil) arrives at Tumacacori.
1770's Renovation of Jesuit mission. Fray Ximeno and Fray Clemente
begin building adobe dwellings for the Indians and refurbish the
Jesuit church. A wall was built around the entire complex to
repel Apache attacks.
1773 Tumacacori becomes cabacera (district headquarters) of the Pimería
Alta missions. Mission Guevavi abandoned.
1770's into early 1800's Jesuit mission undergoes continual repairs.
1786 Calabasas, a visita of Tumacacori, abandoned because of Apache
pressure.
1790's Increase in mission development due to a new program for appease­
ment of Apaches in 1786.
1795 Jesuit mission reported to be badly deteriorated.
1797-1802 Fray Gutierrez begins construction of Franciscan complex at
Tumacacori. Construction known to have started by 1802.
1805 Construction halted and new buildings presumably neglected.
1820 New funds obtained and construction of Franciscan complex resumes.
1821 Mexico declares independence from Spain.
1822 Franciscan mission at Tumacacori in use, although church unfin­
ished.
1828 Last resident Franciscan Padre (Fray Liberos) leaves Tumacacori.
1843 Missions secularized.
1844 Tumacacori mission lands sold by Mexico to a private citizen.
1848 Last resident Indians abandon Tumacacori and move to Mission San
Xavier taking most, if not all, of Tumacacori's religious para­
phernalia with them.
1854 Gadsden Purchase ratified making Pimería Alta part of the United
States.
1856 U.S. Army takes possession of Santa Cruz River Valley. Mining
activity at Tubac.
1860's Santa Cruz River Valley deserted.
1870's through 1890's Growth of ranches in upper Santa Cruz River Val­
ley.
1900-1923 Southern part of the Franciscan convento used as a schoolhouse.
1908 Site declared a national monument.
1916 Control of monument given to National Park Service.
1929 Resident ranger stationed at Tumacacori.
1930's Visitor center and residences were built.
Chapter 2
PREVIOUS WORK AT TUMACACORI

The following is a brief summary of previous archeological work at Tumacacori that is pertinent to the area affected by the drain excavation. Since stabilization and restoration projects have resulted in almost as much excavation as archeological projects, they have been included when relevant to the current project. For a detailed overview of previous work at the site, see Shenk's 1976 report. Detailed descriptions of individual projects can be found in the specific reports cited.

The first major ruins project undertaken at Tumacacori was the restoration of much of the mission, particularly the church, by Frank Pinkley. This work began in 1918 and continued through the 1920's (Clemensen 1977:57-66). Although it included excavations as well as structure reconstruction, the excavations were designed to find features to aid stabilization of the church and other structures, rather than to obtain archeological information (List of Classified Structures Team 1976:7). The actual extent of Pinkley's excavations is not known, although records exist indicating some of the areas affected (Shenk 1976:23-25; Pinkley n.d.a, n.d.b). A photograph of the mission taken in the 1920's shows piles of backdirt in the plaza and at the southwest corner of the church (Fig. 6).

During 1934-1935, Paul Beaubien undertook a major archeological project to locate all subsurface architectural features at the site. Again, the extent of the excavations is unknown; however, he reportedly trenched the interior and exterior of virtually all presently known walls. Included in this project was partial excavation of the "Indian village" mound (Fig. 5). The original site records were lost (Shenk 1976:27-28; Beaubien n.d.).

In 1951, Sallie Brewer undertook an archeological project in the area west of the church, outside of what was then the monument's western boundary wall. The excavation consisted of 25 trenches, one of which extended to the southwest corner of the church. Her project report (Brewer 1951) includes a list of cultural material found and notes on the stratigraphy exposed.
Fig. 6: Disturbance in plaza and adjacent to Franciscan mission church west wall resulting from Pinkley's restoration work begun in 1918 (Pinkley n.d.a:16).
Recent activity in the area includes stabilization projects conducted by Martin Mayer in 1970 (Mayer et al. 1971) and George Chambers in 1979. Both projects affected the area adjacent to the west nave wall (Trench C of the plaza excavations). Mayer excavated this area to a depth of about 1.2 m, and removed part of the transept wall foundations. In an attempt to damp-proof the foundations, a plastic liner was laid in the trench and continued about 4.6 m into the area west of the church. The trench was filled with sterile sand and the plastic apron was buried under 15.2 to 20.3 cm of sand, gravel, and soil (Mayer et al. 1971:110, 118-119, 125-128). Mayer took field notes and made some field drawings, but no trench profiles were drawn (Mayer et al. 1971). In 1977, Chambers re-excavated Mayer's west nave wall trench, removed the cement from the foundations and the plastic liner. He then backfilled the excavated trench with sand and covered it with a clay cap. He also applied a new coat of lime plaster to the west nave wall (George Chambers: personal communication).
Prior to excavation, a magnetic survey and surface collection were conducted to obtain information about subsurface deposits. Additionally, we hoped that the distribution of artifacts on the surface would provide information about their origin and would allow documentation of the extent of the rodent activity in the area to be excavated.

The magnetic survey was conducted in 1977 by John W. Weymouth as part of Tumacacori's general stabilization and management program. Most of the monument was surveyed including the parts affected by the drain excavation, i.e., the plaza and the area west of the Franciscan church. Although the survey was done in 1977 and the report completed in May, 1979, a copy was not available until May, 1980, after the excavation had been completed. Therefore, we were unable to use the magnetic survey data during planning and excavation. However, since some of the survey data are pertinent to the project, they are summarized and discussed below. We collected plaza surface material just prior to excavation. Cultural material recovered from the surface collection and excavation is summarized in Table 1.

Magnetic Survey

Magnetic surveying is based on the fact that local anomalies in recorded readings of the earth's magnetic field are produced by subsurface features that are more strongly magnetized than the surrounding soil (Weymouth 1979:1-2). Anomalies are produced by soil that has been heated, such as hearths and groups of fired brick, by iron objects that have become magnetized in the earth's field, and by the chemical changes that occur in soils associated with occupational activity. The survey data were processed into magnetic contour maps illustrating the differences between regions of high and low of magnetic activity, thereby indicating the location of anomalies (Weymouth 1979: Figs. 3-16).

Problems were encountered during the Tumacacori magnetic survey due to the site's complex nature and the presence of modern metal structures and equipment. Underground electrical and water systems and metallic structures, such as wall reinforcements, sheet metal roofs, and window
### Table 1

**Tumacacori Cultural Material (Recovered from Surface Collection and Excavation): Counts and Percentages**

<table>
<thead>
<tr>
<th>Artifact Type</th>
<th>Number Recovered from Surface Collection</th>
<th>Number Recovered from Excavation</th>
<th>Total Number Recovered</th>
<th>Percentage of Tumacacori Cultural Assemblage Recovered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indigenous Ceramics</td>
<td>1,022</td>
<td>7,775</td>
<td>8,797</td>
<td>47%</td>
</tr>
<tr>
<td>Stone Artifacts</td>
<td>65</td>
<td>472</td>
<td>537</td>
<td>3%</td>
</tr>
<tr>
<td>Bone and Shell Artifacts</td>
<td>5</td>
<td>54</td>
<td>59</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Nonindigenous Ceramics</td>
<td>34</td>
<td>351</td>
<td>385</td>
<td>2%</td>
</tr>
<tr>
<td>Glass</td>
<td>112</td>
<td>430</td>
<td>542</td>
<td>3%</td>
</tr>
<tr>
<td>Metal</td>
<td>46</td>
<td>289</td>
<td>335</td>
<td>2%</td>
</tr>
<tr>
<td>Miscellaneous Nonindigenous Artifacts</td>
<td>12</td>
<td>19</td>
<td>31</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Bone</td>
<td>461</td>
<td>7,637</td>
<td>8,098</td>
<td>43%</td>
</tr>
<tr>
<td>Total</td>
<td>1,757</td>
<td>17,027</td>
<td>18,784</td>
<td>100%</td>
</tr>
</tbody>
</table>
screens used in the ruins stabilization, produced strong anomalies that distorted or prevented magnetometer readings. The Franciscan church blocked out magnetometer readings of the area immediately adjacent to the west nave wall where Trench C (Area III) and Trench D (Area IV) were located, and the underground waterline distorted some of the readings taken in the plaza (Fig. 7). See Chapter 4 for information on excavation and stratigraphic units.

Despite these problems, the magnetic survey indicates that significant anomalies that could not be attributed to known modern features are present in the excavation project area (Weymouth 1979). Two anomalies, 4-A and 1-J, are in the vicinity of the excavation trenches, with Trench A (Area I) fortuitously cutting directly through Anomaly 4-A (Fig. 7). Anomaly 1-J appears just south of excavation Units U and B (Trench B, Area II). Besides these two anomalies, other anomalies of probable archeological significance (Weymouth 1979:6) appear just outside the northwest corner, along the western boundary and in the east-central part of the surface collection grid (Fig. 7).

**Surface Collection**

Systematic collection of artifacts on the plaza surface was accomplished by using a horizontal grid. The grid's west boundary was established on a line running north-south in relation to the church and was located about midway up the east side of the mound presumed to be the remains of part of the Indian village. The south boundary, placed along a line running east-west relative to the church, was located just north of the Visitor Center and picnic area. The east boundary was established where the vegetation (particularly the mesquite trees and catclaw bushes) made collection virtually impossible. The north boundary was placed south of the church outside an area that had recently been disturbed by stabilization activities (Fig. 8). The grid consisted of 63 units, 54 measuring 5 meters square, with the nine northernmost units, Gl through G9, measuring 2.5 m x 5 m as shown in Figure 9. To designate individual grid units, a 5-meter-square unit was constructed with string and chaining pins. This portable unit was then moved around the collection area. All artifacts and bone fragments larger than 1 centimeter square were separated into two groups, those associated with rodent
Fig. 7: Distribution of Cultural Material from Surface Collection and Location of Magnetic Anomalies.
holes (actually in the backdirt), and those not associated with rodent holes. Scaled sketch maps were made of natural and cultural features in each grid unit. No botanical specimens were collected.

Surface collection results are shown in Figures 10-12. As shown by Figure 7, which illustrates the density of the total amount of cultural material collected, the amounts of bone and artifacts on the plaza's surface decreased from the west and north toward the grid's southeast corner. This scatter followed the ground's natural eastward downslope. The greatest concentrations of cultural material were in the middle of the plaza, in the westernmost units located on the "Indian village" mound southwest of the church, and in the units in the northwest and northeast corners of the grid.

The densest scatters of bone and indigenous and nonindigenous artifacts were in the plaza center, and the lightest scatters were in the southern and southeastern parts of the collection area. Figure 10 shows that besides in the middle of the plaza, concentrations of bone occurred on the "Indian village" mound and in the northwest corner unit (Gl). In contrast, the northeast corner had a relatively low density of bone. Indigenous artifacts formed the largest material culture group collected and had the most diffuse distribution (Fig. 11 and Table 1). Although most dense in the plaza's center, indigenous material concentrations also occurred on the "Indian village" mound and in the northwest and northeast corners of the grid. The density of the nonindigenous artifacts showed areas of concentration in the northeast corner and in the plaza center (Fig. 12). Very few nonindigenous artifacts were found on the "Indian village" mound or northwest corner of the grid.

An examination of the surface collection data on file at the Western Archeological and Conservation Center in Tucson, Arizona, showed that rodent-hole-associated material was patterned in a way similar to that discussed above, although the concentrations were less diffuse. The surface material was divided into rodent-hole-associated and non-rodent-hole-associated groups because we assumed that material in rodent hole backdirt definitely originated from subsurface deposits in the vicinity of the hole, although the deposits' exact location and horizontal and vertical extent could not be known. In contrast, the origin of non-rodent-hole-associated material, whether from erosion of surface depos-
Fig. 8: Surface Collection Area; looking south from Franciscan mission church toward the visitor center.
SURFACE COLLECTION AREA
SHOWING UNIT LOCATIONS AND DESIGNATIONS

Fig. 9
SURFACE COLLECTION
DISTRIBUTION OF BONE

Number of artifacts per area
1 = 0 - 9
2 = 10 - 19
3 = 20 - 40
4 = > 40

Fig. 10
SURFACE COLLECTION
DISTRIBUTION OF INDIGENOUS ARTIFACTS
Number of artifacts per area
1 = 0 - 8
2 = 9 - 14
3 = 15 - 34
4 = 35 - 99
5 = > 99

Fig. 11
Fig. 12

SURFACE COLLECTION
DISTRIBUTION OF NONINDIGENOUS ARTIFACTS

Number of artifacts per area
1 = 0 - 4
2 = 5 - 9
3 = 10 - 14
4 = > 14

28
its or from subsurface deposits, and the general location of those deposits, were unknown. The largest amount of rodent-hole-associated material was collected from the plaza center. Concentrations also occurred in the northwest and northeast corners and on the "Indian village" mound. Regardless of provenience, the proportions of rodent-hole-to non-rodent-hole-associated bone, indigenous and nonindigenous artifacts recovered were about the same. Fifty-nine percent of the material collected was non-rodent-hole-associated, and 41 percent was rodent-hole-associated.

Thirteen percent of the cultural material assemblage from this project was recovered in the surface collection. As indicated by Table 1, bone and sherds of Piman plainware and glass were the most numerous artifacts collected. The proportions of bone and artifacts recovered from the surface collection were similar to the proportions recovered from excavation.

Discussion

One of the questions prompting the surface collection study concerned the origin of the material appearing on the plaza surface. The decrease in density of surface material from west to southeast suggests that at least some of the material was washed out of the "Indian village" mound. Although it is impossible to be absolutely sure of the origination of surface material, artifacts and bone found in rodent hole backdirt were presumed to have come from subsurface deposits. Of the 70 artifacts recovered from Unit Gl, only three were non-rodent-hole-associated, indicating that most of the material in this area came from subsurface deposits. Only 10 of the 116 fragments of material collected from the eight adjacent grid units were rodent-hole-associated, indicating that most of the surface material in this area was transported from elsewhere; in this case, probably from Unit Gl. This scatter of material in the collection grid's northwest corner indicates that material deposited by rodent activity is washing down slope toward the southeast. The surface collection and excavation indicate that material is also being exposed as a result of the erosion of culture-bearing strata located at the ground's surface. I presume that the same pattern of movement toward the southeast also applies to this material.
Presumably, surface material indicates the presence of subsurface deposits. Magnetic anomalies also indicate that subsurface features and deposits exist. Tumacacori magnetic survey and surface collection data coincide extremely well and correspond with what is known about the site. Data from these two studies indicate that subsurface deposits and features exist in the central and mid-eastern parts of the plaza, along the eastern slope of the "Indian village" mound, and in the plaza's northeast and northwest corners (Fig. 7).

Excavation confirmed at least one subsurface feature. In the plaza center where the heaviest densities of cultural material occurred and where Anomaly 4-A appeared on the magnetic survey maps, our excavations exposed Feature 7. This feature, dating from about 1800, consisted of trash dump fill containing a large quantity of whole and fragmentary fired adobes. The bricks probably caused the anomaly. Although the outlines of Feature 7 indicated by the surface material densities are larger than those indicated by the magnetic survey, the feature's general location and extent may be determined by combining the information from the two methods. The variance in the boundaries may be explained in part by the fact that the two methods are sensitive to different data. The surface collection information is based on bone and artifactual material which apparently is not picked up by magnetometer readings. Also, the surface collection data base includes a wider variety of cultural material than the magnetic survey. This smaller material is subject to movement by rodent activity or drift. These factors may partially explain why Feature 7's boundaries, as indicated by the surface collection, and those indicated by the magnetic survey do not correspond precisely (Fig. 7).

Along the eastern slope of the "Indian village" mound, Anomalies 1-H and 1-G appeared in areas of surface material concentrations (Fig. 7). An interesting correlation also exists between the presence of Anomaly 1-I just north of surface collection Unit GI where a large concentration of indigenous artifacts and bone was collected. The cultural material on the plaza's northeast corner did not have a complementary magnetic anomaly because readings in this area were distorted by the waterline. In contrast, magnetic Anomaly 4-B, appearing in the east central part of the surface collection area did not have an attending
concentration of surface material because there was less rodent activity in this area and thick vegetation hampered collection in this area.

Anomaly 1-J appeared just south of excavation units U and B in Area II (Trench A) in the western part of the plaza. This anomaly is described as a "moderate monopole type, probably of significance" (Weymouth 1979:6). Monopole anomalies are produced by relatively deep localized features that were magnetized in situ. Only a small amount of cultural material was recovered during excavation of units B, U, and T, and the amount of surface material in this area was sparse (Fig. 7). However, during excavation, two depressions appeared in the south wall stratigraphy of Units U and B. The depression in Unit B contained an almost fully articulated dog skeleton that apparently had been purposefully buried (Fig. 13). (See Appendix C.) The other depression, Feature 12 of Unit U, consisted of a series of alluvial deposits (Figs. 14 and 16). This southern end of Area II could not be adequately interpreted because not enough of the deposits were exposed. The complex nature of the stratigraphy suggests the presence of associated features outside the boundaries of the excavation trenches. The composition of the deposits in this part of Area II and the sparse amount of surface collection material suggest that Anomaly 1-J may be a feature, having relatively few associated artifacts, that is associated with one or both of the depressions appearing in Area II. On the basis of Feature 12's alluvial nature and acequia-like appearance, I think the stratigraphy in the southern part of Area II is associated with some man-made water control feature, perhaps a catch-dam or well used for drainage or irrigation, that may possibly be Anomaly 1-J. Alternatively, Feature 12 and the alluvial deposits in the vicinity could be natural; Anomaly 1-J could be an isolated feature or it could be associated with the "Indian village" mound. There is some evidence that a natural drainage feature may exist in this area (Crosby 1978:68).

Since the presence of magnetic anomalies and dense scatters of surface material is presumed to be an indication of subsurface deposits, the absence of such evidence probably indicates that no subsurface deposits are present. Data from the Tumacacori studies suggest that apparently no major subsurface features or deposits are present in the study area's southern end and southeast corner (Fig. 7).
Fig. 13: Area II (Trench A) Units B and D.
South wall profile showing depression containing alluvial deposits in which a dog skeleton was found.

Fig. 14: Feature 12 (Area II [Trench B] Unit U)
Besides its use as an indicator of subsurface deposits, the surface collection provided some general information about the probable composition of those deposits. The majority (almost 90 percent) of the artifacts collected from the surface collection units in the vicinity of Feature 7 was bone and indigenous artifacts. These two groups also accounted for 98 percent of the cultural material recovered from excavation of that feature. The surface collection units along the "Indian village" mound also contained mostly indigenous artifacts and bone (Figs. 10, 11, 12). Indigenous artifacts formed over half of the material collected from these 18 units. We know that structures are present in this area because Beaubien exposed walls here during his 1934-1935 excavations (Fig. 5). These structures are thought to have housed the mission's neophyte Indian population (Shenk 1976:38), and the surface collection material from this area seems to support that interpretation. Unfortunately, no archeological data from the 1934-35 excavations exist to compare with the surface collection data. Sixty-nine of the 70 cultural material fragments from Unit G1 were bone and indigenous artifacts. Their ratio was about 2:1. This unit is located at the northern end of the "Indian village" mound, near the southern boundary wall of the Franciscan complex. This area would be a likely location for a garbage dump, suggested by the proportion of bone from the unit. Cultural material is also concentrated in the northeast corner of the collection grid where one-third of the artifacts collected were nonindigenous. This area is near the part of the convento reportedly modified by Anglos and used as as schoolhouse between 1900 and 1923 (Southwestern Parks and Monuments Association 1970:14) and as the monument's office in the 1930's (National Park Service Southwestern Monuments 1936:129). During excavation, the main deposits of nonindigenous material were in this general area (eastern end of Trench A, Area 1) (Fig. 12).

Conclusions

A study of cultural material from the Tumacacori plaza surface provided information about the origin of that material and probable location and composition of subsurface archeological deposits and features. Some of this information was corroborated by magnetic survey data and confirmed by excavation. Based on the appearance of previously known
subsurface archeological features that have been excavated and back-filled, Weymouth (1979:8, 13) concludes that "archeological features are sometimes identifiable in the magnetic maps." This conclusion is confirmed by the congruence of Feature 7 and Anomaly 4-A in excavation Area I (Fig. 7). The correspondence of information about subsurface deposits obtained from the magnetic survey with the study of surface material, especially that associated with rodent holes, and the confirmation by excavation of some of these deposits, indicate that the potential is high for using these two methods, especially in conjunction, as reliable predictive models of archeological resources.
Chapter 4
EXCAVATION AND DEPOSITIONAL HISTORY

The stratigraphy of Tumacacori's plaza and west nave wall was complex, and many areas were intact. Although disturbance was present, it did not prevent interpretation of stratigraphy or establishment of a depositional sequence for the area. Cultural fill was usually about 1 m thick. We were mostly able to excavate stratigraphically; however, disturbance occasionally obscured relationships and necessitated excavation in arbitrary levels. Excavation exposed deposits and features. Deposits consisted of sheet trash, trash dump fill, and trash pit fill. Use surfaces, holes and trenches, transept wall foundations, burned areas, and natural features were found. Some deposits and features were alluvial in nature. Stratigraphic units were grouped into four areas containing associated deposits and features. Most of Area I deposits represent refuse disposal. Much of Area II stratigraphy reflects alluvial deposition. The deposits and features of Areas III and IV are largely associated with west nave wall construction and erosion.

The depositional history is based on feature and deposit stratigraphic relationships, dates of diagnostic artifacts, and the site's documentary history. It is the apparent or suggested sequence for the excavated areas. Deposits apparently span the site's entire occupation and, therefore, may date as early as 1753. We found no evidence of prehistoric occupation in the tested areas. Deposits were grouped into four arbitrary time periods. The early and late mission horizons are part of the mission period. Early mission horizon deposits date from approximately 1750 to about 1800, and the late mission horizon deposits date from approximately 1800 to 1850 and later to about 1900. Both the late nineteenth-early twentieth century and twentieth century components represent post-abandonment modification and reuse of the mission ruins.

In this chapter, I discuss the excavation methods used, describe the stratigraphy exposed, and present a depositional history for the excavated areas. The Methods section contains a summary of excavation location and extent and a description of unit designations, conventions used to maintain horizontal and vertical control, and the excavation and recording procedures followed. The Description of Deposits and Features
contains a general description of the stratigraphy, definition of terms used, and a description of deposits and features starting with Level 1 (most recent deposit of sheet trash), and the Basal Level (sterile soil; site's pre-occupation surface), and continuing with the stratigraphic units of Areas I, II, III, and IV. Each area description begins with a summary of its excavation units, stratigraphic units, nature, and date, and continues with descriptions of individual deposits and features. Presentation of the excavated area's apparent depositional history appears in the Depositional History section.

**Excavation Methods**

Four trenches, designated A, B, C, and D, were excavated (Fig. 15). Trenches A (23 m long and extending across the plaza) and B (16.7 m long and extending from the church's southwest corner to the west end of Trench A) were divided into rectangular units, most measuring 2 m x 1 m.

These units were labeled alphabetically, A through L for Trench A, and M thru U for Trench B. Trench C began at the southwest corner of the church and extended north 23.93 m adjacent to the west nave wall without undercutting the buttress. The depth of the trench varied from 0.75 to 1.10 m with a variation in width from 1 to about 1.75 m. This variation resulted from wall slough, presumably resulting from the prior excavation. Previously excavated in 1970 by Martin Mayer as part of a stabilization project (Mayer et al. 1971:15), this area had been backfilled with sterile sand. We reexcavated Mayer's trench and removed as much sand as possible until soil was exposed so that stratigraphic profiles could be drawn. No artifacts were recovered from Trench C.

Trench D, 6.5 m long and excavated in an attempt to associate stratigraphy exposed in Trenches A and B with the Franciscan structure, was divided into three rectangular units, V, W, and X (Fig. 15). The Trench D units were not labeled sequentially because during excavation we had not expected to have multiple units. The excavation of Trench D was severely limited by time. A 1-meter-square unit (Unit X) was dug where, according to Beaubien's 1934 map, the southwest corner of the west transept wall was located. When we did not find the transept wall foundations, we proceeded to dig north along a line of disturbance (trench) observed in the first unit until the transept walls were located. This
Fig. 15
unit, labeled W, was excavated to a depth of about 50 cm. Once the wall foundations were found, we dug until sterile soil was reached and then excavated west for 2 m until relatively undisturbed soil appeared. This unit, labeled V, was 50 cm wide.

Vertical control was established from a main elevation datum, labeled "Kino," which was given an arbitrary elevation of 0. Actual elevation was 3,261.02 ft. above sea level (Fig. 3). Excavation proceeded according to natural or cultural stratigraphy whenever possible. When stratigraphic levels could not be defined, were too thick (more than 25-30 cm), or when more exact provenience control was desired, units were excavated in arbitrary levels of 10 and 20 cm. Except for Trench B, Unit K, the first arbitrary level of those units excavated in arbitrary levels was 10 cm, and all succeeding levels were 20 cm. All Unit X arbitrary levels were 20 cm. Levels denoted vertical relationships within units and were numbered sequentially. Features and surfaces were numbered sequentially as encountered. Units A, B, U, and M served as test units and were dug completely in arbitrary levels.

All units (except Unit W of Trench D) were excavated to sterile soil (Basal Level). In most areas, this appeared about 1 m below the present ground surface. All soil from Trenches A and B was screened through one-quarter-inch wire mesh. Fifty percent of the soil from Unit X was screened. The soil from Units W and V was not screened. In most cases, artifacts less than 1 cm square were discarded. Very small or badly deteriorated pieces of bone were also discarded. However, whole objects, such as buttons and beads, and distinctive or diagnostic artifacts 1 cm square or smaller were collected. Architectural debris samples (fired adobe, floor tile, lime mortar, and plaster) were also collected. Trenching was done with pick and shovel, while trowels, whisk brooms, and other small tools were used to define features. The asphalt visitor trail was removed with an air hammer.

We mapped with a transit and tape. The main elevation datum was also the main mapping datum. Since a topographic map of the site had been previously made showing all physiographic and cultural features, we simply added the surface collection grid and excavation units to it.

During excavation, profiles were drawn of all walls to be removed when the next unit was dug. The following procedure was used to prepare
trench wall stratigraphy for recording: (1) the walls were brushed with whisk brooms and paint brushes; (2) they were then vacuumed with a 50-gallon shop vacuum; and (3) the walls were sprayed with water. We found this to be a fast, efficient, and satisfactory procedure. The vacuum cleaned the fine, powdery, dry dust from the walls much better and faster than could have been done by brushing, and brought features and strata into clear view. Obscuring brush marks were eliminated, and the time needed to prepare for profiling was cut in half.

Following excavation, profiles of all trench walls were photographed. Both 35-mm color slides and 4" x 5" black-and-white photographs were taken of Trench A and B profiles. Only 35-mm color slides were taken of the profiles in Trench C, and only 35-mm black-and-white photographs were shot for Trench D.

Soil, rock, architectural debris, flotation, and dendrochronological samples were taken during excavation and from trench walls after profiling and photographing. All samples and artifacts were taken to the Western Archeological and Conservation Center for cleaning, processing, and analysis. Soil, rock, and architectural debris samples were submitted to the Materials and Ecological Testing Laboratory, Western Archeological and Conservation Center, for analysis.

Description of Deposits and Features

Contrary to expectations, the stratigraphy in most of the excavated area was both deep and mostly intact; disturbance, though present, was relatively minimal. The usual depth of cultural deposits above sterile soil (Basal Level) was 1 m, and the actual thickness varied from 30 to 120 cm. During most of the excavation, we were able to maintain vertical control, and during profiling, the boundaries of individual strata and features were usually easy to define. However, there were areas in which relationships were not clear because of disturbance and problems encountered during excavation. Root and rodent activity and intrusive features such as postholes, trenches, and potholes also obscured stratigraphic relationships. There are reports of pothunting at the site in the 1930's, and a former workman involved in stabilization activities recalled that several holes were dug in the plaza area at that time (National Park Service Southwestern Monuments 1934:66; Mr. Amado: per-
sonal communication). Rodent activity at the site is fairly extensive and is an old problem going back at least to the Franciscan period. A missionary residing at Tumacacori in 1772-73 mentions "a plague of mice" (Kessell 1972:98). Matrix changes undetected during excavation were seen later during profiling.

Stratigraphic profiles are illustrated in Figures 16 to 18 (end pocket). Tables 2 and 3 summarize deposit and feature contents and physical characteristics. Terms used in the discussion follow Shenk and Teague (1975:55-56) and are listed below:

**Basal level:** The top of this deposit represents the ground surface of the site before intensive prehistoric or historic occupation or the construction of structures.

**Sheet trash:** A relatively thin, widespread layer of gradually accumulated cultural material.

**Trash pit fill:** Deposits found inside a pit or hole that was dug either for the purpose of refuse disposal or utilized for that purpose.

**Trash dump fill:** Concentrated refuse deposits forming a layer. Dates are based on datable artifacts recovered and the deposits' position in the depositional sequence. Deposit dates are discussed completely in the Depositional History section.

All deposit measurements given are approximate and have an error of at least ±2 cm. The use of "to" between two measurements refers to the entire vertical or horizontal extent of a level or feature, from top to bottom, or from side to side. A hyphen appearing between two numbers means that the measurements given represent the variation in depth of the top or bottom of a level or feature, either within a particular excavation unit or within the entire extent of the level or feature. For example, the measurement "40 cm to 75-80 cm" means that the top of the particular level or feature appears approximately 40 cm beneath the present ground surface, and its bottom varies in depth from 75-85 cm beneath grade. All depth measurements recorded in this discussion were taken from the present ground surface. The surface of the asphalt visitor trail was also considered to be part of the present ground surface.

Stratigraphic units are grouped into four general areas of associated deposits and features, designated Areas I, II, III, and IV. In addition to these four areas, a level of sheet trash, Level 1, and the Basal Level appeared in all of the areas excavated.
Table 2
DISTRIBUTION OF CULTURAL MATERIAL RECOVERED BY PROVENIENCE

<table>
<thead>
<tr>
<th>CULTURAL MATERIAL TYPE</th>
<th>AREA I</th>
<th>AREA II</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LEVEL 1</td>
<td>LEVEL 2</td>
</tr>
<tr>
<td>Indigenous Ceramics</td>
<td>1,060</td>
<td>294</td>
</tr>
<tr>
<td>Stone Artifacts</td>
<td>33</td>
<td>16</td>
</tr>
<tr>
<td>Bone and Shell Artifacts</td>
<td>101</td>
<td>1</td>
</tr>
<tr>
<td>Total Indigenous Artifacts</td>
<td>1,094</td>
<td>311</td>
</tr>
<tr>
<td>Nonindigenous Ceramics</td>
<td>60</td>
<td>13</td>
</tr>
<tr>
<td>Glass</td>
<td>86</td>
<td>5</td>
</tr>
<tr>
<td>Metal</td>
<td>29</td>
<td>6</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Nonindigenous Artifacts</td>
<td>153</td>
<td>24</td>
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<tr>
<td>Bone</td>
<td>679</td>
<td>621</td>
</tr>
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</table>

Table 2—Continued

<table>
<thead>
<tr>
<th>CULTURAL MATERIAL TYPE</th>
<th>AREA II</th>
<th>AREA IV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LEVEL 1</td>
<td>LEVEL 2</td>
</tr>
<tr>
<td>Indigenous Ceramics</td>
<td>4</td>
<td>185</td>
</tr>
<tr>
<td>Stone Artifacts</td>
<td>60</td>
<td>84</td>
</tr>
<tr>
<td>Bone and Shell Artifacts</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Total Indigenous Artifacts</td>
<td>4</td>
<td>185</td>
</tr>
<tr>
<td>Nonindigenous Ceramics</td>
<td>18</td>
<td>27</td>
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<td>Glass</td>
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<tr>
<td>Nonindigenous Artifacts</td>
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<td>18</td>
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<tr>
<td>Bone</td>
<td>122</td>
<td>217</td>
</tr>
</tbody>
</table>

NOTE: Number of artifacts and bone recovered from Area IV is 22. See Chapter 4 for explanation.
Table 3
SUMMARY OF DEPOSIT DESCRIPTIONS
Area I

<table>
<thead>
<tr>
<th>DEPOSIT</th>
<th>SOIL TEXTURE</th>
<th>SOIL COLOR</th>
<th>INDIGENOUS ARTIFACTS</th>
<th>NONINDIGENOUS ARTIFACTS</th>
<th>BONE</th>
<th>Flora</th>
<th>Charcoal</th>
<th>DEPOSIT DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 2</td>
<td>Silty, sandy</td>
<td>Slightly dark grayish-brown</td>
<td>57%</td>
<td>8%</td>
<td>35%</td>
<td>x</td>
<td>x</td>
<td>Late 19th-Early 20th Centuries</td>
</tr>
<tr>
<td>Level 3</td>
<td>Silty, sandy</td>
<td>Brown, grayish-brown, greenish-yellow</td>
<td>33%</td>
<td>2%</td>
<td>65%</td>
<td>x</td>
<td>x</td>
<td>Late Mission Horizon</td>
</tr>
<tr>
<td>Level 4</td>
<td>Silty, sandy gravelly with some clay</td>
<td>Grayish-brown</td>
<td>33%</td>
<td>2%</td>
<td>65%</td>
<td>x</td>
<td>x</td>
<td>Late Mission Horizon (ca 1800)</td>
</tr>
<tr>
<td>Feature 1</td>
<td>Silty, sandy</td>
<td>Reddish</td>
<td>29%</td>
<td>36%</td>
<td>34%</td>
<td>x</td>
<td>x</td>
<td>20th Century</td>
</tr>
<tr>
<td>Feature 6</td>
<td>Silty, sandy with some sand, gravel, and cobbles</td>
<td>Grayish-brown</td>
<td>59%</td>
<td>2%</td>
<td>39%</td>
<td>x</td>
<td>x</td>
<td>Late Mission Horizon</td>
</tr>
<tr>
<td>Feature 7</td>
<td>Silty, gravelly</td>
<td>Reddish brown</td>
<td>58%</td>
<td>2%</td>
<td>40%</td>
<td>x</td>
<td>x</td>
<td>Late Mission Horizon (ca 1800)</td>
</tr>
<tr>
<td>Feature 8</td>
<td>Silty, sandy</td>
<td>Dark grayish-brown</td>
<td>33%</td>
<td>20%</td>
<td>47%</td>
<td>x</td>
<td>x</td>
<td>20th Century</td>
</tr>
<tr>
<td>Surface 3</td>
<td>Compact, hard, silty</td>
<td>Light gray</td>
<td>47%</td>
<td>33%</td>
<td>20%</td>
<td>x</td>
<td>x</td>
<td>Late Mission Horizon</td>
</tr>
<tr>
<td>Alternating Ash and Soil Lenses</td>
<td>gravelly</td>
<td>Light tan</td>
<td>59%</td>
<td>3%</td>
<td>38%</td>
<td>x</td>
<td>x</td>
<td>Late Mission Horizon (post ca 1800)</td>
</tr>
<tr>
<td>Disturbance Pit</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>20th Century</td>
</tr>
</tbody>
</table>

NOTE: x denotes the presence of the material in the deposit.
<table>
<thead>
<tr>
<th>DEPOSIT</th>
<th>SOIL TEXTURE</th>
<th>SOIL COLOR</th>
<th>INDIGENOUS ARTIFACTS</th>
<th>NONINDIGENOUS ARTIFACTS</th>
<th>BONE</th>
<th>Charcoal</th>
<th>DEPOSIT DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 5</td>
<td>Sandy</td>
<td>Light tan</td>
<td>29%</td>
<td>2%</td>
<td>69%</td>
<td>x</td>
<td>Early Mission Horizon</td>
</tr>
<tr>
<td>Level 6</td>
<td>Gravelly</td>
<td>Brown to reddish-brown</td>
<td>59%</td>
<td>3%</td>
<td>38%</td>
<td>x</td>
<td>Cannot be determined</td>
</tr>
<tr>
<td>Level 7</td>
<td>Gravelly with alluvial deposits</td>
<td>Brown</td>
<td>14%</td>
<td>1%</td>
<td>85%</td>
<td>x</td>
<td>Early Mission Horizon</td>
</tr>
<tr>
<td>Level 8</td>
<td>Ashy</td>
<td>Dark, gray-brown</td>
<td>72%</td>
<td>9%</td>
<td>19%</td>
<td>x</td>
<td>Cannot be determined</td>
</tr>
<tr>
<td>Level 9</td>
<td>Compact and hard</td>
<td>Light tan</td>
<td>30%</td>
<td>65%</td>
<td>5%</td>
<td>x</td>
<td>20th Century</td>
</tr>
<tr>
<td>Level 10a</td>
<td>Sandy with gravel and rocks</td>
<td>Light gray-brown</td>
<td>66%</td>
<td>15%</td>
<td>19%</td>
<td>x</td>
<td>Cannot be determined</td>
</tr>
<tr>
<td>Level 10b</td>
<td>Silty, sandy, gravelly</td>
<td>Dark reddish-brown</td>
<td>80%</td>
<td>20%</td>
<td>0</td>
<td></td>
<td>Cannot be determined</td>
</tr>
<tr>
<td>Level 11a</td>
<td>Loose, silty, sandy with coarse sand</td>
<td>Light gray-brown and gray</td>
<td>62%</td>
<td>7%</td>
<td>31%</td>
<td>x</td>
<td>Early Mission Horizon</td>
</tr>
<tr>
<td>Level 11b</td>
<td>Loose and sandy</td>
<td>Dark brown</td>
<td>58%</td>
<td>6%</td>
<td>36%</td>
<td>x</td>
<td>Early Mission Horizon</td>
</tr>
<tr>
<td>Level 12</td>
<td>Compact, silty, sandy, gravelly</td>
<td>Dark grayish-brown</td>
<td>64%</td>
<td>10%</td>
<td>26%</td>
<td>x</td>
<td>Early Mission Horizon</td>
</tr>
<tr>
<td>Level 13</td>
<td>Silty, sandy, gravelly, compact</td>
<td>Grayish-brown</td>
<td>17%</td>
<td>71%</td>
<td>12%</td>
<td>x</td>
<td>20th Century</td>
</tr>
<tr>
<td>Level 14</td>
<td>Silty</td>
<td>Brown</td>
<td>40%</td>
<td>0</td>
<td>60%</td>
<td>x</td>
<td>Late Mission Horizon</td>
</tr>
<tr>
<td>Feature 2</td>
<td>Compact, hard, silty</td>
<td>Dark gray-brown</td>
<td>3%</td>
<td>7%</td>
<td>90%</td>
<td>x</td>
<td>Early Mission Horizon</td>
</tr>
<tr>
<td>Feature 4</td>
<td>Silty, sandy</td>
<td>Light grayish-tan</td>
<td>33%</td>
<td>2%</td>
<td>65%</td>
<td>x</td>
<td>20th Century</td>
</tr>
<tr>
<td>Feature 5</td>
<td>Silty, sandy</td>
<td>Light grayish-tan</td>
<td>32%</td>
<td>19%</td>
<td>49%</td>
<td>x</td>
<td>20th Century</td>
</tr>
</tbody>
</table>
### Table 3—continued

<table>
<thead>
<tr>
<th>DEPOSIT</th>
<th>SOIL TEXTURE</th>
<th>SOIL COLOR</th>
<th>INDIGENOUS ARTIFACTS</th>
<th>NONINDIGENOUS ARTIFACTS</th>
<th>BONE</th>
<th>DEPOSIT DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 15</td>
<td>Silty, sandy</td>
<td>Light tan</td>
<td>96%</td>
<td>2%</td>
<td>2%</td>
<td>20th Century</td>
</tr>
<tr>
<td>Level 16</td>
<td>Gravelly, silty, with small cobbles</td>
<td>Gray-brown to red-brown</td>
<td>50%</td>
<td>0</td>
<td>50%</td>
<td>Possibly Mission Period</td>
</tr>
<tr>
<td>Level 17</td>
<td>Hard and silty</td>
<td>Dark brown</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>Possibly Late Mission Horizon</td>
</tr>
<tr>
<td>Level 18</td>
<td>Silty, sandy</td>
<td>Light brown</td>
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<td>--</td>
<td>--</td>
<td>Possibly Late Mission Horizon</td>
</tr>
<tr>
<td>Level 19</td>
<td>Powdery, ashy, laminated</td>
<td>Gray</td>
<td>--</td>
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<td>--</td>
<td>Possibly Late Mission Horizon</td>
</tr>
<tr>
<td>Level 20</td>
<td>Gravelly</td>
<td>Dark brown</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>Mission Period</td>
</tr>
<tr>
<td>Feature 13</td>
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</tr>
<tr>
<td>Feature 14</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Feature 9</td>
<td>Laminated, silty with some gravels</td>
<td>Dark brown</td>
<td>62%</td>
<td>0</td>
<td>38%</td>
<td>Late Mission Horizon (ca 1800)</td>
</tr>
<tr>
<td>Feature 10a</td>
<td>Silty with some clay</td>
<td>Dark brown</td>
<td>58%</td>
<td>21%</td>
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<td>20th Century</td>
</tr>
<tr>
<td>Feature 10b</td>
<td>Silty with some clay</td>
<td>Dark brown</td>
<td>64%</td>
<td>0</td>
<td>36%</td>
<td>20th Century</td>
</tr>
<tr>
<td>Feature 11</td>
<td>Silty, sandy</td>
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<td>76%</td>
<td>6%</td>
<td>18%</td>
<td>1968</td>
</tr>
<tr>
<td>Feature 12</td>
<td>Loose, gravelly, rocky, laminated</td>
<td>Dark brown</td>
<td>33%</td>
<td>2%</td>
<td>63%</td>
<td>Early Mission Horizon</td>
</tr>
<tr>
<td>Surface 1</td>
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<tr>
<td>Surface 2</td>
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<td>--</td>
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<td>--</td>
<td></td>
<td>Early Mission Horizon</td>
</tr>
<tr>
<td>Feature 15</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
<td>1797 to before 1822</td>
</tr>
<tr>
<td>Feature 16</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
<td>20th Century</td>
</tr>
</tbody>
</table>
Level 1

This level of post-occupational sheet trash appeared over most of the site and consisted of a cultural mix that includes the most recently deposited material. In Area I, Level 1 extended across Units A, C, L, E, and G. In Unit E, Level 1 appeared only in the north part. In the south part of Unit E, the level lensed out, and Feature 1 appeared at the present ground surface. In the north part of Unit G, the level again lensed out and was replaced by Feature 1. In Units A and C, Level 1 extended from the present ground surface to a depth of from 5 to 32 cm. This level appeared in Unit L below the asphalt visitor trail; however, its presence was not easily identifiable due to the disturbance that resulted when the visitor trail was laid. In Units E and G, where it thinned and disappeared, the extent of the level below grade varied from 2 to 14 cm. Level 1 appeared again in Units B, D, F, and U of Area II. From the present ground surface, this level extended to a depth varying between 5 and 28 cm in these four units, thinning toward the west. The relationship of Level 1 to other deposits shown on the profile (especially Area I) indicates that the level has been removed in the area of Units H, I, J, and K, probably due to grading.

Level 1 consisted of a dry and powdery, light grayish-brown, silty soil containing sand, coarse gravel (about 4 cm in diameter), and vegetal remains of plant cover. Below the surface the level was hard but friable. Level 1 contained a mix of cultural debris (Table 2). This level also contained some limestone rocks and fragments of a fused material identified as limestone heated to over 1,300°C. This material is probably residue from processing lime to make plaster and mortar.

In Units M, N, and O of Area II, and in Area III, Level 1 extended from the present ground surface to a depth varying from 4 to 30 cm. In Area IV, Units V and X, its depth was 20 cm. In Units M, N, O, V, and X, and in Area III, constituents differed from those previously described. In this area, Level 1 consisted of a compact light tan to grayish-brown silty, sandy soil with small inclusions of fired adobe and fragments of plastic liner installed in 1970 (Mayer et al. 1971:6). In Area III, Level 1 had a thick (up to 20 cm), hard, red clay cap that was laid in 1970 as a stabilization aid (Mayer et al. 1971:15). The coarse
gray sand now on the ground was intentionally deposited by the Park Service to improve the appearance of the ground near the mission structures.

**Basal Level**

This stratum appeared in all excavated areas, underlying the cultural deposits and is labeled "Dark Brown Soil" on the profile illustrations. The top of this level represents the ground surface of the site before intensive occupation (since the cultural material recovered from this stratum suggests that the site may have been sparsely occupied prior to the intensive mission period occupation). The Basal Level appeared at a depth varying from 30 to 240 cm. After this level was identified (in Units A, B, U, and I), excavation was halted at the depth where it appeared.

Once identified, the Basal Level was easily recognized, being darker than the overlying cultural deposits. Also, when tested, the soil produced no reaction to a 10 percent hydrochloric acid solution, whereas the cultural deposits did react. The soil was dark brown, gritty and silty with some clay, and was slightly moist (moister than the overlying cultural deposits). It was sandy and occasionally had cobbles. Small amounts of cultural material, mostly indigenous sherds and bone, often appeared in the upper 10 cm of the level. The Basal Level contained significantly less cultural material than the overlying fill, a drop in artifact density being one of the indications during excavation that it had been reached. The small amount of cultural material in this level is thought to result from either the sporadic or sparse presence of people on or traveling across the site or from rodent activity or drift. I refer to the top of the Basal Level as the pre-intensive occupation ground surface because the cultural material recovered from this stratum indicates that the site may have been sparsely occupied prior to intensive mission period occupation.

In Trench A, Units A, C, L, E, G, and I, the Basal Level consisted of waterworn cobbles, ranging from 5 to 30 cm in diameter, in the matrix of dark brown, gravelly soil described above. All the cobbles examined were igneous (basalt and granite). This part of the Basal Level was labeled Feature 3 and was identified as a Santa Cruz River terrace.
feature appeared distinct in Units A and C at a depth of 60 cm. The cobbles were large and covered the bottom of these two units. Beginning in Unit L, the cobbles began to decrease in both size and density until they disappeared in Unit I at a depth of 102 cm. The western upward slope of both the present and pre-intensive occupation ground surfaces illustrated by the profiles is caused by the deposition of soil that washes down from the Tumacacori Mountains foothills located just west of the mission. The plaza soil deposition is thicker in the west near the foothills, and the river terrace cobbles did not appear in the western part of the excavation. In the eastern part of the plaza nearer the Santa Cruz River, soil deposition was less, and the river terrace cobbles only appeared in the eastern part of the excavation. However, corings taken in the western part of the plaza and the area west of the Franciscan church exposed river terrace cobbles at depths varying from 1.07 - 1.22 m to 3.05 m below grade (Richert 1975:5). No cultural debris was found in Feature 3, apparently indicating that rodent activity or drift is the cause of the appearance of cultural material in the Basal Level of other units.

In Area II, Unit M, another stratum was identified as part of the Basal Level. Below Level 14 at a depth of 120 cm was a very dense and moist dark red clay that contained no cultural material. Since this clay was also encountered in Richert's corings, it probably underlies the dark brown soil in the western part of the site.

Area I

Summary

Trench A: Units A, C, L, E, G, H (eastern half). All units are 1 m x 2 m except A (1 m x 1.5 m), C (1.68 m x 1 m x 1.23 m x 1.7 m), L (1.9 m x 1.7 m x 2.28 m x 2.26 m), and E (1 m x 2 m x 1.9 m x 2.41 m). Includes Levels 1-4 and Features 1 and 6-8, Surface 3, a Disturbance Pit, and Alternating Lime Ash (plaster) and Soil Lenses.

Area I contains a series of unconsolidated trash deposits consisting of trash dump and trash pit fill representing garbage disposal. The deposits apparently all date from the late mission horizon (ca 1800 and later). The area's most notable feature is Feature 7 where part of the Basal Level had been removed and the resulting hole filled with trash.
Description of Area I Deposits and Features

Level 1. Discussed above.

Level 2. This level of sheet trash appeared in Units C, L, E, G, I, J, and K, and dates from the late nineteenth and early twentieth centuries. Level 2, first seen on the north face of Unit C, underlay Feature 1 and overlay Feature 6, appearing from 43 to 53 cm below present ground surface in the east and from 10 to 43 cm in the west. A marked decrease in architectural debris and an increase in artifacts differentiated Level 2 from overlying Feature 1. Level 2 had a large concentration of glass and contained fragments of a vitrified material identified as residue from firing adobe (see discussion of Architectural Debris in Chapter 6). The soil was darker at the bottom of the level near Feature 6, and charcoal fragments appeared. The level contained a few small rubble (plaster and fired adobe) inclusions.

Level 3. This level consisted of mottled soils that may have been unburned remnants of Feature 6 material. Level 3 appeared directly underneat Feature 6 and above Level 4 and Surface 3 in Units L, E, G, and I. Level 3 appeared in the north of Unit L from 70 to 72 cm below present ground surface, where Surface 3 was absent, and on the south side of Unit I from 36 to 46 cm below grade.

The soil in this level was distinctly mottled and a little moist. It was high in organic content and consisted of humus, manure, and other highly organic constituents. One constituent consisted of unburned, finely ground limestone. What this material was used for is unknown. Charcoal was also present. Very few artifacts were recovered from this stratum.

Level 4. Located in Units A, C, L, E, G, I, and K, this level consisted of trash dump fill apparently associated with Feature 7 and thus possibly dating about 1800. In Units A and C, Level 4 appeared directly below Feature 6 and above Feature 3, the Santa Cruz River terrace cobbles, from 40 to 50 cm below ground surface in the eastern part and 55 to 64-81 cm in the western part. In Units L, E, G, and I, Level 4 appeared directly below Surface 3. In the eastern part of these four units, Level 4 began between 50-72 cm and ended at between 86-92 cm below grade. In the western part, it began between 47-54 cm and ended at 100 cm below ground surface. In these units, the bottom of Level 4 was
the bottom of excavation. In Unit K, Level 4 overlay Feature 7 and began 60 cm below ground surface, varying from 14 to 34 cm in thickness. The level seemed to fade into the Alternating Lime Ash and Soil Lenses appearing in the western part of Unit K.

This stratum became moister with increasing depth, was slightly darker than Level 1 soil, and contained gravel, cobbles (from 5-10 cm in diameter), and some clay. It was poorly consolidated and in Unit G had a slightly reddish cast probably due to eroding fired adobe fragments. Level 4 was distinguished by a definite drop in architectural debris, especially compared to Feature 1, and a rise in artifactual material. The quantity of architectural debris in Level 4 increased from Unit L through Units E, G, I, and K, and two whole floor bricks without any adhering lime mortar were recovered from Unit E. Some pieces of copper and gypsum appeared, and the level had a high density of bone. In Unit K, Level 4 contained some material from the Disturbance Pit noted on the south wall.

Feature 1. This area of trash dump fill appeared in Units A, C, L, E, G, I, and K, where it lensed out. The feature consisted mostly of architectural debris and, partly on the basis of its stratigraphic position in relation to other architectural debris deposits, it probably dates from the 1920's and later. In Units A and C, Feature 1 extended from 4 to 32 cm below grade. In Unit L, Feature 1 extended from 2-28 cm to 50 cm beneath the asphalt visitor trail. In the southern part of Units E, G, I, and K, the feature extended from the ground surface to 2-32 cm. In the northern part of these units, it began between 2-14 cm below grade and ended between 10-40 cm below grade. The appearance of Feature 1 at the present ground surface in Units E, G, I, and K is probably the result of regrading activity that removed Level 1 in this area.

The soil of Feature 1 was moister than Level 1 soil. The soil had a slightly reddish appearance, probably due to eroding fired adobe, and became darker with depth, apparently due to increased moisture, humus, and/or cultural debris. Feature 1 had a very high density of architectural debris (including fired adobe residue) and a fairly low density of artifacts, although the amount of artifactual material increased from west to east. There was a large quantity of nonindigenous artifacts, especially metal, and significantly fewer indigenous materials. Whole fired adobes with lime mortar were recovered from Feature 1 in Unit E.
Feature 6. Located in Units A, C, L, E, G, and K, directly beneath Level 2, this feature was an easily discernible deposit of charcoal and ash (Fig. 19). In the east, it was thin, appearing from 34 to 37 cm below grade in Unit A. The feature thickened toward the west; in Unit I it was 46 cm thick and appeared from 34 to 80 cm below grade. In Units A and C, the feature was very evident on the south wall, and in the other units, it appeared more distinct in the southern than in the northern part. Feature 6 directly overlay Level 3 and Surface 3 in Units L, E, G, I, and K and may be associated with them.

This feature consisted primarily of alternating black to gray to white ash and charcoal layers of various thicknesses. The white ash consisted of both plaster (lime) and organic ash. The density of cultural material was quite low. Some fused material was present but could not be identified as resulting from ore processing or firing adobes. In Unit G, the artifact density dropped, and some eroding plaster fragments were associated with the feature.

Feature 7. This trash pit fill deposit appeared in Units I, K, J, and H. It is very large, consisting of a pit and its trash fill (Fig. 20). The pit was intentionally dug into the Basal Level and subsequently filled with a large quantity of architectural and artifactual debris. It was then overlain by a series of strata. Feature 7 apparently dates about 1800.

This feature began in Unit I as a fired adobe and plaster lens underlying Level 4 and continued into Unit H where it almost appeared at the ground surface. In Unit I, Feature 7 appeared 100 cm beneath present ground surface in the area where Feature 3, the Santa Cruz River terrace cobbles, disappeared. In Unit H, the architectural rubble on top of Feature 7 appeared 8 cm below grade, and the feature extended to a depth of 82-120 cm, the bottom of excavation. In all units where it appeared, Feature 7 overlay the Basal Level and underlay the Alternating Lime Ash and Soil Lenses.

Feature 7 consisted of loose, unconsolidated fill. The soil had a slightly reddish tint, presumably due to eroding fragments of fired adobe. In Unit K, Feature 7 had a high concentration of indigenous ceramics and bone in a matrix of charcoal, indicating a heavy burn not completely oxidized. The feature increased in size toward the west. In
Fig. 19: Feature 6 (Area I [Trench A]).

Fig. 20: Feature 7 (Area I [Trench A]).
Unit J, the amount of rocks and architectural debris increased until in Unit H large boulders appeared (as large as 50 cm long x 33 cm wide x 23 cm thick). Also beginning in Unit J, whole pieces of fired adobe appeared, many lying on top of the feature. These bricks (cornice bricks) were all badly warped and misfired, and none had any adhering lime mortar. Copper-bearing ore and vitrified material from firing adobe were recovered.

Feature 7 had equally high densities of architectural debris and artifacts (Table 2). The artifacts recovered were primarily indigenous and included a large amount of bone. The rocks and cobbles in Feature 7 were mostly broken, and the limestone rocks that appeared in Feature 4, Feature 5, and Level 1, also appeared in Feature 7.

Feature 8. This feature, an intrusive pit or trench, first appeared at the western edge of Unit C and was fully exposed in the eastern half of Unit L. Feature 8 is presumed to have been dug from either Level 1 or Feature 1 and, based on its shape and appearance on both the north and south faces of Unit L, it was probably a trench. It dates from the 20th century.

The boundaries of Feature 8 were somewhat obscured by the disturbance resulting from the installation of the overlying visitor trail. It was lower in the north, ending 98 cm below grade. In the south, the bottom of Feature 8 was 74 cm below the ground surface. At its widest extent the feature measured 75 cm. The soil was loose and contained much architectural debris and few artifacts.

Surface 3. This hard-packed use area surface appeared in Units L, E, G, I, and K where it directly underlay and was associated with Level 3 and Feature 6. Surface 3 first appeared in the southwest half of Unit L, overlying Level 4. It appeared in Unit E but was only present in the southeast corner of Unit G. The surface appeared again in Unit I, overlying Level 4. In Unit K, a surface presumed to be Surface 3 appeared above fill that was similar to Level 2. However, another surface also appeared below this fill, and the relationship between the two could not be determined. The surface appeared from 62-69 cm beneath the ground surface, directly below Level 3 in Unit L, and disappeared in the east end of Unit K at 41 cm below grade. The second surface in Unit K was destroyed by the Disturbance Pit. This surface appeared at 50 cm below ground surface in the east and ended at a depth of 30 cm in the west.
Surface 3 was a hard, uneven, light gray pock-marked area of compact soil. Virtually no cultural material was recovered. In Units L and E, the surface contained small inclusions of fired adobe and plaster fragments and, in Unit K, it yielded some bits of bone and nonindigenous ceramics.

Alternating Lime Ash and Soil Lenses. This area of sheet trash, postdating Feature 7 and predating Feature 6, was not assigned a numerical designation, because it was not detected until Trench A profiles were drawn (Fig. 21). The lenses appear in Units I, J, K, and H, directly overlying Feature 7. They began in the west end of Unit I and extended from 55 to 80 cm beneath the grade. In the eastern part of Unit H, the strata actually appeared on the ground surface. It is presumed that the lenses in these units have been removed by regrading. Only the major lenses were recorded in the profiles.

The soil was loose and became darker with depth as bits of charcoal began to appear. Rodent activity was very heavy in this area. The white ash lenses are lime plaster. The majority of artifacts recovered were nonindigenous.

Disturbance Pit. This intrusive feature appeared in Unit K and was not assigned a numerical designation because it was not detected until Unit K profiles were drawn. It dates from the twentieth century and was probably dug from Level 1 or Feature 1. It could be associated with Pinkley, Beaubien, or Boundey's activities. The pit appeared only on the south face of Unit K and extended from the present ground surface to a maximum depth of 68 cm. Its maximum horizontal extent was 144 cm. The relationship of this feature to surrounding strata is not completely clear. In Unit I, Feature 1 seemed to overlie it. However, the upper strata, Feature 1, and Level 1, as well as the Disturbance Pit itself, have been altered presumably by regrading activity.

Area II

Summary
Trench A: Units H (west half), F, D, and B.

Trench B: Units M through U. All units are 1 m x 2 m except B (1 m x 1.5 m) and U (1 m x 0.45 m x 1 m x 0.65 m x 1.15 m). Includes Levels 1 and 5-14, Features 2 and 9-12, and Surfaces 1 and 2.
Most Area II deposits are alluvial. A natural water channel or some other man-made water control feature may have been located in the vicinity, or water from periodic flooding may have simply accumulated in this area. A subsurface investigation associated with the mission's monitoring project apparently indicates that an arroyo or drainage may extend under the church from the structure's southwest corner to the northeast (Crosby 1978:68). Area II deposits date from Tumacacori's early mission horizon.

Description of Area II Deposits and Features

Level 1. Discussed previously.

Level 5. This layer of sandy fill appeared in Units H, F, and D where it overlay Surface 2. Based on its stratigraphic position, it probably dates from about 1750 to about 1800. The level begins in Unit H as a sandy layer, 38 cm below ground surface, underlying Surface 1 and overlying Surface 2. In Unit F, it appeared from 22 to 34 cm below ground surface. In the western part of Unit F between Features 4 and 5, Level 6 began to lens in above Level 5. In Unit D where Feature 2 appeared above Surface 2, apparently Level 5 disappeared. This level predates Feature 7.

Level 5 is alluvial and contained almost no cultural material. Some residue from firing adobe was present. In Unit H, a lens of small rocks/gravel appeared.

Level 6. This rather confusing layer of gravelly fill overlying alluvial deposits appeared in Units D, B, and U under Surface 1 and Level 1 and above Feature 2 and in Units T and S above Level 7. Level 6 may actually be two or more depositional events. The elimination of overlying deposits because of regrading and construction of the visitor trail has prevented identification of its position in the depositional sequence and has hampered interpretation of the level.

In Unit D, it first appeared at a depth of 26 cm. The level got thicker in Units B and U, appearing from 15-25 cm to 22-38 cm beneath the ground surface. In Unit T, Level 6 included all the fill beneath Level 1 and the asphalt visitor trail and above Level 7. It appeared from 4 cm to 26 cm below grade. In the southeastern part of Unit T, Level 8 began to lens in above Level 6. In the south half of Unit S,
the top of Level 6 varied from 10-20 cm below grade, and the bottom varied from 30-36 cm beneath the ground surface. In the north half of that unit, the top of Level 6 appeared from 24-36 cm below grade. Level 6 extended from 30 to 46 cm below grade in this area.

This level was darker than Level 1 or Level 5 and, in Units D and B, contained some small gravel pockets. In Units T and S, the soil, though still gravelly, also contained some sand.

Level 7. Appearing in Units B, U, T, and S, Level 7 consisted of alluvial deposits overlying the Basal Level. We apparently hit the western edge of Level 7 during this excavation and presume that most of the stratum lies east of Units T and S. It is, therefore, difficult to interpret the level. It may be an acequia or the edge of a large borrow pit or other depression into which water puddled or ran. Also, it may be part of the possible arroyo or drainage under the church (Crosby 1978:68). Level 7 predates Feature 7.

This stratum included the depression and fill visible in Unit B and the alluvial soils surrounding Feature 12 in Unit U. In Units T and S, Level 7 began as a hard, curved, waterlain "surface" and extended to the bottom of the excavation in the eastern part of these units. In Unit B, Level 7 underlay Feature 2 and began at a depth of 25-42 cm. At its maximum depth in Unit B, it varied from 81-114 cm. Level 7 increased in depth from north to south. It appeared in Unit U below Surface 2 and above the Basal Level from 40 to 58-72 cm below grade. It was interrupted by both Feature 12 and a posthole in this unit. In Units T and S, the top of Level 7 consisted of a hard, curved, waterlain surface that may be an extension of Feature 12. The top of the level appeared 24 cm below grade in Unit T and 24 cm below in the western part and 48 cm below grade in the eastern part of Unit S. (It had an eastern downslope.) The bottom of Level 7 was 1 m below grade in the eastern part of Units T and S and 40 cm below grade in the western part of these units.

In Units B and U, Level 7 consisted of a fairly light brown soil that initially was hard and then became lighter and softer with depth. The soil was slightly laminated and contained some gravel lenses. In these units, Level 7 contained mostly bone; a virtually complete, fully articulated dog skeleton was recovered from the depression in Unit B.
(Fig. 13). In Units T and S, Level 7 was composed of a very compact, darker brown soil. Many alluvial deposits such as hard, compact surfaces and sand and gravel lenses appeared in the eastern part of these units. Also, some of the sandy lenses in Unit T were deposited by wind. At least two distinct surfaces and several less definite ones appeared in Level 7. The relationship of these surfaces to Surface 2 could not be determined. Little cultural material was recovered from the level in Units T and S. The above description indicates that Level 7 may actually be two or more separate deposits; however, the level's confusing nature prevented distinction of more than one stratum.

Level 8. This level, containing charcoal and ash lenses, was located in Units T and S, overlying Level 6. Level 8 first appeared in Unit T where it lensed in above Level 6. It extended from the top of the ground underneath the visitor trail in Unit T to a maximum depth of 30-34 cm in Unit S.

Level 8 had two areas of charcoal and ash. The area in the south part of Unit S was associated with indigenous sherds in situ and may have been a postoccupational dump, campsite, or even a burned structure. This ash and charcoal area was located 10 cm beneath the ground surface. The second charcoal and ash area was located in the north half of Unit S at 30-34 cm below grade. This area yielded some burned bone and was thicker in the north part than in the south. It is probable that these two areas are the same or are contemporary; however, their relationship could not be determined given the limited extent of the excavation and the disturbance.

The charcoal and ash deposit(s) postdate Level 6, but their relationship to other levels could not be determined. Levels 6, 7, and 8 were interrupted by Feature 11, which obscured the relationship between these three levels, especially in Unit R just north of Feature 11. Other problems included the difference between the west and east wall profiles in this area and the laying of the asphalt visitor trail that has disturbed or removed the overlying deposits. On the east face of Units R and Q, inversion of deposits may have resulted when the visitor trail was laid. Level 6 may be the gravelly deposit that extended from 20 to 30 cm below ground surface, and Level 8 may be the sandier deposit appearing just below from 30 to 40 cm below grade. In Units Q and R, these two deposits were overlain by Level 10.
Level 9. This deposit of disturbance fill appeared directly beneath the visitor trail in Units R, Q, and P and on the western face of Units S and T. It is a recent (twentieth century) deposit associated with visitor trail construction. It consisted of very hard, laminated soil from 3 to 8 cm thick. In Units P and Q, Level 9 was underlain by a thin cement layer 2 cm thick. The hardness and laminated nature of the level is presumed to have been the result of tamping the ground, probably with a hand tamper, to prevent settling of the visitor trail.

Level 10. Appearing in Units P, Q, and R, this level underlay Level 9 in Units Q and R and included the fill of what was apparently a pothole, visible in the west wall profile of Unit Q. This apparent pothole is probably recent (twentieth century) and could be the result of activity by Pinkley, Beaubien, Boundey, or some pothunter, or it could be an abandoned trench, originally intended for water pipe and electrical lines. In the western part of Unit R, it extended from 12 cm to a depth of 72 cm (the bottom of the depression in this area). Although Level 10 appeared through all of Unit R, its boundaries were not distinguishable in the east wall profile. This situation could be due to the disturbance caused by the posthole in this area, or it could be that the depression did not extend to the east side of the unit. In the eastern part of Unit R, Level 10 extended from 10 cm to 40 cm below grade. The horizontal extent of Level 10 ended in Unit P, just north of the visitor trail boundary brick in the western part of the unit and apparently at the boundary brick in the east.

This level was divided into two parts. The upper layer, Level 10a, was a light-colored, nonalluvial deposit containing some gravel and small rocks as well as some eroded plaster and fired adobe inclusions. Its deposition may be associated with the construction of the visitor trail. It is presumed to have been sheet trash or fill. Level 10b, the lower level, was a darker, laminated deposit that had a reddish cast when wet. On the west face of the trench, Level 10b consisted of a depression. The east face profile showed only the bottom layers of the deposit. It contained virtually no cultural material. Level 10b was alluvial and may have been either an area of intrasite water-associated activity or an area that stood open for a period of time.
Level 11. Beginning in Units R and Q, where it was interrupted in the western part by the depression containing Level 10, this level extended across Units P, O, N, and M, where it was cut by Feature 10. Apparently Level 11 is one of the oldest deposits of the excavated area and may date as early as ca 1750 (Fig. 21). The level extended from about 45 cm to 70 cm below grade. Level 11, trash dump fill, consisted of much charcoal and ash. The ash is probably from a wood fire.

This nonalluvial level was divided into two layers. Level 11a, the upper layer, varied in thickness from 4 to 10 cm. It consisted of alternating microstrata of light mottled soils. Lenses of reddish-brown, silty, sandy soil appeared in the level's northern extent. The charcoal inclusions that began to appear in this level were very uniform and gave the matrix its dark appearance. Level 11a contained mostly indigenous ceramics and stone artifacts. Level 11b underlay Level 11a and consisted of ashy-gray and black lenses, including a thick (4 cm) charcoal layer. This layer was trashy and unconsolidated. In Unit 0, a lens of red-brown soil, possibly burned earth, appeared beneath the thick charcoal layer. A lot of bone was recovered from Level 11b.

Level 12. Located in Units P, O, N, and M, where it was cut by Feature 10, this level of trash dump fill overlay Level 11. The level extended from 30 cm to 45 cm below grade. Level 12 was laminated, but we could not determine whether the deposit was alluvial or perhaps simply compacted from heavy equipment used during stabilization activities in this area. The level contained some small cobbles, large pieces of architectural debris (fragments of fired adobe, lime plaster, and mortar) and mostly indigenous ceramics and bone, in contrast to the overlying Level 13 that contained architectural debris and mostly nonindigenous artifacts.

Level 13. Also a layer of trash dump fill, Level 13 appeared in Units P, O, N, and M, where it seemed to be overlain by Feature 10a material. Level 13 may just predate Feature 10a and probably dates from the 1920s. In the western part of the units, the level extended from 10 cm to 32 cm beneath the ground surface and in the eastern part from 4 cm to 26 cm. Level 13 was generally hard-packed and had some lamination that could have been the result of alluvial activity or the use of heavy equipment during stabilization. It contained some small cobbles (less
Fig. 21: Level 11 (Area I [Trench A]).
than 10 cm in diameter) and had a slightly reddish cast, probably resulting from eroding fired adobe fragments. A high density of architectural debris and nonindigenous artifacts was found in this level. A lens of artifacts consisting mostly of glass appeared in the western part of Unit N 8 cm below grade, between Levels 1 and 13. It is possible that this lens may be the edge of a recent (1920's) trash dump located west of our excavation.

Level 14. This exploratory level was located in Unit M under Feature 9. It extended from 165 cm to 225 cm below grade and was dug because a deposit of ash, charcoal, and burned cultural debris appeared beneath Feature 9 where we had expected to find the Basal Level. Level 14 excavation consisted of an exploratory pit dug into the trashy area below Feature 9 until the Basal Level, here consisting of red clay, was reached. The horizontal extent of Level 14 is unknown but is extrapolated on the profiles. This level may be associated with the construction of the Franciscan church, which began in the 1797-1802 period.

The matrix of Level 14 contained charcoal flecks and burned rocks. The presence of silts indicates some alluvial deposition. Level 14 contained indigenous artifacts, most of them burned. A burned metate fragment was recovered.

Level 14 may be associated with Feature 9, an alluvial deposit, the two actually forming a trench or pit that may have been dug from either the top of the Basal Level or Level 11. Alternatively, the hole could have been dug from Levels 12, 13, or 1. However, given the very different nature of the deposits in Features 9 and 10, this possibility is not considered to have been likely. The trench or pit represented by Level 14 and Feature 9 seems to have been dug intentionally and then filled with trash. Therefore, it may be a trash pit or it may be an extension of the church and/or boundary wall foundation trenches.

Feature 2. This layer of compact, waterlain soil and associated alluvial deposits of fine sand appeared in Units B and D, apparently associated with the Level 7 depression where the articulated dog skeleton was found (Fig. 22). Feature 2 is apparently contemporary with or just predates Level 7, and thus dates from about 1800 and earlier. The feature first appeared in Unit D, from 20 to 25 cm beneath the ground surface, overlying Level 5. Its depth below grade increased from east
to west in contrast to the western upslope of the other deposits in this area. In Unit B, Feature 2 directly overlay Surface 2 as Level 5 lensed out. Feature 2 disappeared in about the middle of Unit B at a depth of 40 cm. However, a deposit similar to Feature 2 was seen in Level 7 (Unit T), extending from 36 to 62 cm below grade. This deposit was not detected until Trench B was profiled. Feature 2 and Surface 2 are associated and are probably contemporary. Level 5 was located between the two deposits in Unit D, but lensed out in Unit B. Feature 2 directly overlay Surface 2.

Feature 2 was 3 cm thick, compact, hard, and laminated. In the west half of Unit D, it overlay a gravel lens, and in the east half of Unit B, it overlay a laminated ash lens. Only bone was recovered from this feature in Unit B.
Feature 4. Located in Unit D, this intrusive trench began in Level 1 and extended to the Basal Level at the bottom of excavation, 85-92 cm beneath the ground surface. Its maximum width was 44 cm, and it was wider in the north than in the south. Feature 4 is the result of 20th century activity. The fill was similar to Level 1 fill, although the soil was a little darker and moister. Its most distinctive constituent was a large quantity of limestone rocks.

Feature 5. This intrusive pit, also the result of 20th century activity, was located in Unit F. It extended from Level 1, to Surface 2 in the south, 40 cm below grade, and below Surface 2 in the north, 71 cm below grade. The southern boundary of the feature is in the southern part of Unit F. Its extent to the north of Unit F is not known; however, the feature seems to have been a hole rather than a trench. The maximum width of Feature 5 was 1 m.

The fill was similar to Level 1 but darker and moister. The limestone, so common in Feature 4's fill, also appeared in Feature 5 but in less quantity. The stratigraphic position of the two features and their similar fill indicate that they are probably related and contemporary.

Feature 9. This feature was a series of laminated, almost certainly alluvial deposits, filling a trench or pit. Feature 9 may be associated with Level 11 and may date to the construction of the Franciscan church about 1800. The feature first appeared in the western part of Unit M from 115-125 cm beneath the ground surface and on the eastern part at about 90 cm below grade. Its maximum depth was 172 cm beneath the ground surface, and its maximum horizontal extent was 173 cm. Feature 9 was larger in the east.

The laminated fill consisted of moist soil containing some gravels. The top of Feature 9 consisted of a waterlain surface, similar to Feature 2, composed of silt and coarse sand and containing indigenous artifacts (especially sherds) and burned bone. At least two other waterlain layers similar to Feature 2 appeared within Feature 9. This feature also contained architectural debris (fragments of fired adobe, lime plaster, and mortar) concentrated in its western part.

Feature 10. Located in Unit M just south of the Franciscan church's southwest corner, Feature 10 overlies Feature 9 and may date from the 1920's. It may be associated with Level 13. The feature con-
tains architectural debris and apparently is an intentionally dug pit. It may be the reexcavation of an older trash pit (Feature 9). In the eastern part of Unit M, Feature 10 extended from 10 to 90 cm below grade. In the western part of the unit, it extended from 38 to 115-125 cm. Its maximum horizontal extent was 200 cm.

Feature 10 was divided into two layers: Feature 10a and Feature 10b. The boundary between the two levels was defined at a line of large chunks of architectural debris particularly distinctive in the west wall profile. In the western face, this line appeared 85 cm below grade; on the east, it appeared at a depth of 80 cm. This boundary line was much less obvious in the feature's east face because of the obscuring sand fill deposited as part of the 1970 stabilization project. The major difference between Features 10a and 10b was the size of the architectural debris, i.e., Feature 10a contained large pieces of fired adobe with adhering lime mortar and plaster fragments. Two whole cornice bricks mortared together were recovered from Feature 10a. The boards shown in Figure 24 were placed in the feature during excavation to shore up the area where the cornice bricks were removed. Architectural debris in Feature 10b consisted of distinctly smaller fragments.

Feature 10 is an enigmatic area. Features 10a and b seem to be two separate trash pit fill deposits. The whole fired adobe with adhering mortar is similar to the kind of architectural debris that was found in Feature 1, suggesting that the two are contemporary. A photograph in Mayer et al. (1971:117) shows a portion of Feature 10. He identifies the feature as "wall fall," and reportedly removed a number of whole fired adobes for use in reconstructing part of the church's south wall. Although Feature 10 could be wall fall, the lack of a footing, the unconsolidated and trashy nature of the fill, and the recovery of two whole cornice bricks from Feature 10a make that identification unlikely. However, the feature could have contained wall fall.

Feature 11. Located in the south half of Unit R, this trench contained the monument's water main and some electrical lines. This water main was installed in 1968 (Joseph Sewell: personal communication). Feature 11 was 95 cm wide and extended 70 cm from the ground surface below the asphalt visitor trail to the top of the water main. The copper electrical wires were 19 cm below grade. Excavation of Feature 11
was halted when the top of the water main was partly exposed. Therefore, the entire feature was not excavated. Unfortunately, Feature 11 obscured the transition between the alluvial deposits in the south of Area II and the nonalluvial, culture-bearing deposits to the north.

Feature 12. This depression containing alluvial deposits was located in Unit U, visible in the south wall profile, and may be either a cultural or natural feature, although its location with respect to Level 7 indicates it is probably cultural (Fig. 14). It is probably contemporary with or just postdates Level 7, thus dating before 1800. Feature 12 may be a ditch or acequia, or it could be associated with the possible drainage or arroyo under the church (Crosby 1978:68). The feature extended from 36 to 66 cm below grade and had a maximum width of 65 cm.

The feature consisted mostly of loose, rocky, laminated soil layers interspersed with layers of harder, compact soil. A hard, sandy layer appeared at the bottom of Feature 12, possibly associated with the sand overlying Surface 2. A hard, surface-like layer also appeared on top of the feature, and it may or may not be associated with Surface 2 or Feature 12. Surface 2 is definitely interrupted by Feature 12, and it may be that it and the hard layer overlying Feature 12 are contemporary. Very little cultural material was recovered.

Surface 1. This hard, compact, use-area surface appeared in Units H and F and seems to be in line with the fired adobe overlying Feature 7. Thus, Surface 1 and Feature 7 may be associated. The surface first appeared in the western third of Unit H at a depth of 20 cm. In Unit F, it was destroyed by Feature 5 and did not appear again west of that feature in the northern part of the unit. In the southern part of Unit F, it appeared west of Feature 5 for 14 cm before it disappeared at a depth of 24 cm. Surface 1 did not appear in Unit D.

Surface 2. This use-area surface appears in all Area II units except N and M. In most of Area II, it forms the boundary between the Basal Level and the overlying cultural deposits. It predates Feature 7 (thought to date about 1800) and presumably appeared in Area I until destroyed by that feature. The stratigraphy in Unit P (see Fig. 17 detail) indicates that Surface 2 is contemporary with or just postdates Level 11, thought to date between ca 1750 and ca 1800.
Surface 2 first appeared in the western third of Unit H at 36 cm below grade. In the southern part of Unit B, the surface became faint and virtually indistinguishable. It was destroyed by the Level 7 depression in Unit B but appeared in Unit U, just east of Feature 12, at a depth of 37 cm. The surface is discernible in the western face of Units T and S at 45 cm below grade. It was destroyed by Feature 11 in Unit R. Presumably, Surface 2 is one of the many alluvial surfaces that appeared in the eastern part of Units T and S, but it was not specifically identifiable. Only a remnant of the surface appeared in the western part of Unit R, at 35 cm below grade, and it then disappeared. In the eastern part of Unit R, north of Feature 11, Surface 2 appeared at 50 cm below grade. It continued in Units Q and P, overlying the Basal Level until it disappeared in Unit P at a depth of 40 cm.

Surface 2 was a very hard, compact, distinctively pock-marked, and finely laminated alluvial deposit clearly associated with other alluvial deposits. In Units H, F, and D, it was overlain by fine alluvial sand, and it is apparently associated with Level 7 in Units T and S. Surface 2 contained some bone and indigenous ceramics.

Area III

Summary.

Trench C.

Includes Levels 1, 15, and 17 through 20; Features 14 through 16 and Disturbance Fill.

Area III is related to Area IV in that both areas are directly associated with structures, but is discussed separately because the church walls remained after the transept walls (Area IV) were torn down, before the church was first used. As a result, the activity in the area adjacent to the church was expected to have differed from that in the area of the transept wall foundations. For example, in Area III we found more evidence of construction activity than in Area IV since the church nave walls required periodic maintenance. This area consists of Trench C, excavated adjacent to the church's west nave wall. The stratigraphy and associated features in Area III are related to the construction, maintenance, and erosion of the west nave and transept walls.
Only profiles of the west face of Trench C were drawn. Notes were taken of the stratigraphy and associated features on the east face and are summarized here. Deposit identification and dating is tentative since no artifactual material was recovered. The dates suggested are based on observation of the deposit's contents and their stratigraphic positions in relation to each other and to Area II and Area IV deposits.

Trench C was badly disturbed. Only the north and south ends of the trench contained what are apparently undisturbed deposits. North of Feature 14 (see Fig. 18), the wall sloughed off, apparently due not only to previous disturbance but also to heavy rodent and root activity. Stratigraphic relationships in this area were very unclear and, as depicted on the profiles, must be considered to be apparent and not definite.

Description of Area III Deposits and Features

Level 1. Previously described.

Level 15. Varying in initial appearance from 20-25 cm below grade, this level extended to a depth varying from 40-60 cm. The matrix of Level 15 was a light tan soil and contained fragments of architectural debris (fired adobe, pieces of lime plaster, and mortar). The soil's light color is probably due to the bits of lime plaster in the layer as well as to leaching of the thin lens of lime plaster located between Levels 1 and 15.

Level 15 is probably the result of twentieth century activity. The plaster layer may be associated with 1970 church wall repair (Mayer 1971:7). Regrading activities during the 1930's also may have affected the level. During that time it was common practice to raise the grade around adobe structures about 2 ft. and provide a downslope away from the walls for a distance of 20 to 25 ft. to draw rainwater runoff away from the walls (George Chambers: personal communication).

Based on a similarity of position in relation to the rest of the stratigraphy as well as a similarity of physical characteristics and content, this level and Level 15 of Area IV are probably the same.

Level 17. This dark layer overlay an ashy gray deposit, Level 19. The top of Level 17 varied from 40-60 cm beneath ground surface, and except where Level 18 appeared, it extended to a depth of 75 cm. This
level consisted of very dark soil. The dark color was first thought to be due to charcoal. However, the paucity of charcoal fragments and the fact that the soil did not react when tested with a 10 percent solution of hydrochloric acid suggests that Level 17 may be a layer of adobe melt from erosion of the adjacent west nave wall, made of unfired adobes.

Level 18. This level, apparently consisting of trash dump fill, first appeared 1.6 m north of Feature 14. Its relationship to other stratigraphic units in the south part of Trench C is obscured by extensive rodent and root activity. However, Level 18 may be associated with Level 20. Levels 18 and 20 were designated as two separate deposits because Level 19 appeared between them along most of the extent of Trench C. However, at the southern end of Trench C, south of the adobe chunk exposed during excavation, Level 19 did not appear. Although level 20 in this area seemed to be similar to Level 18, the 50 cm or so of Level 18 in the north part of Trench C lay between Levels 17 and 19. Therefore, Levels 18 and 20 were also designated as two separate deposits. Level 18 appeared 55 cm below grade and extended to a depth of 75 cm. Level 18 matrix was a light soil that reacted to a 10 percent hydrochloric acid solution and was distinguished by its relatively high bone content compared with that observed in the other stratigraphic units of Trench C.

Level 19. This layer of laminated gray, ashy soil, varying from 2 to 5 cm thick, appeared north of the adobe chunk. Initially located between Levels 17 and 20 north of Feature 14, Level 19 appeared between Levels 18 and 20 south of that feature, at a depth of 70 cm. Level 19 reacted strongly to a 10 percent hydrochloric acid solution, indicating it may have been a layer of lime plaster washed off of the west nave wall of the church.

Level 20. Appearing 75 cm below grade, this level overlay the Basal Level in Trench C, where it extended to a depth varying from 80-130 cm below grade. Level 20 matrix was a dark, gravelly soil containing charcoal, bone and fired adobe fragments. This level also showed heavy rodent and root activity causing the soil to be mottled.

Feature 13. Apparently a trench, this feature contained a cultural mix consisting mostly of architectural debris (fired adobe and lime mortar). Its precise relationship to Level 1 and other upper stratigraphic
units was obscured by the 1970 stabilization activities. Feature 13 extended to a depth of 1 m below grade and had a maximum width of 45 cm. Its position, adjacent to the north side of the north transept wall, and its relationship to the other Area III deposits indicates it probably dates from Beaubien's investigations of Tumacacori in the 1930's at which time he trenchd around the transept walls (Beaubien n.d.:8-9).

Feature 14. Located in the southern end of Trench C, this disturbance pit or trench contained Level 1 or Level 15 fill and may be the result of Beaubien's 1934-1935 excavation during which Room 18 was dug (Shenk 1976:88; Beaubien n.d.:8-9) or it may be due to later work done in this area. The feature extended to a depth of 1 m and had a maximum width of 110 cm.

Feature 15. This feature consisted of the north and south foundations of the west nave transept. In 1970, Mayer cut through the transept wall foundations, removing the part that intervened between the west wall of Trench C and the buttress (Mayer et al. 1971:114). The foundations extend underneath the concrete plastered buttress of the church's west nave wall. They are constructed of large to medium-sized waterworn boulders virtually identical to those found in Feature 7, cemented together by a soil mortar. There were no remains of the adobe wall. The south transept wall foundation (1.78 m wide) began 13.3 m from the southwest corner of the church, and the north foundation (1.64 m wide) began 20.9 m from that point. On the south side of the south transept wall near the wall's base was rubble fill, possibly associated with the original excavation of the foundations. The relationship of the stratigraphic units and features in this area is very unclear because of extensive rodent and root activity and sand fill that we could not remove due to the unstable condition of the trench walls.

Both the south and north sides of the two transept wall foundations had pieces of plaster presumably dating from the original plastering of the church (Tony Crosby: personal communication). The plaster fragment on the north side of the north transept wall was decorated with pieces of red and black material (fragments of fired adobe). This same decorative technique appears in areas of original plaster still present on the south sacristy wall. It is interesting to note that the bottom of the plaster fragments curved out slightly from the foundations (Fig. 23).
This curve is presumed to have resulted from plastering the walls upward from the base of the foundation and ground surface, indicating the presumed ground surface at the time the church was first plastered (Tony Crosby: personal communication). Plaster fragments also appeared on the north side of the north transept wall foundations underneath the buttress, indicating that the buttress was a later edition, added after the transept walls were torn down. During this excavation, we did not completely excavate the transept wall foundations, and their complete depth below ground surface in this area is not known.

Disturbance Fill. The ground between the north and south transept wall foundations was completely churned and mixed resulting from excavation of this area (Room 18) by Beaubien in 1934-35 (Beaubien n.d.:8-9).
Feature 16. This feature was a relatively small pit filled with architectural debris (fired adobe fragments, pieces of plaster, and mortar). It appeared 20-40 cm below grade in the area of Disturbance Fill between the two transept wall foundations. The feature's maximum width was 140 cm.

Deposits and Features Beneath the West Nave Wall Buttress. Some stratigraphy did appear directly beneath the buttress, but its rather obscure nature, its separation from the stratigraphy on Trench C's west face as well as time and budget constraints, led to the decision not to draw profiles. However, a description of the observed deposits appears below.

Mayer's 1970 stabilization activities included plastering the buttress with cement (Mayer et al. 1971:118). Its construction and composition cannot now be observed. North 11.38 m from the church's southwest corner, the soil directly underneath the buttress was very hard and varied in thickness from 5 to 15 cm. Underneath this hard layer, the soil was soft and mixed with pieces of charcoal. Beneath this soft layer was a lime ash and charcoal lens 3 cm thick. The hard soil layer may have been adobe melt, and the lime ash lens may have been lime plaster that was washed off the walls. North 1.3 m from the church's southwest corner was what appeared to be a trash pit dug into the Basal Level. Fill was soft and trashy and contained bone and sherds. Apparently, this feature extended beneath the buttress, but its complete extent is not known.

From 11.38 m north (from the southwest corner of the church) to just south of the south transept wall foundation, the lime ash layer appeared directly beneath the buttress. Between the ash and the Basal Level, the soil was soft and contained charcoal. The lime ash layer disappeared just south of the south transept foundation. Another lime ash layer (a plaster lens) was associated with the south transept foundation's south face. However, comparison of its position to the bottom of the plaster on the west part of the transept's south face indicated that the lens, which appears above the plaster, is too high to represent the mission's original ground surface.

The soil directly beneath the buttress between the two transept foundations was hard. Below this hard soil was a layer of soft soil
that contained fragments of charcoal, bone, and sherds, as well as the first lime ash layer, mentioned above. This ash layer, which overlay the Basal Level, was less distinctive, presumably because this area was once enclosed by the transepts. Both manure-tempered and non-manure-tempered Piman plainware sherds were found.

North of the north transept wall foundation, the deposits differed from those south of that structure. The soil contained gravels and cobbles, and the hard stratum and ashy layers did not appear. There is some speculation that the area between the transept and the Campo Santo wall was once enclosed and was possibly a room (Shenk 1976:28-29). If so, this could explain the difference in the stratigraphy.

It seems likely that the hard soil appearing beneath the buttress is the same as, or related to, Level 17. The lime ash layer may be the same as or associated with Level 19, and the soft soil containing bone and sherds may be the same as or related to Level 18 or 20. The relationship of this part of Trench C to the southern 6.18 m of the trench is unclear because the two areas were excavated at different times.

Area IV

Summary.

Trench D: Units V (1.45 m x 1.03 m), W (0.75 m x 2.65 m x 0.76 m x 2.35 m), X (0.45 m x 2.35 m).

Includes Levels 1, 15, and 16, Features 13 and 15.

The deposits in this area are associated with the west transept of the Franciscan church. In Area IV, we expected to see construction activity related to building the transepts. However, since they were torn down before the church was used, we did not expect to see as much construction activity as was present in Area III. After the transepts were removed, people going from the south boundary wall gate to the Campo Santo entrance would have passed through this area, and the deposits exposed seem to reflect this sort of amorphous activity. The paucity of artifacts recovered per stratum in Area IV, compared to the quantity per stratum in Areas I and II, also indicates different and possibly less intense activity (less material discarded) here than elsewhere.
Description of Area IV Deposits and Features

Level 1. Discussed previously.

Level 15. Since this level and the upper deposit in Area III seem to be the same, they were both labeled Level 15. Both consist of sheet trash, resulting from twentieth century activities. This level, located in Units V, W, and X, extended from 20 cm to 40 cm below grade. In Unit V, it overlay what apparently was an alluvial deposit consisting of silts and sand, and similar to Area II, Surface 2. In Unit X, an alluvial sand layer underlay this level. Level 15 contained architectural debris (fired adobe with mortar and plaster fragments) and lime ash/plaster lenses in a light gray-brown matrix. Indigenous and nonindigenous artifacts were recovered.

Level 16. Also located in Units V and X, this level consisted of alluvial and nonalluvial deposits below Level 15 and above the Basal Level. Level 16 extended from 40 to 90 cm below grade. The matrix was mottled with white lenses, possibly lime plaster. Small lumps or lenses of a light greenish-yellow material appeared. Two samples of this deposit were taken, and one was identified as organic, possibly composted plant remains; the other was manure. These deposits indicate animal-associated activity. Almost all artifacts recovered from Level 16 were indigenous.

Feature 13. Discussed previously in Area III, this apparent trench contained mainly architectural debris (fired adobe and lime mortar fragments) and probably dates to Beaubien's 1930's excavation. It was this intrusive feature that we followed in Units X and W until we found the transept foundation. The feature appeared from 10 to 80 cm below grade and was 50 cm wide.

Feature 15. This feature is the south face of the southwest corner of the west transept foundation. It consisted of rocks and boulders in soil adobe mortar, identical to that seen in Area III. The foundation was plastered, but no decoration was present. The foundation's top appeared 24 cm below grade.

Depositional History

The study area's depositional history is based on the stratigraphic relationships of deposits, dating of diagnostic artifacts recovered, and
Tumacacori's documentary history. I would like to stress that this sequence is only the apparent or suggested sequence for the tested areas. The extent and relationship of some deposits could not be determined. Twentieth century activity has removed overlying deposits and destroyed other critical areas. For example, none of the deposits could be physically associated with the mission's foundations. Since no records of these destroyed deposits are available, stratigraphic interpretation was greatly hampered. A summary of each area's depositional sequence is presented, followed by a discussion of the time periods and activity the deposits represent.

Area I. Level 4 and Feature 7 are this area's oldest deposits; however, both postdate the oldest deposits of Areas II and III. Overlying deposits in order of decreasing age are the Alternating Lime Ash and Soil Lenses, Level 3, Surface 3 and Feature 6, Level 2, and Level 1. Level 1, Feature 8, and the Disturbance Pit are disturbed areas related to twentieth century activity. Level 4 and Feature 7 seem to be contemporary and associated. Level 3, Surface 2, and Feature 6 also seem to be contemporary and associated.

Area II. Level 11 is Area II's oldest deposit and is also one of the oldest deposits in the whole study area. It predates Level 7, Surface 2, and Features 2 and 12. These four deposits seem to be associated and predate Levels 12 and 5. Level 12 predates Levels 10 and 13. The relationship between Level 13 and Level 10 cannot be determined. Level 5 predates Levels 6 and 8. Level 8 is apparently more recent than Level 6; however, their relationship to Levels 10, 12, and 13 cannot be determined. Unit M deposits at the church's southwest corner in order of decreasing age are Level 14, Feature 9, and Feature 10. Feature 10 is almost certainly contemporary with and related to Level 13. Feature 11, Level 9, and possibly Level 10 are disturbed areas resulting from twentieth century activity.

Area III. Level 20 is Area III's oldest deposit and is one of the oldest deposits in the entire study area. Overlying deposits by decreasing age are Levels 19, 18, 17, 15, and 1. The relationship of Levels 19, 20, and 18 is unclear. Features 14 and 16 and the Disturbance Fill are related to twentieth century activity. Feature 13 also presumably relates to recent activity.
Area IV. The oldest deposit is Level 16; however, its relationship to Levels 11 and 20 could not be determined. Level 16 predates Level 15. Feature 13 presumably relates to twentieth century activity.

The deposits excavated apparently span the entire site occupation period and, therefore, presumably date from as early as 1753. No definitely prehistoric artifacts were found in the excavated areas, indicating that at least these tested areas were not occupied prior to Spanish contact. The excavated deposits were grouped into the following four arbitrary time periods based on documentary history and artifact date ranges as represented by the schematic line graph (Fig. 24): (1) early mission horizon and (2) late mission horizon, both part of the mission period, (3) late nineteenth-early twentieth century, and (4) twentieth century components. The mission period horizons are arbitrary divisions, based on known major construction periods and historical events. The late nineteenth-early twentieth century component reflects a ruins renovation and reuse period, and the twentieth century component reflects a ruins restoration and stabilization period.

There is some overlap of dates of deposits grouped under a particular time period due to the presence of intrusive material. This situation may be attributed to various forms of disturbance at the site. As indicated previously, the site has a long history of pothunter activity, and rodents are an old problem. The use of heavy equipment for construction and ruins stabilization has probably helped accelerate artifact drift.

For ease of discussion, the dates of the four designated time periods are generalized dates of significant historical events. The period of missionary activity lasted from 1753 to 1828, although the mission was not abandoned by its neophyte community until 1848. Since Jesuit and Franciscan periods could not be distinguished because no diagnostic artifacts were found, the mission period is divided into two horizons based on the construction of the Franciscan mission complex. The early mission horizon dates 1750 to 1800, from site occupation to before the Franciscan complex was built. This time period includes both Jesuit and Franciscan missionary activity at Tumacacori. The late mission horizon dates from about 1800 to ca 1850 and later to ca 1900, from construction and use of the Franciscan complex until mission abandonment. Some of
Fig. 24: Provenience Dates Suggested by Artifact Date Ranges.
<table>
<thead>
<tr>
<th>PROVENIENCE</th>
<th>AD 1700</th>
<th>1750</th>
<th>1800</th>
<th>1850</th>
<th>1900</th>
<th>1950</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level IIb</td>
<td></td>
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</tr>
<tr>
<td>Level IIa</td>
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<tr>
<td>Level I2</td>
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<td></td>
</tr>
<tr>
<td>Level 7</td>
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<td>Feature 2</td>
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<tr>
<td>Level 4</td>
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<tr>
<td>Feature 7</td>
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<td></td>
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<tr>
<td>Alternating soil and ash lenses</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Surface 3</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Fig. 24: Provenience Dates Suggested by Artifact Date Ranges.
the deposits grouped under this horizon probably contain material post-dating 1850 since the structures continued to be sporadically occupied and people are known to have passed through and potted in the ruins through the nineteenth century. Because of this post-abandonment activity and for ease of discussion, the late mission horizon deposits are arbitrarily divided into two groups dated ca 1800 and ca 1850 and later, based on deposit artifact density, composition, and date ranges, as well as on stratigraphic position.

The late nineteenth-early twentieth century component consists of one deposit directly underlying a definite twentieth century component deposit. This earlier deposit is related to occupation of the convento recorded in the site's documentary history. Reportedly from 1900 to 1929, part of the convento's southern wing was renovated and used as a schoolhouse with a resident teacher. The twentieth century component consists of deposits containing artifacts definitely dating from this time and that an almost certainly related to the major stabilization and restoration activities begun with Frank Pinkley's work in 1918 and continuing to the present. Since the establishment of a resident ranger in 1929 and the construction of the Visitor Center in the 1930's, access to the site has been controlled. Some deposits could not be attributed to any one of the above four time periods because their position in the stratigraphic sequence could not be determined, and/or their artifacts did not provide diagnostic date ranges. These deposits, Levels 6, 8, 10, 16, and 18, are not discussed below. Also, Level 1 and the Basal Level were discussed previously in the deposit description section and are not discussed here.

Early mission horizon deposits are Levels 5, 7, 11, 12, and 20, Features 2 and 12, and Surface 2. Level 11 and the lower stratum of Level 20 are the oldest deposits in the excavated area and may be contemporary or the same deposit, as suggested by extrapolating a line through Feature 10 connecting the two deposits (Fig. 17).

Level 20 appeared to consist of two depositional events, indicated by a slight change in soil color. However, since we did not excavate this stratum or recover cultural material (we only observed it in the stratigraphic profile), the upper and lower deposits were designated as the same level. The upper stratum of Level 20 may be contemporary or the same as Level 12.
Both Level 11 and the lower stratum of Level 20 were nonalluvial and consisted of trash fill containing burned artifacts and charcoal from a wood fire. On the basis of the stratigraphic position of Levels 11 and 20 in relation to Feature 10 and the transept wall foundations, and the soft, trashy fill layer (probably Level 20) under the buttress on the east face of Trench C, these deposits are presumed to predate Franciscan construction.

Level 11, trash dump fill, had a lower artifact density than the late mission horizon trash dump deposits, Level 4, and Feature 7, possibly reflecting a lower population. Alternatively, this level may have been only a minor garbage dump. It contained a low proportion of nonindigenous artifacts, 6 percent of its contents equaling 6 percent of the nonindigenous assemblage, as well as corn, wheat, and bean fragments.

Levels 5 and 7, Features 2 and 12, and Surface 2 are early mission horizon deposits, grouped together as associated or contemporary on the basis of their alluvial nature. Except for Level 7, the deposits were virtually sterile. Only 6 percent of the total amount of cultural material recovered came from these five proveniences. They are placed in the early horizon on the basis of their stratigraphic position, just postdating Level 11 and predating Feature 7, and on their location in relation to the Franciscan church and Indian village. The excavation exposed the deposits' western edge. Most of their extent presumably lies to the east, in front of the church's main entrance. Since the deposits' alluvial nature indicates that water, either running or puddling, was present, it is unlikely that major construction would have taken place until the area was drained. Indeed, Feature 7 may have been constructed to drain this wet area so that construction could proceed. Although Feature 12 could be a purposefully dug acequia, it seems unlikely that such a feature would be located in front of living quarters where activity would be expected to be heaviest. Because only a small part of these deposits was exposed, they could not be adequately interpreted. The amount of time such deposits represent poses another interpretation problem. A thick deposit, such as Level 7, would seem to indicate a long period of deposition. However, in a desert environment such as the Southwest, a few years of heavy flooding can produce a de-
ceptively large amount of deposition. These deposits could be related to purposeful human activity, such as borrow pit excavation, flood farming, or water drainage. Alternatively, the deposits may represent natural water accumulation in a low area.

Level 12 is placed in the early mission horizon on the basis of its artifact date ranges. Although its stratigraphic position overlying Level 11 and underlying Level 13 suggests a later date, overlying nineteenth century deposits could have been removed during twentieth century regrading, resulting in the deposition of a twentieth century stratum, Level 13, directly over a mission period deposit, Level 12. Level 12 and the upper stratum of Level 20 may be contemporary or the same deposit, as mentioned earlier. The location of Levels 11 and 12, both refuse deposits, in front of the church suggests that the structure was not in use at the time of the levels' deposition. The fact that the church's front entrance is in this area may also explain the lack of nineteenth century deposition between Levels 12 and 13, since it is likely that this area would have been kept clear of debris accumulation.

A feature consisting of large cobbles in soil adobe mortar appears just north of Feature 10 in the upper stratum of Level 20, definitely postdating that level's lower stratum (Fig. 17). This feature had been partially destroyed by Feature 10, and we speculated that it could have been part of the foundation for the Franciscan complex's south boundary wall, known to have extended west from the church's southwest corner. Alternatively, it could be a footing for scaffolding, presumably needed for construction of the nave wall. I think the feature dates from the Franciscan construction period (ca 1800) rather than from twentieth century restoration activity.

Late mission horizon deposits are Levels 3, 4, 14, 17, and 19, Features 6, 7, and 9, Surface 3, and the Alternating Lime Ash and Soil Lenses. The deposits dating ca 1800 are Level 4, Features 7 and 9, and the Alternating Lime Ash and Soil Lenses. The rest date ca 1850 and later to ca 1900. Level 4 and Feature 7 are apparently associated and contemporary and were placed in this time period on the basis of their artifacts' date ranges (Fig. 24) and the high density of architectural debris (whole and fragmentary fired adobes, lime mortar and plaster fragments, wall plaster, and floor tile fragments) in Feature 7, relat-
ing that feature to major construction activity. The only other deposits containing a high density of architectural debris are Features 1 and 10 and Level 13, and their artifacts’ date ranges definitely place those deposits in the twentieth century, when major stabilization and reconstruction occurred (Fig. 24). Also, the nature of the architectural debris recovered from Feature 7 differed from that recovered from Features 1 and 10 and Level 13. Feature 7 contained badly warped and misfired adobes with no adhering lime mortar, indicating they were never used. The later deposits contained whole fired adobes with adhering mortar, suggestive of old bricks being removed and replaced. The only other major construction period known occurred between 1797 and 1822 when the Franciscan complex was built. According to the stratigraphic position and artifact date ranges, Feature 7 and Level 4 predate Features 1 and 10 and Level 13. Therefore, I think that Feature 7 and Level 4 and their associated deposits date from the building of the Franciscan church.

Level 4 and Feature 7 had the largest artifact concentrations of all the excavated deposits, possibly reflecting the presence of a fairly large population engaged in many activities. Alternatively, these two deposits could be the major trash disposal areas of the late mission horizon, thereby reflecting continuous use of the area over a period of time, rather than a large population. Cultural material recovered from these two units totaled 28 percent of the total assemblage recovered. The two deposits contained 26 percent of the indigenous assemblage, including 44 percent of all the shell recovered, 63 percent of the bone recovered and major floral concentrations (Feature 7 had the greatest variety of flora). Only 10 percent of the nonindigenous assemblage was recovered from these two deposits. While also containing architectural debris, in less quantity than Feature 7, Level 4 had a high density of bone and charcoal.

Feature 7 consists of some feature and its contents whose purpose cannot be determined. It could have been a borrow pit, the source of soil for Jesuit mission repair or Franciscan mission construction, or it could be associated with water control. The boulders in the western part of the feature may have been used to buttress a wall, cistern, or some earthwork designed to drain the area. Although Feature 7 could be
a wall foundation, the trashy fill, lack of wall fall, and the fact that the other foundations exposed consisted of boulders set in soil adobe mortar does not support this interpretation.

Overlying Feature 7 are the Alternating Lime Ash and Soil Lenses. The artifact date ranges associate this deposit with Feature 7 and Level 4 (Figure 24). Its stratigraphic position and lime plaster lenses suggest that the deposit represents subsequent maintenance plastering of the church and/or Indian village or erosion of plaster from the church and/or Indian village due to neglect. The deposit is down slope from both of these structures. The upper part of this deposit probably dates about 1850 and later.

Level 3, Feature 6, and Surface 3 are apparently associated and contemporary, and their stratigraphic positions indicate that they are related to the upper layers of the Alternating Lime Ash and Soil Lenses. Level 3 contains mottled soils high in organic constituents and may be unburned remnants of Feature 6. This level had a low artifact density and contained peach pits, walnut shell, and bone. Feature 6 was a thick layer of ash and charcoal. The ash consisted of both lime and organic constituents. Surface 3 was a hard-packed use area. These three deposits are very difficult to interpret or date because their cultural material density was low and contents nonspecific. They may represent activity associated with the structure's construction or maybe garbage burned in situ. It is not clear whether they represent pre-abandonment, abandonment, or post-abandonment activity.

Levels 17 and 19 of Area III are included in the late mission horizon because of their nature and stratigraphic position. Level 17 is a lime plaster layer that may represent plastering or erosion of plaster from the church. Level 17 is almost certainly a layer of adobe melt. According to the documentary history, construction of the Franciscan complex halted by 1805 because no funds were available (Kessell 1972: 322). I think these two deposits date from this period when the church presumably was neglected.

Also included in this time period (ca 1800 to ca 1850 and later to ca 1900) are Level 14 and Feature 9. These two deposits are located at the bottom of a large, purposefully excavated pit at the church's southwest corner. They are distinguished from Feature 10 fill (dating from
the twentieth century) by their different nature, i.e., Feature 9 consisted of alluvial deposits, and Level 14 was a layer of trash pit fill containing burned indigenous artifacts. The low number of artifacts recovered and limited excavation impeded dating and interpreting these deposits. However, their location at the church's southwest corner suggests associating the hole with excavation of the Franciscan complex's foundations. I think that the hole was dug when the church's foundations were built, was partly filled with trash, and then was open for some time, allowing sediments to accumulate (Feature 9). It cannot be determined if Feature 9 is associated with the early mission horizon alluvial deposits or not. The later (twentieth century) excavation resulting in Feature 10 presumably removed any earlier deposits overlying Feature 9. Alternatively, the hole could date entirely to twentieth century stabilization activity.

The early nineteenth-late twentieth century component is represented by one deposit, Level 2. The date is based on artifact date ranges and stratigraphic position (Figs. 24 and 16). The overlying deposit, Feature 1, contains a high density of architectural debris (whole and fragmentary fired adobe, plaster and mortar fragments) and definitely dates from the twentieth century. Level 2 contents suggest an earlier date and are more indicative of residential activity. The level contained almost no architectural debris and more indigenous artifacts (1,090) and bone (679) than Feature 1 (containing 54 indigenous artifacts and 149 bone). Level 2 contained the second highest nonindigenous artifact concentration, only the number in Feature 1 was greater. The level also contained floral remains—walnut shell, peach pits, and corn fragments—not found in Feature 1. Level 2 is a refuse deposit that I think is probably related to the convento's use as a schoolhouse with a resident teacher during 1900-1929.

The site's twentieth century component consists of Levels 13 and 15 and Features 1, 10, and 13. All these deposits contain a high density of architectural debris. Their stratigraphic position and artifact date ranges indicate a definite twentieth century date (Figs. 16-18, 24). On the basis of the different stabilization and restoration activities known to have taken place during this time, I think that Feature 1, Level 13, and Feature 10 probably relate to Pinkley's activities of the
1920's when much of the church was restored. The whole fired adobes with adhering mortar found in these deposits suggest that old material was being removed and replaced with new construction. Supporting this interpretation are two photos taken during the 1920's that show large piles of dirt at the church's southwest corner (Feature 10) and in the plaza (Feature 1) (Fig. 6). I think Feature 13 dates to Beaubien's 1934-1935 excavation during which he trenched around all the mission's walls to identify and define subsurface walls and features. Level 15 is probably the result of regrading practices of the 1930's designed to aid stabilization. In the upper part of Feature 10 is an irregular shallow depression not detected during excavation but visible in Unit M's west wall profile. On the basis of its stratigraphic position and its location at the church's southwest corner, I think it is one of Brewer's 1951 excavation trenches (Brewer 1951).

The remaining twentieth century deposits, Level 9, Features 4, 5, 8, 11, 14, and 16, and the Disturbance Pit are all intrusive deposits presumably related to pothunting, stabilization, construction, or other activities. Pothunting and vandalism at the site have a long history, dating as early as the 1860's and 1870's (Shenk 1976:21, 27-28). Level 9, Feature 11, and probably Feature 8 are possibly the result of twentieth century construction activity. The position of the postholes in Units U and P in the depositional sequence cannot be determined because the overlying deposits' dates are unknown. A 1920's photo shows a fence, constructed in 1913 of wooden posts and wire in this vicinity (Clemensen 1977:31; Photo No. 58,549 on file, Western Archeological and Conservation Center, Tucson). The holes may be related to its construction.
Chapter 5
INDIGENOUS ARTIFACT ASSEMBLAGE

Tumacacori artifacts are divided into two main assemblages based on manufacturing technology. Indigenous artifacts, such as stone artifacts, are made of materials and techniques that either were familiar or could have been familiar to native people of the American Southwest prior to European contact. Nonindigenous artifacts, such as glass objects, reflect the manufacturing technology of European industry during and after the eighteenth century.

As discussed by Shenk and Teague (1975:59), distinctions between these two assemblages are not always clear-cut. On the basis of ethnohistorical data, the use of manure as a tempering agent in native ceramic manufacture is presumed to date from the Spanish introduction of the horse (Fontana et al. 1962:57). However, since manure was available and could have been used by native people prior to Spanish contact, manure-tempered Piman wares are considered part of the indigenous assemblage. Apparently manure was never used for tempering in nonindigenous ceramics manufacture. In the case of Papago Glazed Ware, a nonindigenous decorative technique, ceramic glazing, is used to decorate typical indigenous ceramic objects. Since glazing was not used to decorate Piman ceramics during precontact times and the ceramic glazing technique was definitely a Spanish introduction, Papago Glazed Ware is considered to be part of the nonindigenous, European technological sphere.

Discussion of artifact distribution through time will proceed according to conventions already set in the depositional history section. Artifacts will be discussed according to their distribution in early and late mission period horizon deposits, late nineteenth-early twentieth century, and twentieth century deposits. Nonindigenous material recovered from Tumacacori is presumed to date from 1691, when Kino initially made contact with the middle Santa Cruz River people. However, it is possible that nonindigenous artifacts appeared in this area prior to 1691 since seventeenth century Spanish exploration of the Southwest is well known. Discussion of artifact location will proceed according to the proveniences detailed in Chapter 4.
Indigenous artifacts comprise 88 percent of all artifacts recovered. Ceramics, stone, shell, and bone artifacts were found. Shell artifacts are discussed in Appendix A, and bone artifacts are discussed in Appendix C. Indigenous (Piman) ceramics formed the largest indigenous artifact group recovered (94 percent of the assemblage). More Piman ceramic sherds were recovered than any other artifact group. Most of the indigenous ceramics recovered (83 percent) were Piman plainware. Indigenous ceramics, though present throughout the site's occupation, were most numerous in later mission horizon deposits. Only 6 percent of the indigenous assemblage consisted of stone artifacts. Ground stone, flaked stone, and carved stone objects were recovered. Most of the lithics (43 percent) came from early mission horizon deposits. Shell and bone artifacts comprised less than 1 percent of the indigenous assemblage.

Ceramics

Indigenous pottery comprised 94 percent (8,798 sherds) of the indigenous assemblage. Of the indigenous ceramic sherds recovered, 97 percent are of the type described in the literature as Piman plainware and Piman red-slipped ware. The remaining 3 percent consists of Piman decorated wares. Only one reconstructible vessel, a bowl (Fig. 25), was recovered. The amounts and percentages of each ceramic type recovered are summarized in Table 4.

The problems of analyzing historic indigenous ceramics of the Papagueria have been dealt with numerous times and will only be summarized here. The following sources contain more detailed discussion: Di Peso 1953, 1956; Fontana et al. 1962; Haury 1950; and Shenk and Teague 1975. The major problems are that it is virtually impossible (1) to distinguish between the plainwares and red-slipped wares of the Papago, Pima, and Sobaipuri peoples, and (2) to distinguish Piman plainwares and red-slipped wares of the prehistoric, protohistoric, and historic periods on the basis of form and technology. At Tumacacori these problems are further complicated by the fact that all three peoples are known to have resided at the mission. Therefore, I am following Shenk and Teague (1975:60) in designating these ceramics "Piman wares" and in making no
Fig. 25. Piman plainware bowl. Bowl maximum height is approximately 6.9 cm.
Table 4

PIKAN CERAMICS (RECOVERED FROM SURFACE COLLECTION AND EXCAVATION): COUNTS AND PERCENTAGES

<table>
<thead>
<tr>
<th>CERAMIC TYPE</th>
<th>NUMBER RECOVERED FROM EXCAVATION</th>
<th>NUMBER RECOVERED FROM SURFACE COLLECTION</th>
<th>TOTAL NUMBER RECOVERED</th>
<th>PERCENTAGE OF CERAMIC ASSEMBLAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plainware</td>
<td>6,488</td>
<td>830</td>
<td>7,318</td>
<td>83%</td>
</tr>
<tr>
<td>Red-slipped</td>
<td>1,099</td>
<td>181</td>
<td>1,280</td>
<td>15%</td>
</tr>
<tr>
<td>Red-on-brown</td>
<td>146</td>
<td>10</td>
<td>156</td>
<td>2%</td>
</tr>
<tr>
<td>Black-on-red</td>
<td>18</td>
<td>-</td>
<td>18</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Impressed</td>
<td>13</td>
<td>1</td>
<td>14</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>White Slip</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
<td>-</td>
<td>10</td>
<td>&lt;1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>7,775</td>
<td>1,023</td>
<td>8,798</td>
<td>100%</td>
</tr>
</tbody>
</table>
attempt to attribute them to any one of these three indigenous peoples. The decorated ceramics are assumed to have been made by the Papago or Pima Indians since Di Peso (1953:147) states that there is no evidence that the Sobaipuri painted designs on their wares. Although David Doyel (1977:129-130) reports decorated wares associated with late prehistoric material from a middle Santa Cruz River Valley site that may be Sobaipuri, there is some question as to whether these ceramics are actually Sobaipuri (Bruce Huckell: personal communication). The Tumacacori Piman ceramic assemblage does contain plainware sherds that are almost certainly of Sobaipuri manufacture, according to Huckell.

As stated before, the other major problem in Piman ceramic analysis is the difficulty in distinguishing wares of the prehistoric, protohistoric, and historic periods. The main attribute distinguishing historic and prehistoric wares is the presence of manure temper.

The generally small size of the sherds recovered, particularly the rim sherds, limited form identification to the general categories of cups, jars (ollas), bowls, and plates. Sherds identified as cups could also be small or miniature bowls. Sherds identified as bowls could also be bean boiling pots. Categorizing rim sherds as bowls or jars was often difficult, and some overlapping of forms has doubtless occurred. The presence of grease stains or sooting on body and rim sherd exteriors was presumed to indicate that the vessel was used for cooking. The amount of soot varied from heavy to light and appeared over all or part of the surface. Unsooted bowl, plate, and cup sherds indicate that the objects were used as eating utensils, and unsooted jar sherds indicate the vessels' use for storage (Shenk and Teague 1975:68). Indigenous ceramic physical characteristics are summarized in Table 5. Ethnographic study indicates that apparently there were no restrictions on use of particular vessels, and specific forms served various purposes as needed (Fontana et al. 1962:48).

Shepard (1956) is followed for terminology and classification, and the description of rim form and design elements is taken from Colton (1953:43-44, 47-48). Some rim sherd diameters could not be determined. The figures given represent the range of rim sherd diameters that could be determined. All diameter measurements are approximate.
Table 5
INDIGENOUS CERAMIC PHYSICAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>CERAMIC TYPE AND FORM</th>
<th>PERCENT OF CERAMIC TYPE</th>
<th>PERCENT OF FORM SOOTED</th>
<th>WALL THICKNESS (cm)</th>
<th>VESSEL DIAMETER (cm)</th>
<th>PERCENT OF FORM WITH RIM COILS</th>
<th>RIM FORM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Piman Plainware:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bowls</td>
<td>34%</td>
<td>22%</td>
<td>0.3 - 1.2</td>
<td>6-26 and larger</td>
<td>17%</td>
<td>Everted to straight to slightly inverted</td>
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<tr>
<td>Jars</td>
<td>20%</td>
<td>31%</td>
<td>0.3 - 1.1</td>
<td>9-26 and larger</td>
<td>47%</td>
<td>Everted to straight</td>
</tr>
<tr>
<td>Plates</td>
<td>25%</td>
<td>18%</td>
<td>0.4 - 1.0</td>
<td>11-26 and larger</td>
<td>9%</td>
<td>Slightly inverted to straight to slightly everted</td>
</tr>
<tr>
<td>Cups</td>
<td>1%</td>
<td>--</td>
<td>0.33 - 0.8</td>
<td>8-12</td>
<td>25%</td>
<td>Everted to straight to slightly inverted</td>
</tr>
<tr>
<td><strong>Piman Red-Slipped Ware:</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Bowls</td>
<td>50%</td>
<td>3%</td>
<td>0.4 - 1.1</td>
<td>9-26</td>
<td>18%</td>
<td>Inverted to straight to everted</td>
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<tr>
<td>Jars</td>
<td>35%</td>
<td>4%</td>
<td>0.4 - 0.9</td>
<td>7-24</td>
<td>31%</td>
<td>Everted to straight</td>
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</table>
Table 5-Continued

<table>
<thead>
<tr>
<th>CERAMIC TYPE AND FORM</th>
<th>PERCENT OF CERAMIC TYPE</th>
<th>PERCENT OF FORM SOOTED</th>
<th>WALL THICKNESS (cm)</th>
<th>VESSEL DIAMETER (cm)</th>
<th>PERCENT OF FORM WITH RIM COILS</th>
<th>RIM FORM</th>
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<tbody>
<tr>
<td><strong>Piman Red-Slipped Ware</strong></td>
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<td></td>
</tr>
<tr>
<td>plates</td>
<td>5%</td>
<td>20%</td>
<td>0.3 - 0.8</td>
<td>16-25</td>
<td>13%</td>
<td>Straight to slightly everted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cups</td>
<td>1%</td>
<td>--</td>
<td>0.5</td>
<td>5</td>
<td>--</td>
<td>Straight</td>
</tr>
<tr>
<td><strong>Piman Red-on-Brown Ware:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bowls</td>
<td>54%</td>
<td>29%</td>
<td>0.4 - 0.7</td>
<td>15-21</td>
<td>--</td>
<td>Everted to straight to slightly inverted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>jars</td>
<td>31%</td>
<td>--</td>
<td>0.4 - 0.7</td>
<td>13-15</td>
<td>63%</td>
<td>Slightly everted to straight</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>plates</td>
<td>15%</td>
<td>--</td>
<td>0.4 - 0.6</td>
<td>--</td>
<td>--</td>
<td>Straight</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cups</td>
<td>4%</td>
<td>--</td>
<td>0.3</td>
<td>--</td>
<td>--</td>
<td>Straight</td>
</tr>
<tr>
<td><strong>Piman Black-on-Red Ware:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bowls</td>
<td>75%</td>
<td>--</td>
<td>0.4 - 0.6</td>
<td>16</td>
<td>--</td>
<td>Everted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cups</td>
<td>25%</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>
Eighty-three percent of the assemblage is Piman plainware. Plainware jars, bowls, plates, and cups were recovered. Fourteen percent of the Piman plainware is sooted. Of the sooted sherds, 5 percent are sooted on the interior, 87 percent are sooted on the exterior, and 8 percent are sooted on both surfaces. The one reconstructible vessel recovered from an early mission horizon deposit is a crudely fashioned, round-bottomed bowl with a straight rim and a diameter of about 13 cm. It was apparently fashioned completely by hand molding, is unpolished, and is sooted on the exterior, indicating its use for cooking.

As noted by others, the technical features of Piman plainwares vary greatly (Shenk and Teague 1975:61). The Tumacacori sherds are from handmade vessels manufactured by hand modeling and paddle-and-anvil. Some sherds also have smoothing marks—fine striations apparently left by using grass or some other such material (possibly cloth) to smooth the object. Di Peso (1956:294) mentions use of a bast fiber brush to smooth pottery in his discussion of the indigenous wares recovered from San Cayetano del Tumacacori (Paloparado). Most of Tumacacori's polished plainware is polished on the exterior only; however, sherds are also polished on the interior only and on both surfaces.

Sherd color varies from completely black (burned) through shades of gray and tan to dark orange and red. The orange and red color is most prevalent on polished sherds. Fire clouding occasionally appears. Sherds are tempered with manure, sand, crushed minerals such as mica, and some apparently have no temper. The amount of mica used varies from light (very little visible in the paste or on the surface) to heavy (surface and paste virtually covered). The paste color ranges from dark, carbonaceous black to dark brown to light tan or gray that often has a reddish, orangish, or yellowish cast. The paste of many sherds has a carbon streak, and both spalling and air holes are occasionally present. Sherd thickness varies from 0.3 to 1.4 cm.

Twenty-four percent of the recovered plainware is rim sherds. Thirty-four percent of these sherds are from bowls, and 20 percent are from jars. Twenty-two percent of the bowl sherds are sooted. Thirty-one percent of the jars are sooted. Plates make up 25 percent of the Piman plainware rim sherds, and cups 1 percent. Eighteen percent of the plate
rims are sooted. None of the cup (or small bowl) rim sherds is sooted. The form of 20 percent of the Piman plainware rim sherds could not be determined.

Twenty-nine body sherds (1 percent of the plainwares) have black lines and spots, or "splatters" (Fig. 26a). Alternatively, "splattered" ware may have been used for boiling saguaro juice into the syrup that constitutes one of the main ingredients of saguaro wine. The "splatters" may be carbonized sugar that splashed onto the container while the syrup was boiling (Fontana et al. 1962:107). Five of the "splattered" sherds recovered have the black residue on both the interior and exterior surface, and 23 were "splattered" only on the interior. None of these sherds is sooted or burned, presumably an indication that the objects were not used for cooking.

One "splattered" Piman plainware sherd has been worked into disc shape. A total of three of these worked sherds was recovered. The two discs have diameters of 4.6 cm and 4.1 cm at their widest point. They were probably gaming pieces (Fontana et al. 1962:41). One of these sherds is sooted on the exterior, indicating that the vessel it is from was used for cooking. The third sherd is 3.5 cm long and may have been used to polish pottery (Di Peso 1956:292).

Also included in the Piman plainware category are sherds having a textured exterior surface decoration. Ethnohistorically, there is no texture treatment of the surface in Papago pottery manufacture (Fontana et al. 1962:32). Fourteen of the plainware sherds recovered have this exterior surface decoration, including one straight plate rim sherd and two slightly everted bowl rim sherds. Bowl sherd wall thicknesses are 0.7 and 0.9 cm. The plate sherd's wall thickness is 0.7 cm. None of the rim sherds has coils or is sooted.

A handle fragment, probably from a pitcher, bowl, or jar rather than a cup, and a piece of a ring-footed cup base were also recovered. Base sherds from both flat- and round-bottomed vessels were found.

**Piman Red-Slipped Ware**

The addition of an interior and/or exterior red slip that appears yellowish when worn, differentiates Piman red-slipped wares from Piman plainwares. Technological and physical characteristics are otherwise
Fig. 26. Indigenous ceramics;
a, "splattered" Piman plainware sherds;
b, Piman black-on-red ware;
c, Piman red-on-brown ware.
Diameter of "splattered" disk is 4.6 cm.
the same. Fifteen percent of the indigenous ceramic assemblage is Piman red-slipped ware. Sherds that are slipped on the interior and/or exterior surface(s) were recovered.

Although most sherds are slipped and polished, surfaces that are slipped are not always polished. Some sherds have a slipped but unpolished interior or exterior. Other sherds are partially slipped, and some have fire clouding. The slip color ranges from bright dark red, almost cranberry, to a dull reddish brown. As noted by Shenk and Teague (1975:62), the slip may be obvious or so ephemeral that it is difficult to tell whether the sherd has been slipped or simply well polished. Shenk and Teague (1975:62) also suggest that in some cases, the clay bodies may have been floated rather than slipped. Maximum slip thickness on the sherds recovered is 0.3 mm.

Sooting occurs on 7 percent of the sherds. Seventy-eight percent of these sherds are sooted on the exterior only, 21 percent are sooted on the interior only, and 1 percent are sooted on both surfaces. The Piman red-slipped wares appear to be better crafted than plainwares.

Red-slip ware jars, bowls, plates, and cups were identifiable. Jars, comprising 35 percent, and bowls, 50 percent, are the dominant forms. Three percent of the sherds are sooted. Four percent of the jar rim sherds are sooted. Twenty-five of the 97 jar rim sherds are from large vessels presumed to be large storage jars or possibly large bean boiling pots. Two partially reconstructible rims have a raised area or bump just below the rim on the exterior, possibly used to anchor a string for tying a lid of hide or cloth on the vessel (Fontana et al. 1962:47). One plainware jar rim sherd also has this feature. Plates and cups comprise 5 percent and 1 percent, respectively, of the Piman red-slipped ware. Twenty percent of the sherds are sooted. One sherd recovered is probably a cup. It is unsooted. The form of 25 Piman red-slipped ware sherds (9 percent of the assemblage) could not be identified.

Flat-bottomed Piman red-slipped ware sherds were recovered, one with some exterior sooting. Three handle fragments, one presumably from a cup, were also found. One body sherd with part of a handle is probably from a pitcher. Ten sherds could not be definitely identified as red-slipped or plainware.
Piman Red-on-Brown Ware

Comprising almost 2 percent of the total Piman ceramic assemblage, this ware is the same as Piman plainware except that it has been decorated with red designs painted on the interior and/or exterior (Fig. 26c). Both Fontana et al. (1962:77-78) and Shenk and Teague (1975:64) discuss techniques of paint manufacture and application. Although designs are known to have been executed in narrow and heavy lines popular during different time periods, the Tumacacori sherds were too small to enable differentiation on this basis. Fontana et al. (1962:103-9) date the manufacture of this ware from A.D. 1700 to about 1930.

Bowl, jar, plate, and cup sherds were recovered. Sixteen percent of the sherds are sooted. Sherds were decorated on the interior only, on the exterior only, and on both surfaces. Decorative elements identifiable are chevrons, sawtooth lines, straight and curved lines, parallel straight lines, intersecting straight lines with pendant hooks, or solid diamonds. Among the design motifs identifiable are stepped parallel lines, parallel hachures, pendant dots on a curved line, nesting chevrons, and ticked lines.

Bowl and jar rim sherds represent 54 percent and 31 percent, respectively, of the ware recovered. Twenty-nine percent of the bowl rim sherds are sooted, and none of the jar rim sherds is sooted. Plate rim sherds total 15 percent of the Piman red-on-brown ware. None of these sherds is sooted. The sherds are too small to determine vessel diameter. Only one cup rim sherd, also unsooted, was recovered (four percent of the ware).

In addition to the above rim sherds, a fragment of a handle, presumably from a cup and decorated with three parallel red lines, was recovered. Also found was a body sherd having what may be a lug. Alternatively, the sherd could be a portion of a modeled vessel.

Piman Black-on-Red Ware

This ware is the same as Piman red-slipped ware except that it has painted black decoration on the exterior surface only and/or interior surface (Fig. 26b). Both Fontana et al. (1962:77-78) and Shenk and Teague (1975:64) discuss manufacturing techniques and application of the black decoration. Fontana et al. (1962:105) date the appearance of this ware to 1860 and later.
The sherds of Piman black-on-red recovered comprise less than 1 percent of the total indigenous ceramic assemblage. Only bowls and a cup were identifiable. No sherds were sooted. The three rim sherds recovered, all everted, are from bowls. One body sherd recovered is from a thick tableware object or storage vessel. The sherds are too small to identify design motifs; however, some design elements such as a rim band with pendant hooks and ticked straight and curving lines are recognizable.

**Miscellaneous**

Two sherds have a white or cream-colored slip. The slip color cannot be definitely determined because the sherds are too small and poorly preserved. According to Fontana et al. (1962:66), only red and (rarely) white slip are used on Papago pottery. The white slip consists of a thin paste made from a white clay, obtained from a pit near San Xavier Mission.

In their discussion of Period 1 (A.D. 1700-1860) Papago red-on-brown wares, Fontana et al. (1962:103) mention a variant in which broad-line red painted decoration appears on a "creamy slipped surface." They note that the creamy slip is absent from Papago red-on-brown ware of Period 2 (A.D. 1860 to 1930). However, in their discussion of Period 3 (A.D. 1930 to the present) Papago wares, Fontana et al. mention Papago Black-on-white ware that is white slipped.

One sherd recovered is slipped only on the exterior, and the other is slipped white or cream-colored on the exterior and red on the interior. It is very unlikely that the sherd slipped white or cream-colored on the exterior and red on the interior is prehistoric or some ware other than Papago. Its general appearance, the red slip, and manure-tempered paste are typical of Piman red-slipped ware.

Two sherds, one Piman plainware and one Piman red-on-brown, may be fragments of modeled figures. One sherd, recovered from the early mission horizon, seems to be part of a figure, although it could be from a vessel. The presumed exterior surface has vestiges of red paint, apparently the same as that which appears on Piman red-on-brown ware. The other sherd, from the late mission horizon, is also indistinguishable, but the presence of a perforation indicates that it may have been a pen-
dant or part of a pendant. According to Fontana et al. (1962:78), modeled pottery has never been popular with Papago potters, although effigy vessels and figures have been produced.

**Discussion**

Indigenous ceramics form the largest artifact group recovered. Sherds from tablewares, cooking, and storage vessels were found. Also recovered were gaming pieces and fragments from miniature vessels. Two sherds may have come from modeled clay objects. Bowls, jars, cups, and plate sherds were found. Rim forms of the vessels recovered varied considerably, and the greater the number of sherds of a particular form recovered, the more variation in its rim form. Diameters also exhibited a great amount of variation, indicating that a wide range of sizes of particular vessel forms was produced.

Objects were undecorated or decorated with painted designs or texturing. Most of Tumacacori's indigenous ceramics are Piman plain and red-slipped wares. Decorated sherds accounted for only 1 percent of the ceramics recovered. Since the "splattered" sherds recovered were not sooted, indicating that the vessels were not used for cooking, it does not seem likely that the "splatters" are carbonized sugar resulting from boiling saguaro juice into syrup. Only small "splattered" body sherds were recovered, and vessel forms were not determinable. If the sherds are from bowls, I suggest that the "splatters" are more likely black paint residue and the vessels used for concocting the paint.

Most of the sherds that could be attributed to a particular vessel form are from bowls and jars. However, some of the sherds attributed to these two forms could actually be from bean boiling pots. Cup sherds comprised the smallest group. Plainware, red-slipped ware, and red-on-brown ware bowl, jar, cup, and plate sherds were recovered. However, these three Piman ceramic types also account for most of the sherds recovered and would, therefore, show the greatest variation in form. Fewer black-on-red ware sherds were recovered, and their forms are more restricted. Only bowl and plate sherds were found.

Piman plainware comprised the majority of indigenous ware manufactured and used at Tumacacori, followed by Piman red-slipped and red-on-brown wares. The recovery of so few Piman black-on-red sherds (less
than 1 percent of the indigenous ceramic assemblage) apparently indicates that at Tumacacori, it was the least manufactured and least used ceramic type. The predominant Piman plainware forms were bowls and jars. The predominant Piman red-slipped and red-on-brown ware form was bowls. The ceramic type most used for cooking was plainware, and most of the plainware cooking vessels were bowls, although jars were also used. Red-slipped and red-on-brown wares were also used for cooking, but not to the extent that plainware was used. There is no indication that cups were ever used for cooking.

Indigenous ceramics are present throughout the site's occupation but are most numerous in late mission horizon deposits. Forty-eight percent of all excavated Piman ceramic types came from these deposits. Table 6 shows the distribution of Piman ceramics recovered from dated deposits. Piman plainware is the majority ware recovered from all time periods. Decorated wares were most prevalent in late mission horizon deposits. More indigenous ceramic sherds were recovered from the late nineteenth-early twentieth century deposit than were found in early mission horizon deposits. Possibly, the relatively small amount of ware from this early period reflects a lower population for the site compared to other periods. Indigenous ceramics from the late nineteenth-early twentieth century deposit could have been used by the occupants of the south convento "schoolhouse" or by the surrounding community. The twentieth century deposits yielded the smallest amount of all indigenous ceramic types. Ninety-two percent of the Piman black-on-red ware recovered came from late mission horizon and late nineteenth-early twentieth century deposits, generally supporting the dates provided by Fontana et al. (1962:106-107) of 1860 and later for the ware's appearance.

Stone Artifacts

Stone artifacts comprise only 6 percent (537 objects) of Tumacacori's indigenous artifact assemblage. Ground stone tools, flaked stone tools, tool manufacture debris, and a carved ornamental or ceremonial object were recovered. Table 7 summarizes the stone artifacts recovered. The purpose of this analysis, besides providing a morphological description of the stone artifacts recovered, is to attempt to determine
### Table 6

**DISTRIBUTION OF INDIGENOUS CERAMICS THROUGH TIME**

**NUMBER RECOVERED FROM DATED PROVENIENCES**

(Percentage of total number recovered from dated proveniences)

<table>
<thead>
<tr>
<th>TIME PERIOD</th>
<th>PIMAN PLAINWARE</th>
<th>PIMAN RED-SLIPPED</th>
<th>PIMAN RED-ON-BROWN</th>
<th>PIMAN BLACK-ON-RED</th>
<th>WHITE SLIP</th>
<th>IMPRESSED</th>
<th>OTHER</th>
<th>TOTAL INDIGENOUS CERAMICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Mission Horizon (ca 1750-ca 1800)</td>
<td>620 (13%)</td>
<td>49 (6%)</td>
<td>11 (16%)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>2 (25%)</td>
<td>682 (12%)</td>
</tr>
<tr>
<td>Late Mission Horizon (ca 1800-ca 1850 and later to ca 1900)</td>
<td>3,115 (66%)</td>
<td>525 (66%)</td>
<td>39 (57%)</td>
<td>7 (41%)</td>
<td>--</td>
<td>9 (82%)</td>
<td>2 (25%)</td>
<td>3,697 (65%)</td>
</tr>
<tr>
<td>Late 19th - Early 20th Centuries</td>
<td>833 (17%)</td>
<td>196 (25%)</td>
<td>16 (23%)</td>
<td>9 (53%)</td>
<td>1 (100%)</td>
<td>2 (18%)</td>
<td>3 (38%)</td>
<td>1,060 (19%)</td>
</tr>
<tr>
<td>20th Century</td>
<td>185 (4%)</td>
<td>26 (3%)</td>
<td>3 (4%)</td>
<td>1 (6%)</td>
<td>--</td>
<td>--</td>
<td>1 (12%)</td>
<td>216 (4%)</td>
</tr>
<tr>
<td><strong>Total Number Recovered from Dated Deposits</strong></td>
<td>4,753</td>
<td>796</td>
<td>69</td>
<td>17</td>
<td>1</td>
<td>11</td>
<td>8</td>
<td>5,655</td>
</tr>
</tbody>
</table>
Table 7
STONE ARTIFACTS: COUNTS AND PERCENTAGES
(Recovered from Surface Collection and Excavation)

<table>
<thead>
<tr>
<th>Type of Stone Artifacts</th>
<th>Number Recovered From Surface Collection</th>
<th>Number Recovered from Excavation</th>
<th>Total Number Recovered</th>
<th>Percentage of Total Recovered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Flakes</td>
<td>2</td>
<td>45</td>
<td>47</td>
<td>9%</td>
</tr>
<tr>
<td>Secondary Flakes</td>
<td>18</td>
<td>164</td>
<td>182</td>
<td>34%</td>
</tr>
<tr>
<td>Special Flakes</td>
<td>15</td>
<td>76</td>
<td>91</td>
<td>17%</td>
</tr>
<tr>
<td>Debris</td>
<td>23</td>
<td>77</td>
<td>100</td>
<td>18%</td>
</tr>
<tr>
<td>Cores</td>
<td>1</td>
<td>12</td>
<td>13</td>
<td>2%</td>
</tr>
<tr>
<td>Tools</td>
<td>3</td>
<td>80</td>
<td>83</td>
<td>15%</td>
</tr>
<tr>
<td>Ground Stone</td>
<td>3</td>
<td>17</td>
<td>20</td>
<td>4%</td>
</tr>
<tr>
<td>Carved Stone</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Total</td>
<td>65</td>
<td>472</td>
<td>537</td>
<td>100%</td>
</tr>
</tbody>
</table>
raw stone procurement, tool manufacture locale, and tool function, and to discuss regional similarity as implied by stylistic similarities.

We conducted a general morphological analysis and description following Shenk and Teague (1975:69-78). The terminology and class-descriptive classificatory scheme used is from that source. The classificatory scheme is based on formal-functional, attribute-level inferences. No detailed technological analysis was undertaken because the sample size was too small, and any statistical expression of technological attributes would have been meaningless. Also, the number of tools recovered from individual provenience units was too small to allow adequate statistical comparison of technological attributes both within and between units.

**Ground Stone**

Four percent of Tumacacori's stone artifact assemblage is ground stone. One fragment from a trough-shaped metate and eight whole and partial manos were recovered. The manos have both unifacial and bifacial wear patterns. One is pecked along the lateral edge. As implied by ethnographic analogy, both manos and metates were used in food processing. Eight whole and fragmentary handstones (or polishing stones) and objects that are probably handstones were recovered. Handstones are usually smaller than manos and made from cobbles. Probable functions are food grinding, pottery polishing, and plaster smoothing. All Tumacacori's handstones are rounded, polished, and have numerous fine striations from use. Three other artifacts recovered are probably ground stone.

**Flaked Stone**

Flaked stone forms 96 percent of the stone artifact assemblage. Three percent of the flaked stone recovered consists of cores (raw material); debitage (waste material produced during flaking) forms 81 percent; and tools comprise 16 percent. Debitage consists of primary, secondary, and special flakes and debris (shatter; discard material). Primary flakes are forced from the core during tool formation. Secondary flakes are forced from primary flakes when modifying primary flakes into secondary tools. Primary flakes are consistent in size with fin-
ished tools, and secondary flakes are smaller than flakes used as a basis for finished tools (primary flakes). Special flakes result from the manufacturing process of retouch.

Of the 13 cores recovered, the orientation of flaking could be determined for three of the specimens—two were amorphous and one was subdiscoidal. One core exhibits hammerstone usage, and another has a globular shape. Twelve cores have the potential for further flake removal. Flakes form 60 percent of the flaked stone assemblage, and debris forms 18 percent. Fourteen percent of the flakes recovered are primary flakes, 57 percent are secondary flakes, and 29 percent are special flakes. A summary of flake types and material is presented in Table 8.

Flaked stone tools (83 objects recovered) form 16 percent of the flaked stone assemblage. All the stone tools recovered are retouched pieces. Retouched flakes (utilized flakes) form the largest tool type, equaling 47 percent of the tools recovered. A flake exhibiting casual edge resharpening along the angle formed at initial detachment is a retouched flake. The retouched pieces display a wide variety of morphological attributes. They have both interior and exterior retouch and show lateral, distal, proximal, and bilateral positions of retouch. Both continuous bifacial, abrupt, and semi-steep retouch, and irregular and discontinuous marginal retouch occur. Most of the specimens show discontinuous, irregular marginal retouch that may be related more to use than to actual tool formation processes. Some specimens show battered retouch, and two specimens are possibly truncated. Only one retouched primary flake (bilateral marginal) was recovered. All other retouched pieces are secondary flakes. Retouched modified pieces are considered to be tools. We can only speculate that retouched pieces (tools) indicate a wide variety of functions or few functions carried out by a wide variety of tools because comparative analysis of retouched piece utilization in the Southwest is lacking.

Stone objects classed as formal tools comprise 53 percent of the stone tools recovered and 19 percent of the entire flaked stone assemblage. Formal tools have evidence of regular and extensive retouch that changed the angle of the working edge significantly from what probably existed at initial flake detachment. Formal tools consist of scrapers, notched flakes, drills/perforators, battered pieces, and projectile
Table 8

FLAKE TYPES BY MATERIAL (RECOVERED FROM SURFACE COLLECTION AND EXCAVATION): COUNTS AND PERCENTAGES

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>PRIMARY FLAKES</th>
<th>SECONDARY FLAKES</th>
<th>SPECIAL FLAKES</th>
<th>DEBRIS</th>
<th>TOTAL</th>
<th>PERCENTAGE OF TOTAL BY MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhyolitic Jasper</td>
<td>19</td>
<td>80</td>
<td>47</td>
<td>50</td>
<td>196</td>
<td>47%</td>
</tr>
<tr>
<td>Basalt</td>
<td>11</td>
<td>11</td>
<td>2</td>
<td>3</td>
<td>27</td>
<td>6%</td>
</tr>
<tr>
<td>Quartzite</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>7</td>
<td>2%</td>
</tr>
<tr>
<td>Chert</td>
<td>5</td>
<td>29</td>
<td>14</td>
<td>22</td>
<td>70</td>
<td>17%</td>
</tr>
<tr>
<td>Rhyolite</td>
<td>10</td>
<td>44</td>
<td>18</td>
<td>14</td>
<td>86</td>
<td>21%</td>
</tr>
<tr>
<td>Chalcedony</td>
<td>2</td>
<td>13</td>
<td>4</td>
<td>5</td>
<td>24</td>
<td>6%</td>
</tr>
<tr>
<td>Quartz</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>1%</td>
</tr>
<tr>
<td>Silicified</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Limestone</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>Obsidian</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Unidentified</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>&lt;1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>48</td>
<td>181</td>
<td>91</td>
<td>100</td>
<td>420</td>
<td></td>
</tr>
<tr>
<td>Percentage of Total by Flake Type</td>
<td>11%</td>
<td>43%</td>
<td>22%</td>
<td>24%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

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points. The two scrapers recovered comprise 2 percent of the entire stone tool assemblage. One scraper is circular, and the other, a possible partial scraper, has lateral continuous retouch. Notched flakes form 5 percent of the tool assemblage. Two of the four notched flakes have abrupt retouch. Five objects (6 percent of the stone tools) were identified as drills/perforators. One, a double-notched flake having a blunt projection, is possibly a drill; another is an opposite end scraper or a perforator. Also found were one possible bifacial drill tip, one possible perforator (a projection with double notches), and one possible perforator with bilateral abrupt retouch. A single hammerstone fragment, an object with a flattened edge, and four other battered tools (possibly hammerstones) equal 6 percent of the stone tool assemblage.

Twenty-eight whole and partial projectile points were recovered. These tools comprise 34 percent of the entire stone tool assemblage. All of the intact bases are concave or straight. The complete small, black obsidian point may have been "polished down," that is, flattened or thinned (Fig. 27). The points show both bifacial and bilateral retouch. All of Tumacacori's projectile points were formed by edge trimming primary and secondary flakes. At least one point was definitely formed from a primary flake. The points show hafting breaks but apparently have no impact fractures.

Comparing the Tumacacori specimens with the Tubac points illustrated and described in Shenk and Teague (1975:76-78), indicates that four Tumacacori points (3 rhyolitic jasper and 1 chert) are apparently similar to Tubac Type 1 (Figure 27a), 11 (5 rhyolitic jasper, 2 chert, 2 chalcedony, 1 obsidian, and 1 quartz) are apparently similar to Tubac Type 2 (Fig. 27b), four (2 chert, 1 quartz, 1 rhyolitic jasper) are apparently similar to Tubac Type 3 (Fig. 27c), and one (chalcedony) may be similar to Tubac Type 4 (Fig. 27d). One complete Tumacacori projectile point (rhyolitic jasper; Fig. 27c) did not correspond to any of the Tubac types. It measures 18.5 mm x 12.5 mm x 3.5 mm and has a triangular side-notched straight base and evidence of both pressure and percussion edge trimming with notches formed by pressure technique. The remaining seven Tumacacori points (4 rhyolitic jasper, 2 chert, 1 chalcedony) could not be assigned to any formal class.
Fig. 27. Stone artifacts. Length of 3 is 18.5 mm.
According to Russell (1908:96, fna, fnb), the Pima Indians used stone to tip their war arrows only. The points of hunting arrows were merely the sharpened end of the shaft. Robinson (1976:156) states that with "little evidence for hunting of wild animals (at Guevavi), the unusual number of projectile points may, instead, relate to the Apache pressure that caused ultimate abandonment of the mission. . . ." There is also little faunal evidence of wild animal hunting at Tumacacori. The fact that the projectile points recovered exhibit evidence of having been hafted but not used suggests arrows stored for future use. Tubac, a presidio site occupied continuously for a longer period of time than either Mission Guevavi or Mission Tumacacori, yielded a little more than half (17) as many points as Tumacacori. Tubac is a Spanish military site and would logically have had a greater need for and ease of attainment of metal weapons than would presumably have been the case for the two missions.

Carved Stone

Perhaps the most interesting stone artifact recovered from Tumacacori is a hand-carved, soapstone fetish, apparently of a bird (Fig. 27f). The carving is quite delicate and well executed, and the piece is altogether charming. It measures 2.1 cm. Its provenience date is uncertain.

Discussion

Early mission horizon deposits contained 43 percent of the excavated lithic assemblage recovered. Late mission horizon deposits contained 18 percent, the nineteenth-twentieth century deposit contained 7 percent, and the twentieth century deposits contained 11 percent of the assemblage. This distribution indicates a decrease in lithics at Tumacacori through time. Flakes are the largest group of stone artifacts recovered.

Table 9 details the distribution of excavated stone artifacts through time. Level 11, an early mission horizon deposit, had the largest concentration of both flakes and tools containing 35 percent and 28 percent, respectively, of all the flakes and tools recovered from excavation. This provenience also had the largest concentration of ground
## Table 9

### DISTRIBUTION OF STONE ARTIFACTS THROUGH TIME

Number Recovered from Dated Proveniences  
(Percentage of Total Number Recovered from Dated Proveniences)

<table>
<thead>
<tr>
<th>TIME PERIOD</th>
<th>FLAKES</th>
<th>DEBRIS</th>
<th>CORES</th>
<th>TOOLS</th>
<th>GROUNDSTONE</th>
<th>STONE ARTIFACTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Early Mission Horizon</strong></td>
<td>133</td>
<td>27</td>
<td>4</td>
<td>29</td>
<td>8</td>
<td>201</td>
</tr>
<tr>
<td>(ca 1750–ca 1800)</td>
<td>(60%)</td>
<td>(45%)</td>
<td>(36%)</td>
<td>(48%)</td>
<td>(62%)</td>
<td>(55%)</td>
</tr>
<tr>
<td><strong>Late Mission Horizon</strong></td>
<td>50</td>
<td>14</td>
<td>4</td>
<td>13</td>
<td>2</td>
<td>83</td>
</tr>
<tr>
<td>(ca 1800–ca 1850 and later to ca 1900)</td>
<td>(23%)</td>
<td>(25%)</td>
<td>(36%)</td>
<td>(21%)</td>
<td>(15%)</td>
<td>(23%)</td>
</tr>
<tr>
<td><strong>Late 19th – Early 20th Centuries</strong></td>
<td>12</td>
<td>9</td>
<td>3</td>
<td>9</td>
<td>–</td>
<td>33</td>
</tr>
<tr>
<td>(5%)</td>
<td>(15%)</td>
<td>(28%)</td>
<td>(15%)</td>
<td></td>
<td>(9%)</td>
<td>(9%)</td>
</tr>
<tr>
<td><strong>20th Century</strong></td>
<td>27</td>
<td>10</td>
<td>–</td>
<td>10</td>
<td>3</td>
<td>50</td>
</tr>
<tr>
<td>(12%)</td>
<td>(15%)</td>
<td></td>
<td>(16%)</td>
<td>(23%)</td>
<td>(13%)</td>
<td></td>
</tr>
<tr>
<td><strong>Total Number Recovered from Dated Deposits</strong></td>
<td>222</td>
<td>60</td>
<td>11</td>
<td>61</td>
<td>13</td>
<td>367</td>
</tr>
</tbody>
</table>

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stone, 29 percent of that recovered in excavation. The debitage distribution parallels those of the cores, tools, and ground stone except that the decrease in material from early to late mission horizon deposits is more marked. Data from the table indicate that stone tool manufacture and use continued through the mission period but declined from early to late mission horizons. The stone artifacts from late nineteenth-early twentieth century deposits suggest that stone was still being worked; however, its presence in these deposits could also be the result of disturbance. If stone was still being worked on-site during this period (post-abandonment), the quantity was less than during the late mission horizon. The increase in ground stone, flakes, and debris and the appearance of an equal proportion of tools in twentieth century deposits compared to the late nineteenth-early twentieth century deposit is presumed to be the result of strata intermixing during twentieth century activity.

Comparing the raw material of Tumacacori's stone artifacts with the material of the Tubac assemblage shows, as expected, that virtually the same material was utilized at both sites. The material most often used for flaked tools was a dark red rhyolitic jasper or chert. More obsidian stone artifacts were recovered from Tubac, but the discrepancy could be the result of differences in sampling. Most of the ground stone tools from both sites were made of basalt. Shenk and Teague (1975:78) state that "the stone of the sort used for tools at Tubac may be found within 4 km, 2.5 mi., of the site, and occurs abundantly in the adjacent terrace gravels." Comparing Table 10, summarizing the material types of the tools, cores, and ground stone, and Table 8, summarizing the debitage material types, indicates that the majority of tools recovered from Tumacacori were made on site.

Shenk and Teague (1975:79-80) briefly discuss similarities between the Tubac stone artifact assemblage and assemblages from other protohistoric and historic southwestern sites, emphasizing metate and projectile point forms as being the most diagnostically sensitive lithic classes. For the most part, their discussion also applies to the Tumacacori assemblage. The single, trough-shaped metate recovered is apparently identical to those found in historic or late prehistoric contexts from the southern Arizona sites of Babocomari, Quiburi, Santa Cruz de Gayba-
Table 10

TOOLS, CORES, AND GROUNDSTONE BY MATERIAL TYPE (RECOVERED FROM SURFACE COLLECTION AND EXCAVATION): COUNTS AND PERCENTAGES

<table>
<thead>
<tr>
<th>MATERIAL TYPE</th>
<th>NUMBER OF TOOLS</th>
<th>NUMBER OF CORES</th>
<th>NUMBER OF GROUNDSTONE</th>
<th>TOTAL NUMBER RECOVERED</th>
<th>PERCENTAGE OF TOTAL BY MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhyolitic Jasper</td>
<td>38</td>
<td>7</td>
<td>1</td>
<td>46</td>
<td>40%</td>
</tr>
<tr>
<td>Basalt</td>
<td>1</td>
<td>-</td>
<td>7</td>
<td>8</td>
<td>7%</td>
</tr>
<tr>
<td>Quartzite</td>
<td>-</td>
<td>-</td>
<td>4</td>
<td>4</td>
<td>3%</td>
</tr>
<tr>
<td>Chert</td>
<td>20</td>
<td>2</td>
<td>2</td>
<td>24</td>
<td>21%</td>
</tr>
<tr>
<td>Andesite</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>Rhyolite</td>
<td>5</td>
<td>2</td>
<td>5</td>
<td>12</td>
<td>10%</td>
</tr>
<tr>
<td>Chalcedony</td>
<td>16</td>
<td>-</td>
<td>-</td>
<td>16</td>
<td>14%</td>
</tr>
<tr>
<td>Quartz</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>Obsidian</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>83</strong></td>
<td><strong>12</strong></td>
<td><strong>20</strong></td>
<td><strong>115</strong></td>
<td><strong>100%</strong></td>
</tr>
<tr>
<td>PERCENTAGE OF STONE ARTIFACTS RECOVERED</td>
<td><strong>72%</strong></td>
<td><strong>10%</strong></td>
<td><strong>18%</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
nipitea, San Salvador Baicatcan, Paloparado (San Cayetano), and Tubac (Di Peso 1951:130-133, 1953:154-162, 1956:463-467; Shenk and Teague 1975:70-72, 79-80). Projectile points apparently similar to Tubac Type 1 have been found in the context of an eighteenth century Sobaipuri occupation at Alder Wash Ruin, from a probable early nineteenth century Papago occupation in the Santa Rosa Wash, and from Batki, an historic Papago village (Shenk and Teague 1975:80; Haury 1950:272, Fig. 560,s). Points similar to Tubac Type 2 "are found throughout southern Arizona in various historic Papago, Pima, and Sobaipuri contexts" and points similar to Tubac Type 4 are "ubiquitous, ranging in time from preceramic to historic periods in the Southwest" (Shenk and Teague 1975:80). To summarize, Tumacacori's stone artifact assemblage is consistent with assemblages from other historic Pima, Papago, and Sobaipuri sites in southern Arizona.
Chapter 6  
NONINDIGENOUS ARTIFACT ASSEMBLAGE

Twelve percent (1,091 objects) of the artifacts recovered from Tumacacori are nonindigenous. We found ceramics, glass, metal, rubber, leather, mother-of-pearl buttons, and architectural debris. Ceramics and glass were the largest nonindigenous artifact groups recovered. Thirty percent of the nonindigenous artifact assemblage was ceramics. This group contained earthenware, porcelain, and stoneware sherds. Mexican lead glazed earthenware was the largest ceramic type recovered. Glass formed 42 percent of the assemblage. Sherds of bottle glass, flat glass, household and tableware objects were found as well as glass trade beads. Bottle glass sherds formed the largest category. Only 6 percent of the glass recovered came from mission period deposits. Twenty-six percent of the nonindigenous artifacts recovered were metal. For ease of discussion, this group was divided into two categories: (1) mission period and (2) late nineteenth and twentieth century metal artifacts. Scrap metal and hardware formed the largest groups, together equalling 83 percent of the metal recovered. In the following chapter ceramics are discussed first, followed by glass, metal, and miscellaneous objects.

Ceramics

Sherds (385) of earthenware, stoneware, and porcelain vessels were found. Earthenwares have relatively soft, opaque, non-vitreous bodies that are usually glazed to make them impermeable. Porcelain vessels have a very hard, highly vitrified and fairly translucent paste that is usually glazed. The paste of stoneware is also very hard but opaque and slightly permeable. Stoneware vessels are usually glazed. No whole or reconstructible nonindigenous ceramic objects were recovered. The majority of sherds are from tablewares. Only a few sherds from nonindigenous ceramic storage vessels were found. The minimum number of vessels was determined by attributing sherds and then counting the number of distinctly different sherds or sherd groups. Sherds were identified as being from different vessels on the basis of their color, decoration, identifiable form, and/or vessel part. The nonindigenous ceramic sherds recovered are summarized in Table 11.
Table 11

NONINDIGENOUS CERAMICS (RECOVERED FROM EXCAVATION AND SURFACE COLLECTION): COUNTS AND PERCENTAGES

<table>
<thead>
<tr>
<th>TYPE OF WARE</th>
<th>NUMBER OF SHERDS RECOVERED FROM EXCAVATION</th>
<th>NUMBER OF SHERDS RECOVERED FROM SURFACE COLLECTION</th>
<th>TOTAL NUMBER RECOVERED</th>
<th>PERCENTAGE OF TOTAL RECOVERED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Majolica</td>
<td>69</td>
<td>5</td>
<td>74</td>
<td>19%</td>
</tr>
<tr>
<td>Mexican Lead-glazed</td>
<td>157</td>
<td>10</td>
<td>167</td>
<td>43%</td>
</tr>
<tr>
<td>Earthenware</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Olive Jar&quot; Earthenware</td>
<td>24</td>
<td>1</td>
<td>25</td>
<td>7%</td>
</tr>
<tr>
<td>Oriental Export Porcelain</td>
<td>23</td>
<td>1</td>
<td>24</td>
<td>6%</td>
</tr>
<tr>
<td>Papago Glazed Ware</td>
<td>27</td>
<td>3</td>
<td>30</td>
<td>8%</td>
</tr>
<tr>
<td>Anglo ceramics</td>
<td>43</td>
<td>14</td>
<td>57</td>
<td>15%</td>
</tr>
<tr>
<td>Unidentified</td>
<td>8</td>
<td>--</td>
<td>8</td>
<td>2%</td>
</tr>
<tr>
<td>Total</td>
<td>351</td>
<td>34</td>
<td>385</td>
<td>100%</td>
</tr>
</tbody>
</table>
Most of the ceramics recovered are earthenwares. Shenk and Teague (1975:87) note that from at least 1752 into the nineteenth century "earthenwares represented the cheapest and most easily obtained ceramic type for the frontier population." Especially after about 1752 and until about 1800, majolica, "olive jars," oriental export porcelain, and Mexican lead-glazed earthenware constitute most of the nonindigenous ceramics from Spanish colonial sites (Shenk and Teague 1975:87-88; Caywood 1950:80-88; Barnes 1975:11-12). Also present is the Spanish-influenced Papago Glazed Ware, made locally as a substitute for Hispanic glazed wares that were difficult to obtain (Fontana et al. 1962:104; Caywood 1950:95; Barnes 1975:8-9). After about 1800, Anglo ceramics flooded the Mexican market and began to appear in Pimeria Alta. The import of majolica, oriental export porcelain, and "olive jars" began to decline (Barnes 1975:61-62).

There is some controversy regarding the appearance of ceramics such as Mexican lead-glazed earthenware, majolica, and Papago Glazed Ware in Pimeria Alta because much of the information is based only on their appearance on sites for which occupation dates are known. At present, few studies or excavations have been conducted in the centers where these wares are known or are presumed to have been made. Therefore, the dates cited from the literature must be considered tentative and subject to change with further research.

During the Spanish frontier period, ceramic wares reached Pimeria Alta settlements from Mexico, and the political and economic climate of Mexico affected their availability in northern Sonora. The nonindigenous ceramics supplied to the frontier during the eighteenth century were Mexican lead-glazed earthenware and Mexican majolica, both manufactured by flourishing home industries established by the Spanish conquerors in the sixteenth century, oriental porcelain brought to New Spain by the burgeoning trans-Pacific trade, and products such as "olive jars" that were imported from Spain. These wares were transported to Pimeria Alta settlements by infrequent mule trains bringing supplies. Not until Tubac Presidio was established in 1752 did supplies begin to reach northern Pimeria Alta in greater quantity and on a more regular basis (Shenk and Teague 1975:87-88).
The Spanish colonial government restricted import of foreign wares into New Spain, protecting both the Spanish and home industries, especially majolica and Mexican lead-glazed wares that were made in imitation of the fashionable but difficult to obtain foreign products. In the early nineteenth century, this protection began to decrease as the amount of contraband entering Mexico through the black market increased. Following Mexican independence in 1821, the Anglo-Mexican Trade Treaty of 1824 allowed direct importation of European goods, subsequently flooding the Mexican market and causing a severe decline in both the quantity and quality of Mexican-made ceramics. Also, the 1821 Revolution greatly disrupted supply routes to northern Sonora, causing a drop in the amount of ware reaching this area.

The 1854 Gadsden Purchase gave political control of northern Sonora to the United States, and American surveyors, entrepreneurs, settlers, and military began arriving almost immediately. The opening of the Santa Fe Trail in 1825 increased the availability of supplies to southern Arizona (Snow 1965:32). During the 1880's, railroad lines were built linking Mexico (Nogales) to Tucson (through Benson) and Tucson to the rest of the United States, and the quantity and variety of ceramics entering southern Arizona increased tremendously (Barnes 1975:53). By the 1920's, northern Pimeria Alta was no longer a frontier outpost.

In this section, Hispanic ceramics are discussed first, followed by oriental export porcelain, Papago Glazed Ware, Anglo wares, and unidentified sherds.

**Majolica**

The term majolica (or maiolica) refers to a type of Spanish or Mexican earthenware distinguished by the quality of its glaze, an opaque light-colored enamel usually white or off-white. Paste color of majolica vessels ranges from red to white and objects are wheel manufactured. Majolica vessels may be decorated or plain (Goggin 1968:3-4; Lister and Lister 1969:5, 1974:1718). Because the Mexican majolica industry and its products have been previously discussed in depth, only a brief summary is given below. Barber (1908, 1911, 1915), Barnes (1971), Barnes and May (1972), Caywood (1950), Gerald (1968), Goggin (1968), Lister and Lister (1974, 1976, 1978), Snow (1965), and Tunnell (1966) contain more
The Mexican majolica industry, established in the early sixteenth century, was an expanding and profitable enterprise by the seventeenth century. The most famous center of Mexican majolica manufacture was La Puebla de Los Angeles, Mexico, although the ware was also made elsewhere (Lister and Lister 1974:25; 1978:3, 11-12, 21-22; Snow 1965:25). Majolica found on American sites in the Southwest is presumed to have been manufactured in and imported from Mexico. Goggin (1968) identified all the styles of Tumacacori sherds recovered prior to the 1979 excavation as those known to have been produced in Puebla. Since the same majolica styles were recovered during this excavation, I presume that the majolica we recovered originated in Puebla. However, it is possible that some of these wares were manufactured in other Mexican cities known to have had majolica industries (Goggin 1968:8). Also, since majolica produced in Spain and Italy has been recovered from excavations in Mexico City, the possibility must be considered that majolica found on southwestern sites, for which the place of manufacture is unknown or cannot be determined, is actually non-Mexican made (Lister and Lister 1978:3-4).

During the seventeenth century, the popularity of Chinese porcelain, imported in large volumes to New Spain, threatened the Mexican majolica industry. To survive, the Puebla potters began to produce blue-on-white majolica imitations of Chinese wares. These wares dominated Mexican majolica manufacture of the eighteenth and early nineteenth centuries and are the most abundant majolica styles found at Tumacacori and other southern Arizona sites (Snow 1965:26; Lister and Lister 1974:29; 1978:11; Barnes 1976: 158-159; Barnes and May 1972:4; Barnes 1971:62).

During the colonial period, the Spanish government restricted the import of foreign wares into New Spain, thus protecting the Mexican majolica industry from competition (Barnes 1971:61). Around 1800, an increase in the contraband entering Mexico caused a decline in both quality and quantity of majolica produced (Gerald 1968:54; Robinson 1976: 158). The disruption of affairs resulting from the 1821 Mexican Revolution caused a dramatic decline in the amount of majolica reaching southern Arizona, and the 1824 Anglo-Mexican Trade Treaty virtually destroyed the Mexican majolica industry (Barnes and May 1972:5; Barnes 1971:61;
Although majolica production in Mexico continued from the nineteenth into the twentieth centuries, Mexican majolica was virtually nonexistent in the American Southwest from the 1820's until the twentieth century, when majolica manufacture regained impetus (Barber 1915a:5; Goggin 1968:210). Many of these modern products imitate early styles and are difficult to distinguish from earlier wares (Caywood and Toulouse 1942:6). It is possible that some of the majolica recovered from Tumacacori is of modern manufacture.

Spanish missionaries, soldiers, and colonists brought majolica to the Southwest. It continued to be imported to the frontier from Mexican factories throughout the colonial period. Archeologically, the ware is most abundant in major civil or military centers, in wealthy towns, and in missions and other religious establishments (Goggin 1968:223). During the 1700's, majolica was "sent in the baggage of every priest that went to settle on the northern frontier of New Spain" (Barnes 1976:158). The presence of majolica on sites occupied by various orders indicates that it was in widespread use. Documents suggest that its use was limited to the altar service and infirmary. Majolica is found in considerably lesser quantities in New Mexico and Arizona than elsewhere, indicating the transportation and supply difficulties of frontier life (Goggin 1968:223).

The 74 majolica sherds recovered are all from tableware vessels presumably manufactured in La Puebla de Los Angeles, Mexico. Table 12 summarizes the majolica types and gives the number of sherds and the relative percentages of each type discovered. Dates noted in the table are the earliest and latest dates of manufacture for the particular majolica type or group that are stated in the literature. Sherds representing the following styles were recovered:

Puebla Polychrome, Castillo Polychrome, or Puaray Polychrome. Four sherds were identified as being possibly of these three styles. Alternatively, they may be a variant of Puebla Blue-on-white having black lines (George Teague: personal communication). Attribution of these sherds to any one style is not certain as the sherds are too small. Also, except for Puebla Blue-on-white, the dates given for the production of these wares are a little early for the site's initial occupation.
<table>
<thead>
<tr>
<th>MAJOLICA TYPE</th>
<th>DATE OF MANUFACTURE</th>
<th>NUMBER OF SHERDS RECOVERED</th>
<th>PERCENT OF TOTAL RECOVERED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Puebla Polychrome, Puaray Polychrome, or Castillo Polychrome</td>
<td>1600-1725</td>
<td>4</td>
<td>5%</td>
</tr>
<tr>
<td>San Agustin Blue-on-white</td>
<td>1700-1730 or 1750</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Puebla Blue-on-white or San Agustin Blue-on-white</td>
<td>1700-1850</td>
<td>5</td>
<td>7%</td>
</tr>
<tr>
<td>San Elizario Polychrome</td>
<td>1750 to 1830-1850</td>
<td>5</td>
<td>7%</td>
</tr>
<tr>
<td>Huejotzingo Polychrome</td>
<td>1700-Present</td>
<td>7</td>
<td>10%</td>
</tr>
<tr>
<td>Wavy Rim Band</td>
<td>1770-1830</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Tumacacori Polychrome</td>
<td>1780-1860</td>
<td>3</td>
<td>4%</td>
</tr>
<tr>
<td>Aranama Polychrome</td>
<td>1750 or 1790-1830</td>
<td>2</td>
<td>3%</td>
</tr>
<tr>
<td>Orange Band Polychrome (Variety 1)</td>
<td>post-1820</td>
<td>5</td>
<td>7%</td>
</tr>
<tr>
<td>Unclassified White</td>
<td>ca 1700-Present</td>
<td>20</td>
<td>27%</td>
</tr>
<tr>
<td>Unclassified Blue-on-white</td>
<td>ca 1700-Present</td>
<td>15</td>
<td>20%</td>
</tr>
<tr>
<td>Unidentified</td>
<td>ca 1700-Present</td>
<td>6</td>
<td>8%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>74</td>
<td>100%</td>
</tr>
</tbody>
</table>

**NOTE:** Sherds recovered from surface collection and excavation.
date of 1753. However, the sherds fit the published descriptions of these styles better than any other. Their paste is buff-colored and decoration consists of designs in dark and light blue accentuated by black lines or very thin dark blue lines on a white background. One sherd has some blue decoration on the exterior. (For type descriptions of all four styles, see Goggin 1968: 173-186, 190-195).

Goggin (1968:183) assigns a date of "the last quarter of the 17th century" for manufacture of Puaray Polychrome. Puaray and Castillo are related and Goggin dates the manufacture of Castillo as "probably" from "about the late 1680s into the very early 18th century." (Goggin 1968: 183). Dating of Puebla Polychrome is uncertain. Goggin (1968:180) dates this style from the last half of the seventeenth century but acknowledges the possibility of an earlier date. Gerald (1968:42) dates Puebla Polychrome 1600-1725.

San Agustin Blue-on-White. This ware is distinguished by both the overlapping light blue arches on the underside of plate rims and the stark, chalky white enamel background. Decoration consists of light and dark blue designs (Goggin 1968:187-189). The one sherd of this ware recovered is from a plate rim. Its paste is buff-colored. The date of manufacture is accepted as 1700 to either 1730 or 1750 (Barnes and May 1972:31).

Puebla Blue-on-White or San Agustin Blue-on-White. Sherds from plates and cups, representing at least five vessels, were identified as being of these two styles. Puebla Blue-on-white ware is difficult to identify in sherd form. Vessels have blue decoration on a white background. Two shades of blue may be used, and floral designs are the most common (Goggin 1968:190-195). The sherds recovered have a buff paste color. Puebla Blue-on-white dates 1750 to 1850 (Barnes and May 1972:7). This ware was very popular and has been found on other southern Arizona sites, sometimes in large quantities. For example, 152 sherds were recovered at Tubac (Shenk and Teague 1975:89).

San Elizario Polychrome. The sherds recovered represent four vessels found, but only plates are identifiable. The distinctive decora-
tion of San Elizario Polychrome consists of a broad blue band accented by thinner brownish-black bands near the rim of plate interiors. Below the blue band are suspended blue dots and blossoms that are sometimes also accented in thin black lines (Gerald 1968:48). The paste color of the sherds recovered ranges from whitish to buff. Dates cited for the production of this ware are 1750 to 1830-1850 (Barnes and May 1972:10, 33). Gerald (1968:46) states that the ware was most popular between 1770 and 1800.

**Huejotzingo.** Sherds from at least five plates were found. The distinguishing characteristic of this ware is a band appearing on the interior and exterior rim of an otherwise undecorated white plate (Goggin 1968:195-196). Two Tumacacori sherds have a green rim band; the rest are blue. Paste color ranges from buff to reddish terra-cotta. According to Barnes, green or yellow rim bands as well as blue began appearing sometime after about 1790 (Barnes 1968:159). Dating of this ware is uncertain. Dates of 1700-nineteenth century, 1750-1830 and 1780-1850 have been given (Barnes and May 1972:10). Barnes (1971:62) dates the blue-on-white type from 1700-1850.

**Wavy Rim Band.** Similar to Huejotzingo but having a wavy instead of straight rim band, only one plate sherd was recovered. The sherd's white enamel has a slightly greenish tint, and the band appears only on the plate's rim and interior surface. Paste color is reddish terra-cotta. This style was probably introduced between 1770 and 1780 (Barnes and May 1972:11). Barnes (1971:62) dates its manufacture 1780-1830.

**Tumacacori Polychrome.** Two of the sherds of this ware recovered are most likely from cups. The vessel form of the other sherd could not be identified. Tumacacori Polychrome is characterized by a pale blue enamel background on which designs in black or brown, orange, yellow, green, and dark blue are painted (Goggin 1968:198-200; Barnes and May 1972:11). One sherd recovered is a distinctly lighter blue, probably due to exposure since the sherd was found on the surface. The sherds recovered have a buff paste color. Although three dated patterns have been
distinguished, the lack of decoration on the Tumacacori sherds allows no finer dating than the 1780-1860 general period of manufacture cited in the literature (Barnes and May 1972:11).

**Aranama Polychrome.** A plate rim and a body sherd representing at least one vessel were recovered. Aranama Polychrome is characterized by two exterior orange-yellow bands, one near the rim and one circling the base, both outlined by thin, black bands (Goggin 1968: 196-198). The rim sherd recovered has evidence of a green band, accented by thin black lines appearing directly below the orange band. The sherd's paste color is a reddish terra-cotta. Barnes dates the appearance of Aranama Polychrome in the Santa Cruz River Valley as 1790-1830 (Barnes and May 1972: 12). May gives 1800-1830 for Monterey Polychrome, a style of his Aranama Tradition that corresponds to Barnes' description of the ware (Barnes and May 1972:12). Goggin (1968:198) dates the ware 1750-1800.

**Orange Band Polychrome (Variety 1).** Sherds of at least two vessels, one cup, and another vessel of unidentifiable form, were found (Mark Barnes: personal communication). This majolica style is thought to be derived from Aranama Polychrome but does not have the basal orange band. Orange Band Polychrome wares do have a black accented interior orange-yellow rim band. Variety 1 of this style is apparently characterized by four floral elements and a carnation design painted in runny green and yellow outlined in brown, appearing below the orange rim band (Barnes and May 1972:12-13). The three Orange Band Polychrome cup sherds recovered have interior and exterior runny green and brown decoration, and the two sherds from the other vessel are decorated only on the interior with green and brown. Paste color ranges from buff to reddish terra-cotta. Variety 1 sherds have been recovered from the post-1820 context in Tucson (Barnes and May 1972:13).

**Unclassified White.** These plain white sherds, representing plates, bowls, and cups, come from either undecorated white vessels or from the undecorated parts of decorated vessels. Sherd paste color ranges from buff to reddish terra-cotta. Undecorated white wares were apparently being produced in the same potteries that made decorated wares and may
date any time during the period of majolica production in Mexico or Europe (Lister and Lister 1974:30). However, the sherds from Tumacacori are presumed to be of Mexican manufacture and probably date no earlier than about 1700.

**Unclassified Majolica.** Twenty-one majolica sherds could not be classified because the sherds were too small, too nondescript, or simply did not fit any of the descriptions of recognized styles. All these sherds are presumed to be of Mexican manufacture and to date from about 1700.

Fifteen sherds are from blue-on-white wares. The white enamel on one of these sherds is unusually thin and shows no crazing. Another sherd, the bottom of a plate, may be an example of what May calls "Chinese Rice Bowl Majolica," with a suggested date of 1820-1830 (Barnes and May 1972:37) (Fig. 28d). The white exterior enamel background of this sherd is apparently the same as that which appears on other styles; however, the interior enamel background has a definite and apparently intentional bluish tint. It cannot be determined whether the tint is a wash or not. Decoration consisting of medium blue bands and dots, which may be flower petals, appears on the interior. The paste is buff-colored. There seems to be some question as to whether this type is actually Mexican or European Delft ware (Barnes and May 1972:37).

The remaining six unclassified sherds have decoration in colors other than blue. Three have bits of light yellow or greenish-yellow decoration. The fourth sherd, probably from a bowl, has exterior decoration consisting of dark emerald green dots and squiggly lines accented by small splotches of dark chocolate brown and large splotches of dark (burnt or bronze) orange (Fig. 28a). The sherd's interior is undecorated but has pronounced throwing rings. The enamel background is distinctly cream-colored instead of white, and the paste is buff-colored.

Shenk and Teague (1975:92) suggest an "1821 to 1900" date for the unclassified Mexican polychrome majolica from Tubac because by that time the market had been so dominated by cheap European ceramics that "only the least expensive majolica could have been transported from Mexico and still have undersold foreign competition." The four unclassified non-
Fig. 28. Nonindigenous ceramics; a, g, unidentified majolica; b, c, d, oriental export porcelain; e, h, Anglo earthenware; f, i-n, Tonala polychrome. Maximum length of "a" is 1-3/8 in.
blue-on-white sherds from Tumacacori could be placed in this category, or they could be sherds from other identifiable styles (except blue-on-white styles).

Mexican majolica comprised 19 percent of the nonindigenous ceramics recovered. Puebla Polychrome, Puaray Polychrome, Castillo Polychrome, and San Agustín Blue-on-white have manufacture end dates that predate the site's initial occupation date of 1753, suggesting that these styles may have been produced for a longer period than is presently thought, or that people were at the site prior to 1753. Alternatively, the sherds may be from older objects. Sixty-four percent of the excavated majolica is from mission period deposits. Thirty-three percent is from the early horizon, and 30 percent is from the later horizon, suggesting that majolica, though present throughout the site's occupation, was most abundant during the mission period (Table 12). Because this ware was included in the baggage of frontier priests for celebrating mass, majolica appearing in southwest mission site deposits dating to the Spanish colonial and Mexican periods is probably more an indication of how priests were outfitted for their frontier posts than of the population's degree of prosperity.

**Mexican Lead-Glazed Earthenware**

The term "Mexican lead-glazed earthenware" is from Barnes (1975:1, 3) and refers to Mexican-made pottery having a transparent lead oxide glaze that may be clear or tinted red or green by the addition of iron or copper. The glaze may be applied directly on the bisquit-fired vessel, or it may be applied over a slip. Dusting powdered glaze on the object, wear, or the object's use for cooking can result in the glaze having a matte instead of glossy appearance. Mexican lead-glazed earthenware is formed either by manufacture on the wheel or by molding (Barnes 1975:3–4). Wheel-manufactured ware apparently was made in large Mexican cities or pottery centers on an immense scale for export to all areas of New Spain. Molded wares were apparently manufactured by rural family potteries and probably had a more limited distribution. Although molded Mexican lead-glazed earthenware has been recovered from southern Arizona sites, Barnes states that these wares do not seem to have been made at Tucson or Tubac (both presidio sites), but apparently were
Table 13
MEXICAN LEAD-GLAZED EARTHENWARE
RECOVERED FROM TUMACACORI

<table>
<thead>
<tr>
<th>TYPE OF WARE</th>
<th>DATE OF MANUFACTURE</th>
<th>NUMBER OF SHERDS RECOVERED</th>
<th>PERCENT OF TOTAL RECOVERED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mexican Green Lead-Glazed Earthenware</td>
<td>ca 1600 to present</td>
<td>66</td>
<td>40%</td>
</tr>
<tr>
<td>Guanjuato Green Lead-Glazed Earthenware</td>
<td>1680-1840 (or no earlier than 1780)</td>
<td>3</td>
<td>2%</td>
</tr>
<tr>
<td>Awatovi Green Lead-Glazed Earthenware</td>
<td>1680-1850 (or no earlier than 1780)</td>
<td>1</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Tonala Polychrome</td>
<td>ca 1780-1830</td>
<td>86</td>
<td>51%</td>
</tr>
<tr>
<td>Galena Polychrome</td>
<td>ca 1780 to present</td>
<td>3</td>
<td>2%</td>
</tr>
<tr>
<td>Miscellaneous Lead-Glazed Earthenware</td>
<td>after 1780</td>
<td>8</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>167</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

NOTE: Sherds recovered from surface collection and excavation.
imported from Mexico (Barnes 1975:54). Only two of the 167 Mexican lead-glazed earthenware sherds from Tumacacori were molded.

The manufacture of this ware dates from at least the sixteenth century. According to Barnes (1975:60), it reached northern Pimería Alta about 1730 or 1750 with mission growth. Caywood (1950:85) suggests a date of about 1780 for its appearance, resulting from the change of religious orders in 1767. The amount of Mexican lead-glazed earthenware entering this area increased after about 1750. Early in the nineteenth century, the Mexican Revolution and the Anglo-Mexican Trade Treaty caused a decline in the amount of Mexican wares being imported from Mexico (Barnes 1975:61). The Mexican pottery industry eventually recovered, and this resurgence, combined with the coming of the railroad to Tucson and other communities during the 1880's, again brought Mexican lead-glazed earthenwares into southern Arizona, where they are still on the market (Barnes 1975:13, 61; personal observation of this ware for sale in shops in Tucson and Nogales in 1979). The types of Mexican lead-glazed earthenware recovered from Tumacacori include Mexican green, Guanajuato green, and Awatovi green lead-glazed ware, Tonala and Galera polychrome. Table 13 summarizes Tumacacori's Mexican lead-glazed earthenware. Dates noted in the table are the earliest and latest dates of manufacture that are stated in the literature for each particular Mexican lead-glazed earthenware type.

**Mexican Green Lead-Glazed Earthenware.** Sherds of Mexican lead-glazed earthenware having a transparent green-tinted glaze and representing at least 16 vessels were recovered (Fig. 29a). Most of the sherds (58) are from tablewares; at least nine plates, two bowls, and one cup were identifiable. Six sherds are probably from at least four utilitarian vessels. One sherd, a flaring and everted rim sherd (Colton's type IIIC3), is probably from a lebrillo or large bowl (Lister and Lister n.d.:56). The vessel was about 12-1/4 in. in diameter and may have been oval instead of round. A transparent, glossy, brownish-green glaze with whitish chalky splotches that may be oxidized areas appears on the sherd's rim and covers most of the interior and exterior surfaces. Lebrillos were typically large, steep-sided, flat-bottomed bowls that may have been used for washing hands at the table. Originally of
Fig. 29. Nonindigenous ceramics;  
a, b, Mexican green lead-glazed earthenware;  
c-g, Papago Glazed Ware;  
h, unidentified ware.
Spanish manufacture and imported, they are known also to have been made in Mexico, especially during the seventeenth century (Lister and Lister n.d.:56).

The five base sherds recovered all have foot rings. Two sherds, probably from the same holloware vessel, are burned and sooted on the exterior, indicating their use for cooking. This vessel, molded and glazed only on the interior, is apparently an example of "Interiorly Glazed Bowls," originally a central Mexican (Michoacan) product widely used throughout New Spain (Barnes 1975:29-30). The other sherds recovered were wheel manufactured.

Sherds are glazed entirely or partially on both the interior and exterior. The glaze, often worn, varies in color from a light emerald green to a dark moss green that is almost brown. The paste color ranges from terra-cotta to gray. A carbon streak is visible in three sherds. The paste may or may not have spalling or air holes. Only two vessels, represented by six sherds, are decorated; both are plates (Fig. 29a). The underglaze hand-painted brown decoration consists of a band on the rim interior and what are apparently large, loose swirls on the body interior.

Barnes (1975:19, 25) dates this ware's manufacture about 1600 to the present and feels that it was made in several different areas, dependent upon the availability of copper and lead oxides.

Guanajuato Green Lead-Glazed Earthenware. This type of ware is identified by its tile red paste, of better quality than majolica, and its dark green glaze, almost identical to that on "olive jar" sherds. The green glaze may cover both surfaces of the vessel or all of the interior and part of the exterior. Apparently all objects were manufactured on the wheel (Caywood 1950:86; Barnes 1976:160). Caywood (1950:86) identifies this ware as having been manufactured in Guanajuato, Mexico. However, Barnes states that probably not all of the ware identified as this type was manufactured there (Barnes 1976:160). Goggin (1960:28) writes that during the colonial period, green-glazed non-"olive jar" forms were produced in Seville, Spain, and elsewhere, and are "often found in the New World." Three sherds fitting descriptions of this ware were recovered. All are from wheel-made tableware, al-
though the sherds were too small to identify specific forms. Caywood (1950:85-87) apparently includes this ware among the ceramics first appearing in Pimeria Alta about 1780; Gerald (1968:53) gives dates of 1680-1850.

**Awatovi Green Lead-Glazed Earthenware.** This ware may have been manufactured in Puebla or Spain (Caywood 1950:87). The sherd from Tumacacori identified as this type has a grayish-white paste, untempered and similar to majolica, and a thick, transparent, dark emerald green glaze covering the rim and both surfaces. This rim sherd is most likely part of a wheel-manufactured plate. Caywood (1950:85-87) apparently includes this ware among the ceramics that appear in Pimeria Alta beginning about 1780; Gerald (1968:53) dates the ware 1680-1850.

**Galera Polychrome Lead-Glazed Earthenware.** This category consists of glazed redware reportedly produced in Tlaquepaque, Jalisco, Mexico, beginning about 1780 and continuing into modern times. Descriptions of the decorative technique vary, but all mention designs painted in various colors, including dark brown, yellow, white, black, green, and blue (Barnes 1975:35; Gerald 1968:53-54; Shenk and Teague 1975:96). The three small sherds found at Tumacacori have a clear lead glaze covering the interior, giving the ware a somewhat yellowish cast. One of these sherds has a clear glaze on the exterior. Underglaze hand-painted dark brown decoration appears on the interior of two sherds. All are apparently from tableware objects, either wheel manufactured or hand molded.

**Tonala Polychrome.** Sherds are characterized by a white slip on one or both surfaces with hand-painted designs in rust brown or green, covered by a transparent lead glaze that may be clear or tinted green (Fig. 28f). The designs often have drops of glaze where the brush stroke began or ended and generally reflect a lack of skill or care in execution. The paste is usually of poor quality and friable, and, as a result, the slip and glaze often flake off. The objects, apparently exclusively tablewares, were formed on the wheel (Caywood 1950:85; Barnes 1975:33). Tonala polychrome sherds from cups, plates, and bowls and representing at least six vessels were recovered.
Two distinct decorative types are discernible, differentiated by the glazed paste color. One type has a moss green exterior surface resulting from the application of green tinted lead glaze directly to the paste. The other type has a clear lead glaze applied directly to the paste on part or all of the interior or exterior which causes a rust colored surface. Twenty-one of the Tonala polychrome sherds recovered are rust-colored, and five are moss green.

The sherds’ designs are hand-painted over slip and under glaze. The rust glazed-paste color sherds have rust-brown lines and swirls filled with emerald green or yellow. Sherds with moss green glaze have designs in moss green and yellow. Of the sherds not having the rust glazed-paste color or the translucent green glazed exterior, many are slipped and glazed on both sides and have underglaze decoration consisting of brown lines filled in with green or yellow. Other sherds have underglaze overslip decoration consisting of rust lines only. Still others are slipped and glazed only.

The dates given for this ware’s appearance in Pimeria Alta are about or after 1780 to 1830 (Caywood 1950:85; Gerald 1968:84; Barnes 1975:34). According to Barnes (1975:34), the restricted distribution of this ware to northwestern New Spain indicates that it is a distinct style, made in western Mexico, with a definite span of production. The potter’s lack of control over the glaze, as evidenced by its poor quality, may be a factor in the ware’s relatively short (about 50 years) period of production. Fourteen percent of the Tonala polychrome sherds recovered came from Level 2, the late nineteenth-early twentieth century provenience. The 1830 end date given for the manufacture of this ware seems too early for its appearance in Level 2, suggesting that Tonala polychrome may have had a longer period of manufacture. Alternatively, these sherds could represent the discard of an old object.

Miscellaneous Mexican Lead-glazed Earthenware. Eight sherds are probably Mexican lead-glazed earthenware. Seven are redwares, and all are from wheel manufactured tablewares. Plates, and possibly one bowl, are identifiable; a minimum number of five vessels is represented. Two rim sherds are from plates with approximate diameters of 7-1/8 in. and 10-1/2 in. These sherds' paste color ranges from buff to pink to terra-
cotta. The paste contains fine to medium temper, and usually has some spalling or air holes. Some of the sherds' paste also have a carbon streak. Five sherds are unglazed. Two have clear glaze covering the interior, and one sherd's exterior is also partially covered with glaze. These two sherds have a reddish glazed-paste color.

The eighth sherd is a body sherd covered on both surfaces with a transparent, glossy pea green glaze. The paste is a very light buff and has a carbon streak but no temper, spalling, or air holes. This sherd may be a type of Mexican green lead-glazed earthenware; however, the paste is unlike that of the sherds identified as this ware. These sherds of miscellaneous Mexican lead-glazed earthenware were either locally made or imported from Mexico.

Mexican lead-glazed earthenware comprises 43 percent of the nonindigenous ceramic assemblage from Tumacacori. The distribution of sherds recovered through time indicates that the ware appears throughout the site's occupation but was most frequent during the mission period (Table 14). Thirteen percent of the excavated sherds came from early mission horizon deposits and 61 percent were recovered from late mission horizon deposits. Eighteen percent were recovered from the late nineteenth and early twentieth century provenience.

"Olive Jar" Earthenware

Twenty-three sherds are definitely from "olive jars," and two more are apparently from this type of ware (Table 11). "Olive jars" are large, amphora-shaped vessels with heavy walls, constricted necks and small mouths, primarily used for storage and transportation of liquids such as olive oil and wine, foodstuffs such as olives in brine, condiments and vegetables, and other goods, especially lard and tar. Additionally, they were used as water jars, construction fill, and architectural finials (Goggin 1960:6). Although their exact place of manufacture is not known, Goggin (1960:5) states that Early and Middle style vessels were almost certainly made only in Spain (Andalusia), and that the Late style vessels were possibly made in the Americas as well as in Spain. Groggin (1960) contains a comprehensive discussion of this type of ware.
Table 14

DISTRIBUTION OF NONINDIGENOUS CERAMICS THROUGH TIME

(Number Recovered from Dated Provenience
(Percentage of Total Number Recovered From Dated Proveniences)

<table>
<thead>
<tr>
<th>TIME PERIOD</th>
<th>MAJOLICA</th>
<th>MEXICAN LEAD-GLAZED EARTHENWARE</th>
<th>&quot;OLIVE JAR&quot; EARTHENWARE</th>
<th>ORIENTAL EXPORT PORCELAIN</th>
<th>PAPAGO GLAZED WARE</th>
<th>ANGLO WARE</th>
<th>UNIDENTIFIED</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Mission Horizon (ca 1750-ca 1800)</td>
<td>23</td>
<td>(43%)</td>
<td>(65%)</td>
<td>(25%)</td>
<td>(4%)</td>
<td>(3%)</td>
<td></td>
<td>56</td>
</tr>
<tr>
<td>Late Mission Horizon (ca 1800-ca 1850 and later to ca 1900)</td>
<td>21</td>
<td>(39%)</td>
<td>(20%)</td>
<td>(31%)</td>
<td>(83%)</td>
<td>(47%)</td>
<td>(100%)</td>
<td>137</td>
</tr>
<tr>
<td>Late 19th-Early 20th Centuries</td>
<td>5</td>
<td>(9%)</td>
<td>(18%)</td>
<td>(10%)</td>
<td>(25%)</td>
<td>(13%)</td>
<td>(22%)</td>
<td>40</td>
</tr>
<tr>
<td>20th Century</td>
<td>5</td>
<td>(9%)</td>
<td>(8%)</td>
<td>(5%)</td>
<td>(19%)</td>
<td>(28%)</td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>Total Recovered from Dated Deposits</td>
<td>54</td>
<td>108</td>
<td>20</td>
<td>16</td>
<td>23</td>
<td>32</td>
<td>7</td>
<td>260</td>
</tr>
</tbody>
</table>
Tumacacori yielded only body sherds ranging in thickness from 5/16 in. to 5/8 in. An estimate could not be made of the number of vessels represented or their shapes and sizes because the sherds are too small and nondescript. The thin, hard, lead glaze varies in color from very dark green (almost black), to dark moss green or dark emerald green. Five sherds are glazed on both the interior and exterior. Nineteen of 20 sherds completely glazed on the interior have vestiges of a white or cream-colored slip on the exterior. Some of these slipped sherds show small splotches of green glaze on the exterior, presumed to be accidental. One sherd, glazed on the interior, also has an apparent splash of red paint in addition to the exterior white slip. If the red paint is part of a maker's, seller's, user's, or some other kind of mark, it cannot be identified. Although Goggin (1960:11) notes that painted red identification marks on "olive jars" are common on Early style vessels (dating about 1500-1580), this sherd is considered to be from a Middle style vessel (dating about 1580-1780) or possibly a Late style vessel (dating about 1780 to 1850 or later) on the basis of its thickness (9/16 in.) and its recovery from this site.

Dating Tumacacori's "olive jar" earthenware sherds is very difficult. Goggin's (1960) dates are primarily based on vessel size and shape, properties that cannot be determined from the Tumacacori sherds. On the basis of known site occupation, the sherds of "olive jar" earthenware recovered are thought probably to be from Middle or Late style vessels.

Six percent of Tumacacori's nonindigenous ceramic assemblage is "olive jars." Its scarcity is probably a reflection of supply and transportation problems. The amount of the ware recovered is too small for its distribution to be meaningful. However, 65 percent of the ware recovered from excavation came from early mission horizon deposits and late horizon deposits dating about 1800. Ten percent came from late mission horizon deposits dating after about 1800, suggesting the ware's use throughout the site's occupation but its decline in availability after about 1800. Table 14 summarizes the ware's distribution through time.
Oriental Export Porcelain

This ware is distinguished from European porcelain by its grayish-blue, grayish-green, or off-white glazed body color. Objects were hand-made, either with a mold or on the wheel, and hand decorated (Palmer 1976:13, 14). Twenty-four oriental export porcelain sherds were recovered (Table 11). It is possible that some of this ware is Japanese. Often, it is virtually impossible to identify small sherds as either Chinese or Japanese. Japanese export porcelain sherds have been found during excavations in Tucson, indicating the ware's presence in southern Arizona (Tucson Urban Renewal Collection). Some of the decorated oriental export porcelain sherds from Tumacacori are definitely Chinese, and some are probably Chinese. William Liesenbein assisted in identifying many of the sherds recovered.

The trade in oriental porcelain, successfully manufactured in China since before the sixteenth century, was a large and profitable Spanish enterprise during the seventeenth and eighteenth centuries (Caywood 1950:84-85; Palmer 1976:25; Barnes 1976:161). Chinese blue-on-white wares formed a large bulk of this trade, and large quantities were brought to Mexico. In the Americas, oriental goods actually cost significantly less than Spanish and Mexican ware because much of these shipments remained in the Spanish colonies (Snow 1965:26; Olsen 1978:9; Caywood 1950:84). During the eighteenth and early nineteenth centuries, large quantities of oriental porcelain were also imported into the United States, first by the English and later by Americans (Miller 1972:77; Palmer 1979:11). American trade with China began to decline after 1830. However, during the 1840's, 1850's, and later, oriental goods continued to enter the United States, primarily through the port of San Francisco, along with the influx of Chinese workers (Palmer 1976:25-26). The expanding oriental population in the West and Southwest and the establishment of permanent communities helped to spread this ware (Olsen 1978:47).

As the above discussion indicates, oriental export porcelain found on southwestern sites may have been brought by the Spanish, Americans, or Oriental immigrants. Since Tumacacori is a mission site established by Spanish missionaries and abandoned by its Indian population in 1848, the sherds recovered are probably from vessels that were imported into
Mexico, then brought or exported to the mission for the resident priest. However, it is possible that some of these sherds could have been deposited after site abandonment by Americans or Chinese workers passing through or stopping there. Sherds found in upper excavation levels could be from ware used by convento "schoolhouse" residents during the early twentieth century.

Oriental export porcelain may be divided into two groups based on decoration. The object may have underglaze cobalt blue decoration or overglaze polychrome decoration (Caywood 1950:84-85). The overglaze polychrome wares were reportedly more expensive than the underglaze blue-on-white (Miller and Stone 1970:86; Palmer 1976:15). Although eighteenth century Chinese export porcelain varied considerably in glaze and decoration, the quantity of these wares made specifically for the export trade began to decline toward the end of the century (Miller and Stone 1970:86; Noel Hume 1970:261). Olsen (1978:44) notes that very little stylistic change can be detected in utility wares, and early decorative styles and techniques can and do appear on modern (twentieth century) objects. Sherds of both underglaze blue-on-white and overglaze polychrome decorated ware were recovered.

**Underglaze Blue-on-White.** Twelve sherds with underglaze cobalt blue decoration were found. Eight of these sherds, representing at least four vessels, have the "Canton" rim design and are definitely Chinese (Noel Hume 1970:257-262; Miller and Stone 1970:81-82). All of the sherds are apparently from tableware and are decorated on the exterior only. Objects with the "Canton" pattern were first made sometime during the 1792-1800 period and were sold as late as 1911 (Noel Hume 1970:261-262; Wilson 1966:41-43).

One sherd, probably from a plate, displays a portion of the pseudo-Chinese "Willow Pattern" on the interior. The decorative style indicates that this sherd is probably "Nanking" or "Canton" ware, (therefore, Chinese) and dates from the late eighteenth and early nineteenth centuries (Miller and Stone 1970:82; Noel Hume 1970:261-263). Noel Hume (1970:262-263) writes that the "Willow Pattern" was made with both the "Canton" and "Nanking" style border. The Tumacacori sherd probably had the "Canton" style border since other sherds were found with that rim
design. "Willow Pattern" objects did not appear before 1792. The design, reportedly conceived by Thomas Minton at Caughley, England, was shipped to China for use on export porcelain, and the products were then exported back to England for distribution (Noel Hume 1970:130, 261).

Another sherd, from a holloware vessel, has overglaze gilt highlighting the underglaze blue decoration. It is definitely from a Chinese export porcelain object. About 1700 to 1780, much underglaze blue-on-white Chinese porcelain also had overglaze decoration in red, highlighted with gilding (Noel Hume 1970:258). This decorative technique was used throughout the nineteenth and into the twentieth centuries.

Overglaze Polychrome. Noel Hume (1970:259) states that "entirely overglaze-decorated wares are most common in the second half of the 18th century and often display elaborate motifs..." Unfortunately, the eight sherds recovered from Tumacacori are too small to identify the complete decorative motif (Fig. 28). Three sherds have overglaze red decoration and are almost certainly Chinese export wares. One of these sherds has an overglaze brown band on top of the rim (Fig. 28). Sometimes after 1722, such bands were added to protect the rim from chipping or scaling during shipping and handling (Cox 1970:544). An alternative function of these bands was to cover the rim because the glaze would not remain there during firing. These three sherds represent at least two objects, one of flatware and one of holloware.

A rim sherd from a holloware object has a geometrical design on the exterior just below the rim in overglaze black and red, and a foliate design on the body in overglaze green and black (Fig. 28). Miller and Stone (1970:86) describe a similarly decorated sherd with overglaze green leaves outlined in black dating from about 1725-1775. Alternatively, on the basis of the rim design, this sherd could date from the eighteenth to the early nineteenth century.

Four sherds are probably Chinese export ware. One, from a flatware object, has a floral design on the exterior in overglaze red and black. Apparently a third color has worn off leaving a matte residue. The other sherd has overglaze decoration in red, black, or brown, and light green (Fig. 28).
Other Wares. Two other sherds are from rice bowl bases. The interior of one sherd has a hastily painted overglaze red floral decoration. These sherds are presumed to be Chinese export porcelain based on comparison with known Chinese export ware.

Unclassified Wares. Four undecorated sherds are assumed to be either from undecorated objects or from the undecorated parts of decorated vessels. One sherd is a small piece of a foot ring. The unglazed edge has a distinct orange color. Apparently, Chinese export porcelain of the 1725-1775 period often has unglazed, slightly rough, orange-colored foot rings (Miller and Stone 1970:81). The foot ring could also be an example of "roasted" porcelain (William Liesenbein: personal communication). The other three sherds are probably Chinese instead of Japanese since the decorated sherds recovered are Chinese.

Like "olive jar" earthenware, oriental export porcelain was scarce at Tumacacori, comprising only 6 percent of the nonindigenous ceramic assemblage. This situation is surprising since it was supposed to be cheaper than Spanish or Mexican ware. Perhaps the more fragile porcelain was too difficult to transport. Not enough of this ware was recovered for the distribution to be meaningful. However, it is notable that 25 percent came from early mission horizon deposits and deposits from the late horizon dating about 1800 (Table 14).

Papago Glazed Ware. As discussed previously, the indigenous pottery industry was influenced by Hispanic culture. An example of this influence is the use of manure as ceramic temper. Another example is ceramic glazing. The glazed, Indian-made ceramics appearing on Pimeria Alta sites are called "Papago Glazed Ware" (Fontana et al. 1962:103-104) (Figure 29c-g). This designation is retained, because Fontana notes that "Papagos recognized the ware as Papago," although the more general term "Piman wares" is used for the other indigenous ceramics of the area (Fontana et al. 1962:104). There is no mention in the literature of Pima or Sobaipuri manufactured glazed ware (Fontana et al. 1962; Doyel 1977; Russell 1908; Di Peso 1951, 1953, 1956). Papago Glazed Ware has been described as consisting of "a green glaze added to a typical broadline Papago (Piman)
Red-on-brown" (Fontana et al. 1962:103-104). The green color reportedly results from adding copper to what is apparently a lead glaze (Fontana et al. 1962:144).

Fontana notes that this pottery's development and manufacture were apparently inspired by Franciscan priests, or that it dates from the Franciscan period because Papago Glazed Ware sherds appear in the vicinity of, and associated with, missions (Fontana et al. 1962:104). According to Caywood (1950:94), native ware with green glaze may be found on village, presidio, and mission sites. The temporal distribution of Papago Glazed Ware is relatively uncertain. Fontana places the ware in Ceramic Complex Period I, dating 1700-1860, but notes that its appearance "is believed to be restricted to A.D. 1790 to 1850," apparently on the basis of its archeological context (Fontana et al. 1962: 104).

A total of 30 Papago Glazed ware sherds (29 definite, one possible), representing at least seven objects, were recovered from Tumacácori (Table 11). All the sherds are from tableware vessels; however, one sherd has exterior sooting, indicating use of the ware for cooking. Holloware forms such as bowls, cups, and serving dishes make up almost the entire assemblage. Two sherds are possibly from a flatware dish, and one sherd was identified as possibly coming from a jarro chocolatero (chocolate pot) (Fig. 29). Body sherds number 24, and rim sherds number 6. All sherds show evidence of having been manufactured by hand, using paddle-and-anvil and molding techniques described by Fontana et al. (1962:58). One sherd has the vestiges of a joint, indicating hand molding with or without a form. The thickness of the body sherds varies between 0.4 cm and 0.8 cm. A few sherds have been burned, and one has sooting on the exterior, indicating the vessel's use for cooking. The physical features of the sherds vary considerably and are discussed below.

Paste color ranges from coarse, carbonaceous black to dark gray, to terra-cotta with a carbon core. Occasional air holes and slight spalling occur. Organic temper, presumably manure, is present in all sherds studied. Mica is also present and may have been used as a tempering agent.

The treatment of the unglazed surface varies from untreated to only smoothed to smoothed and polished. Half of the sherds are smoothed on
both the interior and exterior. Five sherds have smoothed exteriors only, and one is untreated. Six sherds also have been polished. The surface treatment of four sherds could not be determined.

The glaze ranges from transparent glossy to matte, and the color ranges from pea green to dark emerald green to dark green to dark brownish-green to dark olive green. The glaze's matte appearance is presumed to result from wear or from a mistake in glaze composition or firing. Variation in color results from differences in composition of the glaze batch. Rims are always glazed, although the appearance of glaze and painted red decoration varies on the interior and exterior surfaces just below the rim. Only one body sherd is glazed on the interior only. The rest are either glazed on the exterior only or on both the exterior and interior. On some sherds, the glaze covers the entire surface. On others, only part of the surface has been glazed, the other areas either being left unglazed and undecorated, or having painted decoration consisting of red lines.

Most of the painted red lines appear to be straight bands, following and accenting vessel form. Only a few sherds have gently curving red bands or painted decoration that does not take the form of a band. It appears that the green glaze may cover virtually the entire interior and/or exterior surfaces of the vessel. Other sherds have only bands of glaze, the rest of the surface apparently being undecorated. One sherd has black lines painted between the red decoration and glaze. Although Fontana et al. (1962:104) discuss the presence of "dark, nearly black" areas resulting from glaze running onto the red decoration, examination of the above sherd under a 10x hand lens shows that the black lines are indeed painted. The exterior of a sherd that may be from a flatware object is unglazed and unsmoothed and has a painted broadline band. The rest of the surface on either side of the band is covered with a worn, transparent, pea green glaze. On some sherds, the glaze has chalky, white splotches, reportedly areas where the glaze has oxidized. One sherd, possibly Papago Glazed Ware, has unusual paste, a carbon core, and a dark metallic gray slip on the interior. According to Fontana, oxidized glaze may appear metallic gray (Fontana et al. 1962:104). Alternatively, the gray may be intentional smudging or a slip.

Because of the sherds' small size, only the forms of the rim sherds
were identifiable. Rim sherd characteristics are summarized in Table 15. Two rims, one straight and one apparently everted and flaring were identified as probably being bowl rims. The surfaces of both sherds are smoothed but not polished, and the everted and flaring rim has an interior red band. This sherd displays transparent, glossy/matte, pea green glaze bands on the exterior and on the rim. The straight rim sherd shows a transparent, glossy, brownish-green glaze on the interior.

Comparison of another everted rim sherd with an illustration in Fontana et al. (1962:45) indicates that the vessel was a serving dish. Its diameter was about 5-7/8 in. The sherd's surfaces have been smoothed, and the interior surface apparently also has been polished. A painted red band appears on the exterior rim base, and transparent, partially matte, partially glossy pea green glaze appears on the rim and as bands on both the interior and exterior surfaces. The sherd seems to have vestiges of a rim coil.

Another everted rim sherd is from a handled cup or jarro choclatero (chocolate pot) (Di Peso 1953:184) approximately 5-1/2 in. in diameter (Fig. 29b). The entire sherd is covered with a badly worn or misfired, transparent pea green glaze. The jarro choclatero was a common Spanish copper object. According to Di Peso (1953:185), the form was popular during the seventeenth and eighteenth centuries and continued into the early nineteenth century. The fifth rim sherd is everted and flaring and is probably from a bowl. Both surfaces have been smoothed, and the interior surface may also have been polished. The sherd is covered with a transparent, partially glossy/partially matte, pea green glaze, except for the area on and just below the rim coil seam where a painted red band appears. The last sherd is very slightly inverted (almost straight) and may be from a bowl or plate. All surfaces have been smoothed. A brownish-green glaze, partially matte/partially glossy, appears on the rim and covers most of the interior and exterior surfaces.

Papago Glazed Ware comprises 8 percent of the nonindigenous ceramics recovered. Not enough sherds were found for the distribution to provide definitive information, although the Tumacacori sherds generally support the dates for the ware's appearance given by Fontana et al. (1962) and indicate that Papago Glazed Ware was most common during the period when the 1821 Mexican Revolution disrupted supply routes and Mex-
### Table 15

**PHYSICAL CHARACTERISTICS OF PAPAGO GLAZED WARE RIM SHERDS**

<table>
<thead>
<tr>
<th>RIM SHERD</th>
<th>VESSEL FORM</th>
<th>VESSEL DIAMETER (cm)</th>
<th>RIM FORM (Colton Type)</th>
<th>RIM SHERD THICKNESS (cm)</th>
<th>RIM COIL PRESENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Probably bowl</td>
<td>--</td>
<td>Straight (IV A3)</td>
<td>.4</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>Probably bowl</td>
<td>14</td>
<td>Everted and flaring (IB3)</td>
<td>.8</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>Serving dish</td>
<td>15</td>
<td>Everted (IB10)</td>
<td>.4</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>Jarro Chocolatero (chocolate pot)</td>
<td>14</td>
<td>Everted (IIIB10)</td>
<td>.4</td>
<td>Yes</td>
</tr>
<tr>
<td>5</td>
<td>Bowl</td>
<td>26</td>
<td>Everted and flaring (IB3)</td>
<td>.7</td>
<td>Yes</td>
</tr>
<tr>
<td>6</td>
<td>Bowl or plate</td>
<td>20</td>
<td>Slightly inverted (IIIA4)</td>
<td>.7</td>
<td>No</td>
</tr>
</tbody>
</table>
ican wares were difficult to obtain in northern Pimeria Alta. One sherd (4 percent of the assemblage) is from early mission horizon deposits. Eighty-three percent were recovered from late mission horizon deposits. Thirteen percent (three sherds) were recovered from the late nineteenth early twentieth century deposit (Table 14).

**Anglo Ceramics**

Fifty-seven Anglo ceramic sherds, representing at least 17 objects, were recovered from Tumacacori (Table 11). Fifty-four are white earthenware, one sherd is from a creamware object, and two sherds are probably Anglo porcelain. The term "white earthenware" refers to pottery with a whitish paste that is in various stages of vitrification and that is covered by a thin, hard, transparent glaze. This category includes Ironstone China, Stone China, Semi-Porcelain, Opaque Porcelain, White Granite, Pearlware, etc., because at present, these varieties can only be distinguished by a visual examination if they are specifically marked (William Liesenbein: personal communication). According to Noel Hume (1970:123), creamware is a "thin, hard-firing, pale yellow or cream-colored earthenware, which, after a preliminary firing, could be dipped in a clear glaze." On the basis of their white glazed body color, two porcelain sherds were classified Anglo porcelain. However, one or both sherds could be oriental. Stitt (1974:149, 153, 154-156, 170) notes that porcelain objects with "pure white" bodies are known to have been made in Japan.

Anglo ceramic objects were wheel manufactured, or made by casting clay in preformed molds. The sherds recovered from Tumacacori are from objects presumably manufactured in Europe (Holland, France, Germany, and Great Britain) or in the United States. The two porcelain sherds were probably made in America or Great Britain, although they could conceivably be German, French, or Austrian. This presumption is made on the basis of Anglo white earthenware sherds recovered from excavations in southern Arizona (Tucson, Tubac, Fort Bowie, and Guevavi) for which the country of origin (those countries listed above) is known (William Liesenbein: personal communication; personal examination of a portion of the Tucson Urban Renewal Collection; Herskovitz 1978:96-110; Barnes
1976:161-162). Since the identifiable makers' marks on Anglo white earthenware sherds recovered from Tubac are all British (Shenk and Teague 1975:98), it is likely that Great Britain is also the country of origin of Tumacacori's sherds. Only tableware forms were identifiable, i.e., sherds from cups, bowls, flat plates, soup plates, serving dishes, and saucers (Butler Brothers 1915:250-284).

During the eighteenth century, British potters perfected manufacture of white earthenware and creamware, and Great Britain began to export these products to the United States (Noel Hume 1970:125, 129-130). Apparently, the United States' white earthenware and creamware industries did not become firmly established until the 1850's. Until that time, the United States market for these ceramics is thought to have been supplied mainly by Great Britain (Tucson Urban Renewal Collection; William Liesenbein: personal communication). European porcelain, first made in the early eighteenth century, could not compete with the cheaper oriental product until the 1750's (Palmer 1976:9). English porcelain was imported into America during the late eighteenth century. The United States began to establish its own industry after China trade began to decline in the early 1800's. By 1875, a true American porcelain industry had been established (Miller 1972:76, 79).

Although the Spanish colonial government banned the import of foreign wares, these European ceramics could have entered New Spain through the burgeoning black market of the 1790's and later. The 1824 trade treaty legalized the import of European products into Mexico. These goods subsequently flooded the Mexican market (Gerald 1968:54) and could have reached northern Pimeria Alta. Also, American trappers entering southern Arizona during the Mexican Period could have discarded Anglo ceramics in their wake (Russell 1908:30). However, Anglo ceramics on southern Arizona sites are thought to date post-1850 since the area's Anglo population did not begin to increase until after the Gadsden Purchase made southern Arizona a part of the United States. The railroad lines built during the 1880's brought Anglo products to southern Arizona in increasingly large quantities.

Anglo white earthenwares may be divided into two categories, white-white and blue-white earthenware, based on the presence or absence of a bluish tint to the glaze. There is disagreement in the literature con-
cerning the manufacture and distribution of white-white and blue-white earthenwares. The following sources have more information: Jewitt (1970); Collard (1967); McGuire (1979). The Anglo white earthenware sherds recovered were divided into white-white earthenware, blue-white earthenware, and creamware by comparing the sherds against a white index card. The designation of these categories by sherd color is somewhat arbitrary because the criteria for distinguishing the categories, as found in the literature, are not objective, and sherds recovered in excavation usually have a wide range and subtlety of tint (McGuire 1979: 32). For this analysis only those sherds with distinctly bluish or greenish tint were categorized as blue-white earthenware or creamware respectively. Some of the sherds classified as white-white earthenware could be placed into one of the other two categories. The decorated white earthenware sherds are discussed according to the decorative technique used.

Undecorated Anglo Ceramics. Thirty-six undecorated sherds were classified as white-white earthenware and five as blue-white earthenware. Except for two white-white earthenware rim sherds that may have been gilded, the sherds are either from undecorated objects or are from the undecorated parts of decorated objects. The one sherd classified as creamware and the two Anglo porcelain sherds are also undecorated.

Decorated White Earthenwares. All 14 of these sherds are apparently white-white earthenware. Two sherds are hand-painted underglaze in blue. One of these sherds, from a holloware object, has interior decoration consisting of two thin horizontal bands. The other sherd, from a cup, has exterior medium blue floral decoration and rim band (Fig. 28c). One rim sherd, from a holloware object, was decorated with an overglaze polychrome print floral pattern in red, green, and brown. Comparison of this sherd to other, similarly decorated sherds for which manufacture dates are known (Tucson Urban Renewal Collection) indicates that the Tumacacori sherd's decoration is of a style produced during at least the 1891-1921 period.

A sherd of banded dipped ware from a "London" shaped object was recovered (Fig. 28d). Decoration consists of two underglaze, horizon-
tal, parallel bands, one red and one blue. Since Britain is the only country known to have made this shape, the object is assumed to be of British manufacture. Apparently first made around 1813, "London" shape objects were still manufactured around 1972 (Coysh 1972:78). Ten sherds have underglaze medium blue transfer printed decoration. Two of these sherds apparently have interior decoration known as "flowing" or "flown blue" or flow blue. Alternatively, the decoration could be a poorly executed transfer print. Apparently devised in Britain sometime in the 1820's, ware with this type of decoration is also known to have been made in the United States, France, Belgium, and Holland (Little 1969:21; Williams 1971:12-210). The latest known flown blue object is British and was made sometime during 1912-1936 (Williams 1971:172; Godden 1964: 367).

One rim sherd, form unidentifiable, and a body sherd from a plate have the "standard Willow Pattern" border. Although this border appeared on objects with the "standard Willow Pattern," it is also known to have been used with a non-Willow Pattern central motif (Coysh 1971: 80). Objects with the "standard Willow Pattern" border are known to have been made from about 1795-1805 to the present (Coysh 1971:30; William Liesenbein: personal communication). The designs of eight underglaze medium blue transfer printed earthenware sherds could not be identified, and these sherds are all considered to date no earlier than the 1780's (Little 1969:15-16; Noel Hume 1970:128-129; Coysh 1971:18, 76).

Anglo ceramics form the third largest group of nonindigenous ceramics recovered, comprising 15 percent of the assemblage. Forty-seven percent of the excavated sherds came from late mission horizon deposits dating about 1800 (Table 14). These fifteen sherds could have reached Tumacacori during this early period through the black market or from Anglos passing through the area. However, the sherds' presence in these early deposits also could have resulted from rodent activity or drift. One sherd was recovered from early mission horizon deposits. Twenty-two percent of the excavated sherds came from deposits dating to the late nineteenth and twentieth centuries. Most of this ware was probably brought to the site by residents of the converted part of the convento reportedly used as a schoolhouse from 1900-1929. Some may have been the property of the "old American" who was living at Tumacacori in 1861 (Browne 1869:150) or may have been deposited by people passing through.
Unidentified Sherds

Eight sherds could not be identified. Seven appear to be sherds of badly overfired or misfired alkaline- or lead-glazed ware. Both the interior and exterior surfaces are dull and pitted and have a slightly metallic cast. The paste is dark gray and very hard, almost approaching stoneware. Temper consists of medium to large quartz crystals, and, in five sherds, is of organic material. All are body sherds and range from 0.9 to 1.5 cm thick. On the basis of their thickness, the sherds, suggestive of "olive jars," are probably fragments of storage vessels. Their manufacturing technique could not be determined. All these sherds are from late mission horizon deposits dating from about 1800.

The eighth sherd is a rim, neck, and shoulder fragment of a large, presumably utilitarian vessel (Fig. 29c). The sherd is enigmatic because the paste is typical of sewer pipe salt glaze, or salt glaze alkaline stoneware which usually has a brown slip on the interior, and, as the name implies, is used for sewer pipe (William Liesenbein: personal communication). However, this sherd has no slip and apparently is a vessel fragment. The sherd could be atypical American salt glazed stoneware with Albany slip. However, its recovery from Level 4, dating about 1800, makes that identification unlikely.

Discussion

The distribution of Tumacacori's nonindigenous ceramics substantiates the historical record and reflects fluctuations in supply and availability of particular wares suggested by records. Distribution of these wares through time is summarized in Table 14. The large quantity of Mexican ceramics (55 sherds), and the paucity of Anglo wares (1 sherd) in early mission horizon deposits and late horizon deposits dating about 1800, suggests that most of the available pottery was being manufactured in Mexico. The increase of Anglo wares in nineteenth century deposits (15 sherds) suggests that trade had expanded. However, Mexican wares are still the majority ceramic recovered. The distribution of ceramics in twentieth century deposits is difficult to interpret because the deposits' contents reflect contemporary stabilization activity. As a result of this activity, some of the deposits' sherds were probably incorporated into these later levels from earlier strata dis-
urbed by the stabilization work. However, the ceramics recovered do indicate that Anglo and Mexican products were about equally available.

The forms of the pottery recovered tell something about their use by the site's residents, and at Tumacacori, use of nonindigenous ceramics was apparently concurrent with form. The assemblage consists overwhelmingly of tablewares (90 percent), and most of these were apparently used exclusively for eating. Only 10 percent of the sherds, represented primarily by "olive jar" sherds, come from storage vessels. Some wares, like majolica, were used for altar service. Less than 1 percent of the sherds recovered have exterior sooting, indicating the vessel's use in food preparation instead of food consumption.

The composition of Tumacacori's imported nonindigenous ceramic assemblage in part reflects the residents' priorities. The discrepancy in the quantity of tableware and storage vessel (packaging container) sherds recovered suggests that the acquisition of civilization's trappings, such as a set of fancy dishes, was a status, and possibly class, symbol that was more important than obtaining such products as prepared foods. Frontier resources could produce adequate, if not satisfactory, substitutes for more civilized fare. For example, the fat of cattle substituted for butter and the juice of the soapberry tree was processed into soap (Treutlein 1949:55-56; 100). Apparently, local products were not acceptable substitutes for glazed Hispanic wares, and, judging by the few "olive jar" sherds, the population apparently spent a larger part of its resources acquiring these desired household items instead of on imported foods. Alternatively, indigenous ceramics, such as ollas and jars, may have been used to package and transport luxury foodstuffs instead of "olive jars" and other Hispanic wares. If so, the quantity of imported packaged foods reaching the frontier may have been greater than indicated by documents or artifacts.

In addition to reflecting mission residents' priorities, the assemblage's composition, summarized in Table 11, gives information about Pimeria Alta's ceramic industry. The majority (62 percent) of the wares recovered are Mexican products, and almost all the sherds recovered are from wheel manufactured vessels thought to have been produced on a large scale in urban manufacturing centers for distribution throughout New Spain. Only two sherds of molded Mexican lead-glazed earthenware sherds
were recovered. Such objects are thought to have been produced for local distribution by rural family businesses stimulated by the Catholic church in response to the demands of adjacent communities. Investigations of other southern Arizona sites have produced molded Mexican wares but no evidence that they were manufactured in northern Pimeria Alta. Apparently, these wares also were imported from Mexico along with the wheel-manufactured products. This absence of a local Mexican glazed ceramic industry on the frontier where these products were obviously desired by residents could reflect low population, lack of adequate resources, difficulties of establishing such a business in a harsh frontier environment, or the presence of other wares that provided an adequate substitute. The manufacture of Papago Glazed Ware could have been an attempt, possibly unsatisfactory as indicated by the relatively small amount recovered, to establish a rural Hispanic glazed ware industry.

Glass

Glass fragments account for 42 percent (542 sherds recovered) of the nonindigenous assemblage. Container (bottle) glass, flat glass, household and tableware fragments, and glass trade beads were collected (Table 16). Except for the glass beads, no whole objects were recovered or reconstructible. Most of the glass recovered was very small fragments. Only a few specific container or tableware forms were identifiable; therefore, few attempts were made to identify more than the general bottle or tableware form and its use. The use categories used here are the same as those used to catalogue the bottles in the Tucson Urban Renewal Collection.

The technology of glass manufacture and of container, window (flat) and tableware production has been discussed previously and will be summarized here only as it applies to the Tumacacori assemblage. Jones (1971a and b), Munsey (1971), Noel Hume (1970), Scoville (1948), Shenk and Teague (1975), Toulouse (1969a and b) have detailed discussions of manufacturing techniques and dates of technological changes. Sherds with no maker's mark or with an unidentified maker's mark are presumed to be American, Mexican, or less likely, European. Most of the glass recovered is apparently American made (comparison with known American
<table>
<thead>
<tr>
<th>GLASS TYPE</th>
<th>NUMBER RECOVERED FROM EXCAVATION</th>
<th>NUMBER RECOVERED FROM SURFACE COLLECTION</th>
<th>TOTAL NUMBER RECOVERED</th>
<th>PERCENTAGE OF GLASS ASSEMBLAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottle</td>
<td>415</td>
<td>96</td>
<td>511</td>
<td>94%</td>
</tr>
<tr>
<td>Flat</td>
<td>5</td>
<td>11</td>
<td>16</td>
<td>3%</td>
</tr>
<tr>
<td>Household and Tableware</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>1%</td>
</tr>
<tr>
<td>Beads</td>
<td>7</td>
<td>2</td>
<td>9</td>
<td>2%</td>
</tr>
<tr>
<td>Unidentified</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Total</td>
<td>430</td>
<td>112</td>
<td>542</td>
<td>100%</td>
</tr>
</tbody>
</table>
made glass objects from the Tucson Urban Renewal Collection). End dates given for the use of a manufacturing technique are only approximate and actually more accurately represent the end of the popularity or widespread use of the particular technique in the commercial glass industry.

In the following section, container (bottle) glass sherds will be discussed first and then flat (window) glass, housewares and tableware, trade beads, and miscellaneous sherds.

Container Glass

A total of 511 glass container sherds were recovered. Included in this group are sherds from containers manufactured by hand (blown free hand or by a person into a mold) and by machine. Most of the sherds from objects hand blown into a mold were too small to identify the kind of mold used. However, sherds from objects blown in two-piece molds were recovered.

Form. Sherds of beer, pharmaceutical, food, liquor, toiletry, soda, and wine bottles were recovered. The "Export Beer" style beer bottle and the "Brandy Finish Dandy" liquor bottle were the only specific kinds of bottles identifiable. The "Export Beer" style beer bottle apparently dates no earlier than 1873-1875 and presumably was first manufactured by American bottle makers (Putnam 1965:250; Anderson 1973:111). Tumacacori's bottles are probably the "earlier style" and apparently date no later than about 1933 (comparison with specimens from the Tucson Urban Renewal Collection). Based on comparison with whole bottles having identical bases (i.e., the same maker's mark and base form) from the Tucson Urban Renewal Collection, one partial bottle base recovered is almost certainly from a "Brandy Finish Dandy" liquor bottle (Putnam 1965:170). The size of this base indicates that it probably was a half-pint bottle. The whole liquor bottles examined with identical bases were all finished for cork closures.

Finishes. Five partial bottle finishes recovered are for crown cap closures. The crown cap was invented in three stages in the years 1889, 1890, and 1891 with the 1891 form being the one in use today (Lief n.d.:17). All three forms were patented in 1892 (U.S. Patent Office 1892:618). In 1893, it was advertised in the American Brewer for use on beer bottles (Baron 1962:244, 370). The crown cap was manufactured in Great

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Britain from 1897 until, presumably, the present (Davis 1968:48; personal observation of crown caps on imported British products for sale in 1981). Of the five crown cap finishes recovered, two were machine-made and one was hand-tooled. The manufacturing technique of the remaining two cannot be determined. Other identifiable container finishes recovered are one handmade "sheared" finish, probably from a medicine or pharmaceutical bottle; one "beer" finish and two "brandy" finishes, both for a cork and probably from "Export Beer" style beer bottles; and two finishes possibly from food bottles (Putnam 1965:20; Herskovitz 1978:5; Tucson Urban Renewal Collection).

**Color.** Green, amber, flint (including sun-turned amethyst), dark green, opal, and black glass container sherds were recovered. These glass colors, except "sun-turned amethyst," are original bottle maker's terms, derived from reprints of bottle maker's catalogues found in the following sources: Putnam 1965; Whitall, Tatum and Co. 1971; Illinois Glass Company n.d.; Tibbits 1969; Wilson and Wilson 1969; Wilson 1972; and Knittle 1927.

**Green.** Tumacacori yielded 235 green glass container sherds. "Green" glass results from natural impurities in the glass batch ingredients. Green glass bottles are light colored containers of various shades of green, blue, and combinations of green and blue. They were produced in the United States, Great Britain, and Mexico (Weeks 1895: 311, 316-317; Aldcroft 1968:311; personal examination of a whole specimen from the Tucson Urban Renewal Collection known to have been manufactured in Mexico). Green glass sherds from soda, liquor, beer, and pharmaceutical bottles were recovered from Tumacacori.

**Amber.** One hundred one sherds of amber glass were found. "Amber" refers to glass of various shades of brown, yellow-brown, or red-brown. Amber glass containers are known to have been produced in the United States at least as early as the first half of the nineteenth century and in Great Britain (Weeks 1895:311, 316-317; Wills 1974:52). Amber glass beer bottle sherds were recovered at Tumacacori.

**Flint.** Tumacacori yielded 119 flint glass sherds. Twenty were "sun-turned amethyst." "Flint" glass has had a chemical added that suppresses the natural color and results in a colorless or clear glass (Munsey 1970:37). During the nineteenth century, manganese dioxide was
often used, especially in commercial container production, to produce clear glass. The disadvantage of this method was that the glass turned a shade of purple or amethyst when exposed to the ultraviolet rays of the sun (Munsey 1970:55). The term "sun-turned amethyst" refers to flint glass that has turned a shade of amethyst from exposure. American bottle makers stopped using manganese dioxide around World War I and began to use other decolorizing agents that did not change color appreciably when exposed to the sun (Munsey 1970:55; Toulouse 1969:534). Commercial flint glass containers are known to have been produced in the United States and Great Britain in the eighteenth century. Apparently, United States flint container production was limited until around 1880, at which time the demand for clear glass bottles began to increase (Munsey 1970:55). Flint glass sherds from food, pharmaceutical, and toiletry bottles were found.

**Dark Green.** Fifty-three dark green glass sherds were recovered. The term "dark green" refers to glass that is medium to dark green or greenish-yellow in appearance. Dark green glass bottles are known to have been produced in the United States and Great Britain (Wills 1974: 52; Putnam 1965:31). Dark green glass sherds, probably from wine or liquor bottles, were recovered.

**Opal.** One body sherd from an opal (or milk glass) container was recovered. Opal glass containers are known to have been produced in the United States.

**Black.** Only two black glass sherds were found at Tumacacori. "Black" glass appears black in reflected light but is actually very dark amber or dark green when viewed in direct light (Wilson and Wilson 1969: 85; Wilson 1972:172; Weeks 1895:311, 316-317; Munsey 1970:37). Black glass bottles were produced in Great Britain in the seventeenth century (Noel Hume 1961:102) and in the United States in the first half of the nineteenth century (Knittle 1927:245). Sometime after 1800, the British black bottle trade declined (Aldcroft 1968:311). United States production of black glass apparently ceased sometime during the 1890's; (Weeks 1895:311, 316-317). However, in about 1971, "refined" black glass was reportedly used for commercial containers (Jones 1971:11).

Some Tumacacori sherds identified as dark green or amber glass may actually be from black glass bottles. Their small size and fragmentary
condition make it impossible to identify them as black glass. One black glass bottle fragment has been flaked into a rough projectile point that apparently was never hafted or used (Fig. 30a). This object was recovered from a late mission horizon deposit.

Bases. Thirteen whole or partial bottle bases were recovered at Tumacacori. Four are from machine-made containers, seven were hand-made, and the manufacturing technique of two could not be determined. Seven had evidences of wear, indicating reuse through reutilization and/or recycling. The bases of both hand mold blown and machine-made bottles were worn.

Makers' Marks. Only four bases recovered have makers' marks (Fig. 31). The "S.B. & G. Co." maker's mark, found on an almost certain "Export Beer" style beer bottle base, was used by the Streator Bottle and Glass Company of Streator, Illinois (Toulouse 1971:461; Fig. 32a). Established in 1881, the firm ended in 1910 and apparently used the mark throughout its existence (Sherwood 1979; Inter-State Publishing Company 1886:577; Toulouse 1971:461). The firm apparently made "Export Beer" style bottles at least as early as 1888 and is known to have been manufacturing them in 1902 (Inter-State Publishing Company 1886:577; Anonymous 1888:1; Anonymous 1902:28). The Tumacacori specimen was hand-blown into a two-piece post-bottom mold (Toulouse 1969a) and has no finish. It was found in the historic trash lens that appeared in Level 13 near Feature 10 (Fig. 17).

One base has the "VM monogram" which has been identified as a mark of the firm Vidriera de Monterrey, located in Monterrey, Nuevo Leon, Mexico (Fig. 31). This firm, established in 1909, was still in existence in 1968, and is presumed to have been succeeded by the cartel Vidriera Monterrey about 1969 or by about 1971 (Fontana 1968:47-49; Toulouse 1971:13, 518-519, 593). According to Fontana (1968:48), the firm initially made only beer bottles, although later, other kinds of bottles were also made. The mark on the Tumacacori specimen is partly obscured by a suction machine cut-off scar, but is similar to one of the firm's marks illustrated in Fontana (1968:47, Fig. 1).

It is not known which firms used the "F" and "B" marks. The "F" mark appears on the base of a flint, automatic machine-made bottle (Fig. 31). The bottle was probably a beer or soda bottle (comparison with
Fig. 30: Glass and Metal Artifacts;
    a, worked black glass sherd;
    b, pewter shoe buckle; c, button;
    d, Mexican quarter real; e, button;
    f, button; g, h, i, "tinklers"; j, bullet;
    k, unknown hinge; l, rosehead nail;
    m, unidentified object, possibly ornament;
    n, unidentified brass object, possibly part of
       a piece of furniture. Length of n is 2-1/2 in.
Fig. 31: Bottle Makers' Marks.
whole specimens in the Tucson Urban Renewal Collection). Toulouse (1971:20) states that the "F" mark was used by the Fairmount Glass Works of Fairmount and Indianapolis, Indiana. This firm began in 1898, 1900, or by about 1904, and was succeeded by the Fairmount Glass Works, Inc., about 1934 (Toulouse 1971:200–201; R. L. Polk & Co. 1933:479; R. L. Polk & Co. 1934:488). According to Toulouse (1971: 201), the Fairmount Glass Works used the "F" mark from "1930 to 1934." In 1945, the Fairmount Glass Works, Inc., replaced it with an "F" in a hexagon. However, the "F" in a hexagon was actually first used in 1933 on "Glass Bottles and Jars" (U.S. Patent Office 1934:789) and, as stated above, the Fairmount Glass Works actually ended around 1933. If Toulouse's statement is correct concerning the use of the "F" mark by the Fairmount Glass Works and that its use was succeeded by the "F" in a hexagon, then the above information would mean that the "F" mark was used no later than about 1933. The Fairmount Glass Works was making flint glass bottles as early as about 1904 and as late as about 1933 (Toulouse 1971:201; R.L. Polk and Company 1933:479). Alternatively, the mark may also be that of an unidentified glass maker, user, or merchant, or it may be a mold designation.

The "B" mark which appears on the base of a flint, automatic machine-made liquor bottle (Fig. 31d) is probably a "Brandy Finish Dandy" whiskey flask (Putnam 1965:250). The "B" mark is unidentified but presumed to be the mark of an American bottle maker, user, or merchant, or it could be a mold designation.

Thirteen embossed body sherds were recovered, but all were too small to identify the markings. Fragments of container glass comprise 94 percent of the glass recovered (Table 16). All the glass found is apparently from the nineteenth and twentieth centuries. Sherds for which the manufacturing technique could be identified were made by methods used in the 1820's and later. Table 17 summarizes the distribution of the glass sherds recovered through time. Seven percent of the container sherds came from early mission horizon and late mission horizon deposits. The distribution of the remaining glass reflects its increased availability in northern Pimeria Alta in the late nineteenth and twentieth centuries. Deposits dating during this period contained 77 percent of the glass recovered.
Table 17
DISTRIBUTION OF GLASS THROUGH TIME

<table>
<thead>
<tr>
<th>TIME PERIOD</th>
<th>BOTTLE GLASS</th>
<th>FLAT GLASS</th>
<th>HOUSEHOLD/ DOMESTIC GLASS</th>
<th>GLASS BEADS</th>
<th>UNIDENTIFIED</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Mission Horizon (ca 1750–ca 1800)</td>
<td>21</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>(7%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(7%)</td>
</tr>
<tr>
<td>Late Mission Horizon (ca 1800–ca 1850 and later to ca 1900)</td>
<td>43</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>--</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>(14%)</td>
<td>(25%)</td>
<td>(100%)</td>
<td>(57%)</td>
<td></td>
<td>(16%)</td>
</tr>
<tr>
<td>Late 19th-Early 20th Centuries</td>
<td>79</td>
<td>1</td>
<td>--</td>
<td>2</td>
<td>1</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>(27%)</td>
<td>(25%)</td>
<td></td>
<td>(29%)</td>
<td>(100%)</td>
<td>(27%)</td>
</tr>
<tr>
<td>20th Century</td>
<td>152</td>
<td>2</td>
<td>--</td>
<td>1</td>
<td>--</td>
<td>155</td>
</tr>
<tr>
<td></td>
<td>(52%)</td>
<td>(50%)</td>
<td></td>
<td>(14%)</td>
<td></td>
<td>(50%)</td>
</tr>
<tr>
<td>Total Recovered from Dated Deposits</td>
<td>295</td>
<td>4</td>
<td>1</td>
<td>7</td>
<td>1</td>
<td>308</td>
</tr>
</tbody>
</table>
Flat Glass. Fifteen flat glass sherds were found. Thickness varied from 1/32 to 3/32 in. Seven sherds with thicknesses varying from 1/32 to 3/64 in. came from deposits dating from the late nineteenth and twentieth centuries. Apparently, the flat glass sherds recovered post-date the mission's occupation. With the exception of one dark green sherd, the sherds are green and almost certainly window glass.

Tableware and Housewares. One fluted fragment of "sun-turned amethyst" glass from the top of a decorative lamp chimney was recovered. The object was probably manufactured no later than the 1920's. A fragment of gray pressed glass from a tableware object or household item was found. A machine for pressing glass was patented in 1827. The grainy appearance and stippled background of this fragment indicates it may be an example of early, pre-1850 pressed glass (Lorrain 1968:38). Lorrain (1968:38) states that by 1845 "pressed glass was common in American households." Two glass mirror sherds (1/8 in. thick) were recovered from the surface around the picnic ramada near the Visitor Center. They are considered to be modern and are probably fragments from a pocket mirror.

Glass Trade Beads. Nine glass trade beads were found at Tumacacori. Glass beads were one of the first items of Spanish culture to reach the Native Americans of Pimeria Alta. Spaniards traded glass beads in the Southwest as early as the 1540's, and Father Kino distributed beads and other items during his 1701 journey from Mexico to the Colorado River (Sorenson and LeRoy 1968:36). These ornaments were used to obtain Indian good will, as payment for services, and to purchase things considered by white men to be valuable (Quimby 1966:81; Sorenson and LeRoy 1968:35-36). Many trade beads were used by white women to decorate various objects (Woodward 1965:10).

From the sixteenth century until around the first half of the nineteenth century, most glass beads traded in North America came from the glass factories of Murano, Venice, although beads made in Amsterdam, France, and Czechoslovakia have also been found (Woodward 1965:4). Present data indicate all beads recovered from American sites (1850 and earlier) were probably imported (Noel Hume 1970:53).
Most glass trade beads were manufactured by two methods. Drawn, bugle, or cane beads are produced by the hollowcane method in which a bubble was introduced into the gathered glass which was then pulled into a long, thin hollow tube. After cooling completely, the tube was broken and chopped into various lengths. The beads were left as they were or underwent various processes, such as faceting and tumbling, to shape or decorate them. Drawn beads may show a slight taper in diameter from the middle to the ends (Spector 1976:20–21; Kidd and Kidd 1970:49; Sorenson and Leroy 1968: 39).

To make wire or mandrel-wound beads, the glass was drawn into a long, solid rod and then broken into small segments (Spector 1976:21; Sorenson and Leroy 1968:39). Each segment was reheated with a glass blowing lamp, and threads drawn out from the segments were then wound around a prepared iron or copper mandrel (wire) until a bead of the desired shape and size was formed (Spector 1976:21; Sorenson and Leroy 1968:39). Beads made by this method often have circular striations where the threads were wound around the wire (Spector 1976:21; Sorenson and LeRoy 1968:39).

Beads were also made by pressing glass into a mold or shaping it with a tool (Sorenson and LeRoy 1968:39). Beads manufactured in a mold may have a mold mark. See Spector (1976), Sleen (1967), Kidd and Kidd (1970), Woodward (1965), and Sorenson and LeRoy (1968) for more detailed information on glass bead manufacture.

The following description of glass beads recovered at Tumacacori is based on the outline in Spector (1976). Each specimen's dimensions are given in order of length (maximum distance between the ends), width (maximum distance across the center of the bead, perpendicular to the length), and bore (perforation diameter).

(1) Green faceted bead
Dimensions: 8 mm, 9 mm, 2.5 mm
Color: translucent green
Shape: barrel (Sleen 1967:34)
Surface characteristics: badly worn and scratched, but no patination
Decoration: faceted (Total number of facets is 28.)
Manufacturing Technique: hollowcane, faceted, tumbled

This is a short bead (Sleen 1967:33). Apparently the entire bead is faceted, not just the ends. It could, therefore, be a "multifaceted" bead (Sleen 1967:38) or a "cut" bead (Woodward 1965:10). This bead is similar to one recovered at San Buenaventura Mission from deposits thought to date 1816-1850 (Greenwood 1975:68).

(2) Red faceted bead

Dimensions: 5.5 mm, 7 mm, 0.5 mm and 2 mm
(The bore on each end of the bead is a different size.)
Color: translucent ruby red
Shape: truncated bicone (Sleen 1967:34)
Surface Characteristics: badly worn and scratched, with some patination
Decoration: faceted (Total number of facets is 28.)
Manufacturing Technique: Presumably hollowcane, faceted, tumbled

This is a short bead (Sleen 1967:33). Apparently the entire bead is faceted, not just the ends. It could, therefore, be a "multifaceted" or a "cut" bead. This bead is similar to one recovered at San Buenaventura Mission from upper levels of fill dating post-1870 (Greenwood 1975:74).

(3) Greenish-blue faceted bead

Dimensions: 5 mm, 6 mm, 2.5 mm
Color: translucent greenish-blue
Shape: cylindrical (Sleen 1967:34)
Surface Characteristics: Glass is rough and heavily patinated.
Decoration: faceted (Total number of facets is six.)
Manufacturing Technique: hollowcane and faceted. This bead has not been tumbled.

This is a short bead (Sleen 1967:33). Just the ends have been faceted. The surface between the facets on the ends is uncut, although it appears to be faceted. Apparently Woodward
(1965:10) calls this type "O.P." beads or short "bugles." Although these beads are known as "Russian" beads or "Russian-type" beads, particularly in the Northwest (Noel Hume 1970:54; Sorenson and LeRoy 1968:45-46), Woodward (1965:12) seems to indicate that only the "dark, rich ultra-marine" blue beads should be called "Russian" beads. These types of faceted beads date to around the first half of the nineteenth century, around the mid-1800's, or as late as into the 1870's (Noel Hume 1970:55; Sorenson and LeRoy 1968:45-46; Woodward 1965:10).

(4) Smokey amber faceted bead
Dimensions: 5 mm, 6 mm, 3 mm
Color: translucent smokey amber (grayish brown)
Shape: cylindrical (Sleen 1967:34)
Surface Characteristics: There are nicks in the surface of both ends. One end appears to have been melted, presumably during tumbling. Bead is lightly patinated and scratched.
Decoration: faceted (Total number of facets is six.)
Manufacturing Technique: hollow cane, faceted, and tumbled
This is a short bead (Sleen 1967:33). Only the ends have been faceted. The surface between the facets on the ends is uncut, although it appears to be faceted. For discussion of this type of faceted bead, date, and recovery from other sites, see above.

There is some controversy concerning the method(s) used to produce faceted beads (Steen 1967; Woodward 1967). I could not determine which, if any, of these methods was used to produce the faceted glass beads recovered. Noel Hume (1970:54) states that the most common beads of the first half of the nineteenth century are multifaceted beads that are generally shorter than their diameter.

(5) Dark blue "pony" bead
Dimensions: 3 mm, 3 mm, 0.5 mm
Color: opaque dark blue
Shape: barrel-shaped, with both ends rounded and slightly concave (Sleen 1967:34)
Surface Characteristics: scratched and lightly patinated
Decoration: none
Manufacturing technique: hollowcane and tumbling

This is a standard size bead (Sleen 1967:33). It is referred to as a "pony" or "pony trader" bead and appears on the western plains of the United States in the very early 1800's (Sorenson and LeRoy 1968:40, 44; Woodward 1965:12).

(6) "Fancy" bead
Dimensions: 3 mm, 4.5 mm, 1.5 mm
Color: opaque dark blue exterior and opaque light blue interior (core)
Shape: globular oblate (Sleen 1967:34, 38)
Surface Characteristics: heavily patinated
Decoration: Two bronze- or gold-colored glass threads forming two raised spiral decorations appear on the exterior surface. The threads have not been marvered into the dark blue glass, but only adhere to the surface.
Manufacturing Technique: mandrel-wound

This is a short bead (Sleen 1967:33). It falls into a category of various-sized beads called "fancy" beads for which dates range from the early nineteenth century and earlier into the second half of the eighteenth century. According to Woodward (1965:13), many varieties of "inlaid fancy" beads were traded from the Great Plains, north and west to the Pacific coast during 1800-1830 and on into the 1860's.

(7) Molded, dark blue bead
Dimensions: 23 mm, 5 mm, 2 mm
Color: opaque dark blue
Shape: cylindrical, with two convex ends (Sleen 1967:36)
Surface Characteristics: Patinated. What may be a mold mark appears on the exterior surface slightly off-center.
Decoration: Entire surface is covered with ridges or grooves that run parallel to the length of the bead.
Manufacturing Technique: hollowcane and pressed into a mold. The ends are broken and jagged. Alternatively, it could have been blown into a mold.

This is a long bead (Sleen 1967:33).
(8) "Cornaline d'Aleppo" or "white heart": two recovered, (one whole, one half)

Dimensions: 6 mm, 8 mm, 2 mm and 7.1 mm, 8 mm, 1.2 mm

Color: translucent brick red exterior and opaque white interior (core)

Shape: globular oblate (Sleen 1967:34, 38)

Surface Characteristics: One bead has a small, deep nick in the surface, and the exterior glass has marks apparently from stretching the glass threads. The surface of one bead is heavily patinated. The surface of the other bead is nicked and scratched.

Decoration: none

Manufacturing Technique: mandrel-wound

These are short beads (Sleen 1967:33). These beads are also called "under-whites," "late Hudson's Bay," and "California trade beads" (Woodward 1965:19; Sleen 1967:85; Sorenson and LeRoy 1968:44).

According to one source, such beads appeared no earlier than the 1840's and later in the western United States (Sorenson and LeRoy 1968:44). However, during excavations at San Buenaventura Mission, similar beads were recovered from deposits thought to date 1816-1850 (Greenwood 1975:62). Woodward (1965:19) states that these beads were "widespread in the latter part of the first half of the 19th century."

Glass trade beads form only 2 percent of Tumacacori's glass assemblage (Table 16). One bead was recovered from a late mission horizon deposit, and another came from a twentieth century deposit. Six were scattered in nineteenth century deposits. No beads were recovered from early mission horizon deposits. Trade beads may have been a late introduction at Tumacacori. The small number and scattered distribution of the beads recovered suggests that they were lost rather than discarded, although the Cornaline d'Aleppo from Feature 7, broken beyond use, was probably discarded. Alternatively, the small sample size may be the result of the relatively small area excavated or the loss of beads through screens during excavation.
Miscellaneous Glass Fragments

Two body sherds could not be classified as either container or tableware and household glass because of their small size or unusual color. One sherd, recovered from a late mission horizon deposit dating post-1800, is a bright sapphire blue color. Another sherd, emerald green, came from an early mission horizon deposit.

Discussion

Shenk and Teague (1975:113) note that glass containers were not available on the Spanish frontier in any quantity until after 1850 when American interests and improved transportation systems penetrated the area. It is not surprising that glass was scarce in Pimeria Alta during the Spanish Colonial and Mexican periods. Glass is difficult and, therefore, expensive to ship. Sturdier containers like Spanish "olive jars," Mexican lead-glazed earthenwares, and indigenous storage vessels would have made more appropriate shipping containers. This situation is reflected by the presence of ceramic storage jar sherds in mission period deposits where glass is virtually absent. Fontana (1968:53) notes that eighteenth and nineteenth century Pimeria Alta mission inventories lack glass items, especially bottles. At Tumacacori, 6 percent of the glass sherds were found in early mission horizon and late mission horizon deposits dating about 1800. Although these sherds may have been deposited during the mission period, their presence could also be the result of rodent activity or drift. Data from the Tucson Urban Renewal Collection and from the Tubac Presidio excavation indicate that not only the quantity but also the variety of bottles and other glass objects available to southern Arizona greatly increased after the railroad came to Tucson in 1880. The Tumacacori assemblage also reflects this situation. Glass sherds recovered from late mission horizon deposits comprise 14 percent of that period’s nonindigenous assemblage, and those from the late nineteenth-early twentieth century deposit comprise 27 percent (Table 17). Over half of the bottle glass dates to the twentieth century.
Metal

Tumacacori yielded 335 metal artifacts, totaling 26 percent of the nonindigenous assemblage. Table 18 summarizes the metal objects recovered. The condition of the metal recovered ranged from good to extremely poor. In some cases, deterioration was so advanced that a detailed analysis of the object could not be done. Metal artifacts probably dating from the mission period are discussed first, followed by objects dating from the late nineteenth and twentieth centuries. Most of these later artifacts are related to stabilization activities, although some may have been deposited during the time the south convento was used as a schoolhouse. Others of these artifacts may be related to later monument period resident activity. These recent period artifacts have been divided into the following functional groupings based on use: household and domestic items, personal items, hardware, weapons, and scrap. Finally, unidentified objects are discussed under a miscellaneous category.

Mission Period Metal Artifacts

Eighteen metal artifacts recovered probably date from the mission period. This group includes household and domestic items, personal items, hardware, ornaments, coins, and scrap. An ornamental brass hinge measuring 2-1/2 in. long, with a maximum width of 1-1/3 in., was recovered (Fig. 30k). The hinge was cast and then worked. The eye on the back was brazed on. Two copper pins, one in each arm, held the item with which the hinge articulated. On the basis of its small size and ornamental appearance, it may have been part of a small, personal object such as a trunk, rather than a piece of building hardware such as a door or window hinge. Alternatively, it could have been a drawer pull or a desk top hinge (Mark Barnes: personal communication).

Two metal buttons recovered may date from the mission period. One is about size 22 and may be the type Olsen (1963:553) dates 1785-1800 since the soldered eye has no foot. This is a spun-back type flat, copper button with a one piece shank and die. The other button is brass and may be what Olsen (1963:552-553) calls a "bullet button" and dates 1812-1830 (Fig. 30). Only one partial handwrought rosehead nail, in
Table 18
METAL (RECOVERED FROM SURFACE COLLECTION AND EXCAVATION): COUNTS AND PERCENTAGES

<table>
<thead>
<tr>
<th>METAL ARTIFACTS</th>
<th>NUMBER RECOVERED FROM EXCAVATION</th>
<th>NUMBER RECOVERED FROM SURFACE COLLECTION</th>
<th>TOTAL NUMBER RECOVERED</th>
<th>PERCENTAGE OF METAL ASSEMBLAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mission Period</td>
<td>18</td>
<td>-</td>
<td>18</td>
<td>5%</td>
</tr>
<tr>
<td>Household and Domestic</td>
<td>14</td>
<td>1</td>
<td>15</td>
<td>4%</td>
</tr>
<tr>
<td>Personal Items</td>
<td>13</td>
<td>3</td>
<td>16</td>
<td>5%</td>
</tr>
<tr>
<td>Hardware</td>
<td>174</td>
<td>24</td>
<td>198</td>
<td>59%</td>
</tr>
<tr>
<td>Weapons</td>
<td>5</td>
<td>-</td>
<td>5</td>
<td>2%</td>
</tr>
<tr>
<td>Scrap</td>
<td>59</td>
<td>18</td>
<td>77</td>
<td>23%</td>
</tr>
<tr>
<td>Unidentified</td>
<td>6</td>
<td>-</td>
<td>6</td>
<td>2%</td>
</tr>
<tr>
<td>Total</td>
<td>289</td>
<td>46</td>
<td>335</td>
<td>100%</td>
</tr>
</tbody>
</table>
very poor condition, was recovered (Fig. 30). According to Nelson (1968:n.p.), handwrought nails were used throughout the seventeenth and eighteenth and into the early twentieth centuries. One lead stud or roofing nail, measuring 1 in. long and apparently identical to those recovered from Quiburi (Di Peso 1953:214), was also found.

A fragment of an iron object that apparently is a sickle was recovered. Its very poor state of preservation and fragmentary condition prevented definite identification. Di Peso (1953:191) states that "the short iron sickle blade has remained unchanged in its form since the 17th century" and that they "are a common sight in the markets of 20th century Mexico, even as they were at the mission establishments of Sonora and California in the 17th and 18th centuries." A large piece of rolled copper that could possibly be a tool base fragment was found. Di Peso (1953:190-191) illustrates a similar object and suggests it may be from a copper ox goad base, a farming implement used in mission times to clean mud from the plough share and "as an aid in holding the goad upright when it was plunged into the earth. This same type of ox goad is still made in Mexico today."

A horseshoe nail was recovered. According to Di Peso (1953:213), Spanish Colonial horseshoe nails were made in Mexico and were very expensive. However, Robinson (1976:169) states that on the frontier, nails were made of scrap iron and could be produced locally by any blacksmith. Two ferrous objects recovered may be parts of link hinges (Fig. 30). According to Di Peso (1953:213, 215), these pieces of hardware were used during the eighteenth century and were made from pieces of copper or iron. The metal was driven into wood to form a loop, and another piece of metal was hooked inside the loop and driven into a second piece of wood, thereby linking the two. One hand-cut copper washer was also recovered.

Two copper one-quarter-real coins minted in Hermosillo, Mexico, were found. One coin was minted in 1834. It has a hole through it that may be either a counterstamp, used for devaluation, or a puncture put into the coin so that it could be strung on a string or worn as a pendant (Fig. 30). The other coin has no date stamp but is the type of real minted in Hermosillo from 1832-1836 (Utberg 1963:66). Both coins are in extremely poor condition.
One piece of lead scrap was recovered. According to Robinson (1976:169), lead scrap found on Spanish Colonial sites "usually indicate(s) melting of lead to make ammunition." Lead scrap from the Spanish Colonial period may have come from mines in the Tombstone area, which, according to Di Peso (1953:199), were the source of the lead scrap found at Quiburi.

Three pieces of rolled copper, apparently ornamental objects, were found (Fig. 30). These small, flat copper pieces, rolled and fused to form cylinders, may be "jingles" or beads. Similar objects were recovered from Guevavi, and Robinson (1976:169) suggests they were harness ornaments that hung from the straight side bars of the mouth bit and jingled when the horse moved. Di Peso (1953:192-193) calls these harness ornaments "jingling ornaments" and states that they were not used by the military after about 1785 but continued to be used by civilians until the 1860's. Alternatively, these objects could be beads traded to the Indians or made by them from copper scraps (Woodward 1965:14, 16).

According to Di Peso (1953:203), such conical metal tinklers were "once widespread in primitive America as adornment for a garment fringe, a pouch trim, or the end of an awl case. Prior to the arrival of the Europeans, native copper was used for this purpose. . . ." Length varies from 1/4 to 11/16 in. and diameter from 5/16 to 1/2 in.

Late Nineteenth and Twentieth Century Metal Artifacts

Household and Domestic Items. Fifteen fragments of at least nine identifiable objects were grouped under this heading. This category contains packaging containers, items of personal hygiene, and hardware for interior furnishings.

Of the nine artifacts in this group, six are packaging containers or parts of containers. All are in very poor condition and are devoid of labels or embossing. Six fragments representing at least one partial tin can were recovered. The can is a post-1900 crimped seam type. The numerous holes in the sides indicate its use for target practice. Part of a round metal can lid, approximately 1-5/8 in. in diameter, and the top of a tobacco can measuring 7/8 in. x 3 in. x 1/4 in. were recovered. A roll strip can opener of the type developed about 1895 and in use today (Fontana and Greenleaf 1962:71, 89) was recovered, as were two
partial crown cap bottle closures. This closure was previously dis-
cussed in the section on glass finishes. The crown cap was offered for
sale commercially as early as 1893 and within ten years "began to be
widely used as a closure on bottles of beer and numerous carbonated bev-
erages" (Faubel 1941:69).

Other household and domestic items recovered include three items of
personal hygiene, two hairpins (including a "bobbie" pin) and a protect-
ed coil type safety pin (Butler Brothers 1915:494). The safety pin is
1-1/2 in. long, and the hairpins are 2 in. long. A lead tube embossed
"INFLAMMABLE" on the shoulder was also found. The tube has fragments of
a yellow label and is assumed to have contained glue.

Personal Items. Sixteen objects classified as personal items were
recovered at Tumacacori. This category contains clothing fasteners and
apparel ornaments.

Of the three buttons found, one brass button is undecorated. It is
about size 20, and its condition of preservation is very poor. The re-
maining two buttons are decorated. One is size 27, ferrous, and con-
cave, with four holes formed by crisscrossing metal strips in the center
(Fig. 30f). It is decorated along the edges with a stipple and line
design. The design consists of three equidistant triangles, each with a
series of lines resembling rays. The button's form is suggestive of the
Army trouser type button used after 1875 that was recovered from the
Tubac Presidio (Shenk and Teague 1975:129). The other brass button,
about size 19, has embossed decoration on the top and stamped letters on
the back. The design consists of a central flower surrounded by six
dots and a line with pendant dots around the outer edge (Fig. 30e).
This specimen's condition of preservation is poor, and the inscription
on the back is neither complete nor clear. The inscription reads "______ GILT . TREBLE" and could only be partially identified.

Five metal rivets, a snap fragment, a lacing hook, a strap holder,
and a shoe aglet were also recovered. All the rivets are clothing fas-
teners and are in extremely poor condition. Although they were probably
initially embossed, no markings are now identifiable. Four are two-
piece rivets similar to the "flat, stamped-steel types" recovered at
Tubac (Shenk and Teague 1975:129). Shanks measure 1/2 in. and head
diameter is 5/8 in. The fifth rivet, also a clothing fastener, is
three-piece. The shank measures 1/2 in., the head diameter is 3/8 in., and the burr diameter is 1/4 in. The rivets are in place in four of the five specimens recovered, and all post-date 1860 (George Teague: personal communication). The ferrous snap fragment and brass lacing hook are still manufactured. The ferrous strap holder consists of a bar with two rivets on each end, presumably to keep the holder in place. Its size (1-1/4 in. long) indicates that it may have been part of a set of suspenders. The apparent aglet consists of a soft, nonferrous metal (Bruce Huckell: personal communication).

Three buckles, one partial and two whole, were recovered. The partial buckle frame has an embossed, rope-like decoration on the front. A small (7/16 in.) pewter buckle possibly for a shoe has embossed bumps (Fig. 30b). The other whole buckle is ferrous, and although it is similar to a military trouser buckle apparently dating from 1875 (Herskovitz 1978:37, 38, Fig. 12c), the embossing is different. Instead of the embossed maker's mark appearing on the middle bar, the Tumacacori specimen has an embossed decoration consisting of stippled and three five-pointed stars on the top bar and nothing on the middle bar. A harmonica plate fragment embossed "The Band B_____" was found. In appearance, it is similar to harmonica plates illustrated in the 1915 Butler Brothers catalogue (Butler Bros. 1915:309-310).

**Hardware.** This category contains building construction items, farming tools, and horse gear. Representing the largest category of metal objects recovered from Tumacacori, it contains 197 objects.

Machine-cut square and wire nails were recovered. The distribution of the nails recovered from excavation is summarized in Table 18. Fontana and Greenleaf (1962); Nelson (1968); Robinson (1976); and Shenk and Teague (1975) contain information on nail manufacturing technology. A summary of the sizes and numbers of each size of machine-cut square and wire nails appears in Table 19. The sizes given are representative of the machine-cut and wire nail samples since the size of many of the specimens could not be determined, either due to extreme corrosion or the partial condition of the nail.
The transition from wrought to machine-cut nails occurred during the period 1790 to 1830. Nails were first cut by machine in 1790, although they were headed by hand until 1825 (Fontana and Greenleaf 1962:54). Wire nails were introduced in the 1850's, but American wire nail machinery was not perfected until the 1890's (Nelson 1968:n.p.; Fontana and Greenleaf 1962:55). According to Nelson (1968:n.p.), "wire nails did not really become the dominant type until the 1890's, and many builders preferred using cut nails well into the 20th century." Although wire nails are the most commonly used nail today, cut nails are still used for specialized purposes (Nelson 1968:n.p). Seventeen machine-cut square nails ranging in size from 3d to 9d were recovered. Forty-eight wire nails were found at Tumacacori, ranging in size from 2d to 20d. Thirteen other specimens recovered are thought to be nails, but their condition is too poor to determine their manufacturing technique. Some may actually be pieces of wire.

Five tacks were recovered. The three roofing tacks are 7/8 in. long. The one furniture tack is 9/16 in. long, and the white enameled thumbtack is 11/32 in. long. An iron or steel staple found was probably used for fencing or roofing. Part of a partial, probably handwrought iron spike, in badly corroded condition, and part of a common machine bolt with a round head were found. One copper washer, apparently hand-cut, was recovered.

Two nuts, a heavy-duty wing nut for a 1/2-in. bolt or threaded rod and what is probably a cap nut, were found. A grommet, made of what is probably a lead or zinc alloy, has a diameter of about 1 in. and a hole diameter of about 1/2 in. It presumably was used for plumbing fixtures.
Ninety-nine pieces of wire, consisting of individual pieces and pieces that have been twisted together, were found. Eighty-six percent of the wire recovered from dated proveniences came from late nineteenth-early twentieth and twentieth century deposits; mission period deposits contained only 14 percent. Most of the specimens were less than 10 in. long and appear to be baling wire or heavy, galvanized, smooth fence wire. All specimens are made of iron or steel and diameters ranged between 0.065 and 0.119 in. Three wire specimens with diameters ranging from 0.138 in. to 0.153 in. are handles, probably from paint or lard buckets.

Four artifacts have been categorized as farming tools or horse gear. Comparison with an illustration in Di Peso (1953:191) indicates that one iron object is apparently a sickle fragment. Its very poor state of preservation and fragmentary condition prevent definite identification. The head and part of the shank of a carriage-type bolt were recovered, and a square steel nut, probably from a farm implement or wagon, was also found. The nut has a 3/16-in. hole. A horseshoe nail was recovered.

Four objects were identified as tools or parts of tools. Two hack-saw blade fragments were recovered. One fragment has 24 teeth to the inch, and the other has 14 teeth to the inch. A fragment from a trowel, 4-3/8 in. x 2-1/3 in., with remains of what may be cement or lime plaster, was recovered. Alternatively, the material could be lime that had leached onto the blade from surrounding soil. An object similar to a washer but having three equidistant projections was found. Although unidentified, we presume it is part of a tool or mechanical object. It may, in fact, be a lock washer.

Weapons. Five weapon-related artifacts were recovered. The knife or dagger tip recovered is in such a poor state of preservation that it could not be determined whether it is single- or double-edged.

Three firearm cartridge cases were found. The two .45-70 cartridge cases are from external center fire rounds. One has been fired. Its headstamp indicates manufacture by the Frankfort Arsenal, Philadelphia, in October, 1882. The other cartridge case is unfired. Its headstamp indicates manufacture by the Frankfort Arsenal in June, 1893 (Hackley et al. 1967:298; Barnes 1965:67). The .45-70 cartridge was adopted in 1873.
by the United States military with the single shot "trap door" Springfield rifle and was the official service cartridge for 19 years. Many state militias were armed with .45-70 Springfields well beyond 1900, and military arms and ammunition were "readily available to the civilian population of southern Arizona during the late 1800s" (McGuire 1979:61). It was also a popular sporting cartridge.

The .22 Short cartridge case recovered is from a fired rimfire cartridge with a "P" headstamp, indicating manufacture by the Peters Cartridge Company of Cincinnati, Ohio (Logan 1954:190). The "P" headstamp was registered by the Peters Cartridge Company on February 26, 1895, and had been in use since January, 1895 (U.S. Patent Office 1895:1194). Since this firm was purchased by Remington Arms Company, Inc., in 1934 (Williamson n.d.:204; Vinson 1968:91), I presume that the "P" headstamp was not used after that date. According to Logan (1954:60), rimfire cartridges "were used in both military and sporting rifles, revolvers and carbines."

A single-grooved, lead, conical bullet, about .44 caliber, was recovered (Fig. 30j). It weighs 187 grains (12.72 grams).

Scrap. Seventy-seven pieces of scrap metal (26 percent of the metal artifacts found) were recovered. Most of the 56 pieces of ferrous scrap are probably fragments of tin cans or buckets. Some pieces are likely iron stripping or reinforcement. Twenty-one pieces of copper scrap and stock were recovered. The copper stock shows evidence of having had pieces cut out, probably for patches. One rectangular piece of copper, 2-5/8 in. long, 15/16 in. wide, and 1/8 in. thick, has a hole drilled at one end. Other copper scrap pieces could be the result of mining activity or melting the metal for reworking. Metal was scarce on the frontier and was reused many times before being discarded. Copper stock was particularly useful for repairing copper pots and pans (Shenk and Teague 1975:116; Di Peso 1953:215).

Miscellaneous. Six objects could not be identified due to their fragmentary condition. Three ferrous objects are probably parts of hardware; two of these are possibly tools. One nonferrous object, a folded sheet of brass, was also recovered. The fifth object, which was ferrous, may be part of a trigger guard bow, a knife pommel, or a handle (Bruce Huckell: personal communication). The last object is a small
curved piece of brass wrapped with a brass thread (Fig. 30m). It may be part of a larger mechanism, or it could be an earring or some other ornament.

Discussion

As noted by Shenk and Teague (1975:127), metal was scarce on the frontier because it was too heavy and bulky a cargo for the mule trains that transported supplies to Pimeria Alta during the mission period. Table 20 summarizes the distribution of the metal recovered through time. Nineteen percent of Tumacacori's excavated metal came from mission period deposits. The amount of metal recovered decreased from early to late mission horizon deposits (25 percent of the early horizon nonindigenous assemblage to 17 percent of the late horizon assemblage). Possibly this decrease was partly the result of the political and social upheavals that characterized the 1810-1850 period, totally disrupting the frontier supply system.

<table>
<thead>
<tr>
<th>TIME PERIOD</th>
<th>PERSONAL</th>
<th>HOUSEHOLD/ DOMESTIC</th>
<th>HARDWARE</th>
<th>SCRAP</th>
<th>OTHER</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Mission Horizon (1750-ca 1800)</td>
<td>13</td>
<td>(16%)</td>
<td>4</td>
<td>(9%)</td>
<td>(27%)</td>
<td>(13%)</td>
</tr>
<tr>
<td>Late Mission Horizon (ca 1800-ca 1850 and later to ca 1900)</td>
<td>4</td>
<td>(44%)</td>
<td>12</td>
<td>(15%)</td>
<td>(27%)</td>
<td>(22%)</td>
</tr>
<tr>
<td>Late 19th-Early 20th Centuries</td>
<td>1</td>
<td>(12%)</td>
<td>17</td>
<td>(22%)</td>
<td>(20%)</td>
<td>(19%)</td>
</tr>
<tr>
<td>Total Recovered from Dated Deposits</td>
<td>9</td>
<td>4</td>
<td>79</td>
<td>45</td>
<td>11</td>
<td>148</td>
</tr>
</tbody>
</table>
Because so little metal was recovered, we can only speculate about its availability to mission residents. The sample suggests that metal was never present in any large quantity at Tumacacori. Most of the metal recovered (61 percent) is associated with twentieth century modification and repair of the structures. Even in the late nineteenth-early twentieth century deposit, this artifact group comprised only 19 percent of the deposits' nonindigenous assemblages.

The metal artifact type recovered most frequently was hardware, comprising 59 percent of the assemblage, and the second largest group was scrap, comprising 23 percent (Table 18). Household/domestic and personal items together comprised only 9 percent of the metal found. Since metal was difficult to obtain during the mission period, and therefore, presumably expensive, the limited funds available were probably spent on needed items of building construction and not on personal or household/domestic objects. The metal from the late nineteenth-early twentieth and twentieth century deposits presumably was used for the structure modifications and repairs done during that period. Tumacacori's excavated metal includes only four objects associated with farming and six that were horse-related, a rather surprising situation since farming and ranching were major subsistence activities of the mission community.

Reuse is one explanation for the few farming and ranching associated artifacts and the general paucity of metal recovered from mission period deposits. As suggested by Shenk and Teague (1975:127), "... metal scrap was continuously being recycled into new products by the local residents. Only rarely would new items be added to the pool as they became available." At Tumacacori, reuse is indicated by pieces of copper scrap, probably used for patches, and the absence of whole tools. The few tools found were fragmentary and badly worn, indicating that they were discarded only when useless. If metal was being intensively recycled, little of it would have been thrown away to be recovered during later excavation.
Miscellaneous Artifacts

Rubber

Fifteen rubber fragments were recovered. All were in a very poor state of preservation. Five fragments are "most likely natural rubber manufactured for the chemical or automobile industries" (Bennett 1979). This type of rubber is still manufactured. Three pieces recovered are pure gum rubber vulcanized with sulfur. This kind of rubber, manufactured since vulcanization was first discovered by Goodyear in 1839 (Considine 1976:1950), is still made for surgical purposes, bicycle tires, and other products. The specimens' condition (their leather-like texture), indicates that they are 40 years old and have been buried during most of this time (Bennett 1979). The fragments have fabric imprints on their surfaces, indicating that they may have been originally used as automobile tire tubes since inner tubes were formerly made in fabric molds (Bennett 1979). Three other fragments were identified as probably neoprene rubber "likely manufactured after 1941" (Bennett 1979). Another fragment probably dates from the 1920's, and three other fragments probably date from the 1940's (Bennett 1979). All Tumacacori's rubber specimens were recovered from twentieth century deposits.

Leather Shoe Sole

A leather shoe sole fragment with three ferrous nails was recovered. The fragment was too small, and the condition of preservation too poor, to allow an exact determination of manufacturing technique and age. However, it appears to be a mass-produced shoe manufactured by techniques established about 1912 and still used (Anderson 1968:56-65).

Flash Bulb Bases

Two flash bulb base fragments were recovered. Both are apparently modern, disposable flash bulbs, similar to Sylvania Blue Dot bulbs. The fragments are small and have burned out filaments. One base recovered came from a twentieth century deposit, and the other base fragment, not kept, was found on the surface.
Mother-of-Pearl Buttons

Three mother-of-pearl buttons were recovered. Two are two-holed, handmade, white polished staple types (Butler Brothers 1915:496-497). The holes of one button, about size 15-1/2, were drilled individually. It could not be determined whether the holes on the other specimen were drilled individually or not. This button is about size 18. The other specimen is a "self shank" button of the type illustrated in the 1915 Butler Brothers catalogue (Butler Brothers 1915:487). It is about size 17-1/2, but whether it is machine- or handmade could not be determined.

Architectural Debris

Architectural debris was found in varying amounts in almost all of the excavation's proveniences (see Table 2). On the basis of a visual inspection, Level 2, Feature 7, Feature 10, Level 13, Level 15, Feature 13, and Feature 16, had the largest amounts of architectural debris. Although samples of architectural debris were taken, no attempt was made to recover all the material in any single provenience or to sample formally and establish statistical comparisons. Architectural debris samples collected consisted of fired adobes with and without adhering lime mortar, lime mortar fragments, slag from overfiring adobe, floor tile fragments, decorated and undecorated wall plaster fragments, limestone and caliche, pieces of gypsum, sulfur, and cinnabar. Some burned wood plugs were found in Feature 6.

Most of the fired adobe found was fragmentary. However, pristine whole cornice bricks (two mortared together) were found in Feature 10, and misfired (warped and misshaped) cornice bricks were found in Feature 7. Pristine whole floor bricks were found in Level 4. Two pieces of decorated plaster were recovered from Level 1. One has black and yellow decoration, and the other is painted black and red. Reportedly, all interior surfaces of the church's nave and sacristy were coated with a thin gypsum plaster layer. Cinnabar was used to make the red paint for the plaster decoration (List of Classified Structures Team 1976:7).

Limestone rocks and caliche conglomerates were found in Features 7, 4, and 5 and in Levels 1 and 3. Many of the specimens had vitrified areas, and some were almost completely melted. Limestone and other cal-
cium carbonates like caliche were heated and crushed to make lime mortar and plaster (George Carter: personal communication). The presence of a lime kiln north of the mission's north convento wing indicates that lime was being processed onsite, assumably from such material as we recovered.

Fragments of a vitrified material ranging in color from black to dark blue or green to dark red were recovered from Levels 1, 2, 3, 5, 6 and Features 1 and 7. Fourteen samples of this material were given to the Materials and Ecological Testing Laboratory for analysis of composition and determination of origin. Samples were analyzed by spectrometric methods and microscopic examination. Analysis showed that the samples' silver and copper content were within the ranges considered normal for the surrounding soil and that, by contrast, the iron content was abnormally high. Since metallurgical slag contains greater amounts of copper and silver than was found in our samples, it was concluded that the samples tested were all overfired adobe resulting from brick manufacture. This conclusion is further supported by a visual examination of the overfired adobe cornice bricks from Feature 7 which contain areas of vitrified material identical to the slag fragments found.

Although, at some time, ore may have been processed at Tumacacori, either on or near the mission, we found virtually no evidence of such activity in the areas excavated. Plentiful quantities of slag were present, although all but one of the samples tested resulted from overfiring adobes. One specimen identified as copper-bearing ore was recovered from Feature 7. Although possibly the result of ore processing, this specimen could also have been picked up and carried to the site as a curiosity, much as people collect and keep interesting rock specimens today.

Other excavations at Tumacacori have produced slag which, when analyzed, turned out to be residue from activities other than ore processing. The material from Brewer's 1951 excavation west of the mission contained high quantities of silica and alumina and little or no trace of copper, silver, or gold. It was suggested that this material could be lining for a lime kiln or blacksmith forge (Brewer 1951:n.p.). Simpson's excavation of the convento granary, located in the vicinity of three fired adobe structures (vagos) identified as a mission period
foundry (Shenk 1976:30, 35), also produced slag high in silica and alumina, with little or no trace of precious metals. This slag has been identified as overfired adobe fragments and not as metallurgical residue (Simpson 1980:16).

Although others have cited evidence of ore processing activity at Tumacacori (Jackson 1951:92), the information from the three archeological excavations discussed above which were conducted in three different parts of the mission complex, along with the lack of primary documentary evidence in support of mining at Mission Tumacacori, casts doubt on the existence and importance of mission period mining and ore processing here. Beaubien recovered copper debris during his excavation of the convento, and Caywood found traces of copper oxide from Room 8 in the convento's north wing (Shenk 1976:30, 35, 53, 55), indicating that metal was indeed being worked at the site. However, metal was difficult to obtain on the Spanish frontier, and Tubac and Tumacacori have both yielded evidence that copper objects, in particular, were reused and repaired (Shenk and Teague 1976:116). Although Beaubien, Caywood, and Mayer (1971:33, 105) all report finding "slag," none of this material was ever tested for ore content. Mayer (1971:105) states that the "slag" found in contact with a mission period cobblestone floor in the convento granary is positive proof of mission period metallurgy. However, the "slag" Simpson found in contact with the same feature was identified as fired adobe manufacture residue. While three fired adobe structures (vasos) in the convento were identified as a mission period foundry, their association with the mission period is not conclusive, and the "slag" related to them was never tested. Indeed, the archeomagnetic dates of 1860, ±27 years (Mayer 1971:20), obtained for these structures indicate they were not built or used until after the last resident Franciscan missionary left Tumacacori in 1828. However, the structures could have been in use prior to mission abandonment in 1848.

The recovery of fired adobe manufacture residue, the reported presence of a "brick kiln" located south of the rooms forming the mission's west boundary (the "Indian village"), and the use of fired adobe to build the Franciscan mission complex indicates that fired adobes were manufactured and used onsite. It is interesting to speculate whether fired adobes made at Tumacacori were used only for that mission's construction or were manufactured on a large scale and sold elsewhere.
Stratigraphic and artifactual data obtained from the drain excavation combined with that from documentary records provide information about transportation and communication, subsistence strategies, and building sequence at Tumacacori. Changes in artifacts recovered through time reflect the problems of supplying frontier missions and the quality of life of mission residents.

Floral and faunal remains and artifacts associated with food preparation and consumption, provide information about residents' subsistence strategies, diet, and food preparation practices.

Information about plaza function was obtained. Data recovered, although not definitive, indicate that activity took place in the plaza from initial site occupation into the twentieth century. Information was lacking on the specific function of the plaza. However, evidence of general activities such as refuse disposal, construction, and possibly flood control or farming was present. Information about the Franciscan mission building sequence was obtained from Area III deposits. Data confirming the sequence of construction and removal of the buttress and west nave transept were found. These data support the building sequence implied by documentation.

Transportation and Communication

The missions were mechanisms of culture change—their purpose was to Hispanicize the native population. As noted by Shenk and Teague (1975: 155), communication and transportation networks influence the degree and rate of culture change. Hispanicization at Tumacacori was affected by and dependent upon transportation and communication networks between the mission and its supply source and administrative headquarters to the south, Mexico. As the frontier was settled and supply networks became more reliable, nonindigenous material reached Pimeria Alta in greater quantity. The archeological record reflects change in supplies available and some of the problems of supplying a frontier mission.
Initially, supplies reached Pimeria Alta irregularly and infrequently. After Tubac was established in 1752, supply to the area increased and became more dependable. Caravans of provisions from central Mexico began arriving annually (Shenk and Teague 1975:157). In 1753, the ranchería, San Cayetano del Tumacacori, was moved to the west bank of the Santa Cruz, three miles south of Tubac (Kessell 1970:127). The mission community and the presidio were not only close to each other, but also had close economic ties. Goods arriving at Tubac also would have been available to Tumacacori residents, and an increase in the amount and variety of goods at Tubac presumably would have been paralleled to some degree at Tumacacori.

Although Tumacacori's Jesuit mission was built by 1757, the community remained a visita of Mission Guevavi until 1773. During this period, there was no resident missionary, and nonindigenous products acquired by the mission's population were purchased or traded for at Tubac. In 1773, Guevavi was abandoned. Its priest, Fray Juan Crisostomo Gil de Bernabe, a Franciscan, had evidently moved to Tumacacori in 1770 or 1771, becoming that mission's first resident missionary (Kessell 1972). Frontier missionaries received an annual stipend of 360 pesos with which they supported themselves and their mission. The stipend was sent through an agent to Mexico City where a procurador of the Queretaro College, the Franciscan institution responsible for the Pimeria Alta missions, saw to the purchase and transport of supplies ordered (Kessell 1972:242). Supplies for the Sonora missions came up the west coast of Mexico by way of Guadalajara. The terrain was too difficult for wagons, so goods were transported by mule train, which limited the amount and kind of items carried (Caywood 1950:92). Apache raids were another problem hampering frontier supply. Since much of the freighting was handled privately, goods sometimes brought three or four times their original cost when they arrived at their final destination (Caywood 1950:92-93). The missionaries complained about the high cost of goods and their low stipend, but the system remained the same. Other sources of revenue, such as the sale of mission crops and herds, supplemented the friars' meager budgets. However, throughout the 1770's and 1780's, supplies were prohibitively expensive, and the missionaries' comforts few (Kessell 1972:42-47; Treutlein 1949:43-44, 309-318).
In the 1790's, a new system of Apache appeasement was tried with success, and raiding in Pimeria Alta declined. Reduction of the Apache menace and an economic upsurge in Sonora facilitated mission development from the 1790's to the 1820's (Kessell 1972:322). It was during this time that Tumacacori's Franciscan complex was built. Although the supply system remained the same, greater quantities of supplies began to reach Pimeria Alta (Brinkerhoff 1967:10-18). In 1810, the Hidalgo Revolt in Mexico City disrupted commerce and agriculture and resulted in widespread shortages in the provinces (Kessell 1972:343). In the wake of the upheavals, the central government stopped paying the annual stipend to frontier missionaries in 1815, and the friars were thrown upon their own resources (Kessell 1972:365, 405-406). Pimeria Alta also experienced an economic crisis at this time. Money was out of circulation, and clothes and goods were used instead. A sales tax had been imposed, and mission industry foundered (Kessell 1972:365-366). Construction of the Franciscan complex at Tumacacori, underway in 1803, had fallen behind by 1805 and was virtually stopped prior to 1820 for lack of funds (Kessell 1972:322, 387).

The 1821 Mexican Revolution again disrupted supply and communication networks as well as administrative connections with Mexico City, greatly damaging the missionary system (Kessell 1972:391, 406; Shenk and Teague 1975:102). The 1820's and 1830's also saw a resurgence of Apache raids in Pimeria Alta, which presumably again exerted a negative effect on availability of goods (Kessell 1972:407-408, 437; Brinkerhoff 1967:16). In 1828, Spaniards were expelled from Mexico and Fray Ramon Liber­os left Tumacacori (Kessell 1972:412-413). The mission never had another resident priest.

Fray Liberós left the community's native officials in charge of Tumacacori. Without support from a central administration and with increasingly bad political conditions in Pimeria Alta resulting from the Sonoran civil wars, the Indian community at the mission decreased, and the property declined (Kessel 1972:434, 450-51, 457). The missions were secularized in 1843 (Kessell 1972:458). In December 1848, Apaches devastated Tubac and the settlers moved north to Tucson. The remnant of Tumacacori's neophyte community went with them, transporting all the mission furnishings to San Xavier del Bac. Tumacacori was abandoned (Kessel 1972:462-463).
From 1848 to 1900, Tumacacori was deserted except for people passing through the ruins and occasional and sparse occupation of parts of the structures (Browne 1868:150; Shenk 1976:18-21). People settling in the Santa Cruz River Valley in the late nineteenth century robbed the ruins of construction material, such as wooden beams and fired adobe. They also took "souvenirs" and dug for supposed hidden treasure (Shenk 1976:21).

Anglo influence increased in Pimeria Alta following the 1854 Gadsden Purchase. Supply and communication networks in southern Arizona were reestablished and greatly improved. Railroad lines were built connecting Nogales with Tucson and Tucson with El Paso (through Benson) and San Francisco. Anglo goods became available to the area in increasing quantity and variety (Shenk and Teague 1975:159). From 1900 to 1923, part of the southern wing of Tumacacori's convento was renovated, modified, and used as the district schoolhouse and residence for its teacher. Presumably, activity at the site increased.

By the 1920's, Anglo influence in southern Arizona was well established, and the supply of goods was reliable, fast, and efficient. Major restoration and preservation projects were augmented at Tumacacori, and in the 1930's the mission site again had permanent residents.

Tumacacori's archeological record in part reflects the development of transportation and communication systems in Pimeria Alta. There is an increase in the amount of nonindigenous artifacts appearing in deposits from the mission period to the twentieth century. Because the size of the nonindigenous artifact assemblage recovered from dated proveniences was too small to be statistically meaningful, percentages are used to illustrate correlations (Table 21).

Although mule freight costs, Apache raids, and low stipends made trade goods expensive and difficult to obtain, nevertheless, they were procured. Ten percent of the artifacts from early mission horizon deposits are nonindigenous, imported goods. Ceramics comprise the majority of nonindigenous material recovered from early mission horizon deposits (62 percent) and 66 percent of the ceramics are Mexican products. The place of manufacture of the glass and metal cannot be determined, but based on the ceramics recovered, it was probably Mexico or Spain. The relatively large amount of glass and metal in early horizon
Troubles in Pimería Alta increased during Tumacacori's late mission horizon resulting from political unrest and administrative upheaval in Mexico City beginning in 1810. At Tumacacori, mission property and revenue had increased under the administration of Fray Narcisco Gutierrez. However, the ambitious Father was apparently putting virtually all resources into mission construction because it is reported that the people were living in extreme poverty (Kessel 1972:354).

Although the actual amount of material recovered from late mission horizon deposits doubled, the proportion of nonindigenous artifacts to indigenous artifacts decreased by about half from that in early horizon deposits (Table 20). The relative amounts of ceramics and glass comprising the late mission horizon nonindigenous assemblage increased slightly, and the proportion of metal decreased slightly (Tables 13, 16,
and 19). Most of the ceramics are Mexican products (67 percent). This increase in Mexican ceramics in the late mission horizon is probably the result of the growth and development of new ceramic industries and subsequently lower prices that occurred during this time (Barnes 1975:12, 61). It is interesting to note that the number of Anglo ceramic sherds increased from 2 percent of the nonindigenous ceramics recovered from early horizon deposits to 12 percent in late horizon deposits. This increase could be the result of increased availability of these wares on the black market, or it could indicate Anglo presence in the area.

The increase in Anglo ceramics from early to late mission horizon deposits was accompanied by an increase in glass and a decrease in metal (from 25 to 17 percent). It is interesting that the amount of metal recovered decreased since construction of the Franciscan church was begun during this period. Possibly, more reuse of metal occurred during the late mission horizon for that very reason and, therefore, less was discarded. Tumacacori was deserted during the last part of the late mission horizon, and the deposits reflect abandonment. The upper strata of late mission horizon deposits dating ca 1850 and later to ca 1900 contain only 13 percent of the total artifact assemblage recovered from dated proveniences.

During the last half of the nineteenth century, settlement increased in the Santa Cruz River Valley. With growing Anglo influence and increasing population density along with the development of faster, more advanced, reliable, and efficient transportation and communication systems, supplies reaching Pimeria Alta increased in quantity and variety. From 1900 to 1923, part of Tumacacori was again occupied, and activity at the site presumably increased in amount and frequency.

The change in the availability of supplies is reflected in the contents of the deposit dating from the late nineteenth - early twentieth century. The proportion of the nonindigenous material comprising the assemblage recovered increased from 5 percent in the late mission horizon deposits to 12 percent in the late nineteenth - early twentieth century deposit. Glass instead of ceramics comprises the majority nonindigenous artifact recovered (55 percent). Although the proportion of metal recovered increased slightly from the late mission horizon, it still is the smallest nonindigenous artifact group (Table 19). Again, this is a
rather curious situation given that construction (modification of the convento) occurred during this period. The significant increase in glass recovered reflects the greater availability of products packaged in this material.

The proportion of ceramics recovered declined from 68 percent of the late mission horizon nonindigenous assemblage to 26 percent of the late nineteenth-early twentieth century assemblage. Since the two container sherds recovered from this provenience are most likely intrusive, the decline in tablewares apparently reflects a decline in their use at the site. Mexican ceramics still comprise the majority recovered (60 percent). However, the increase in Anglo wares recovered (from 4 percent of the late mission horizon ceramic assemblage to 18 percent of the late nineteenth-early twentieth century assemblage), in addition to the increase in glass and metal, indicates that the import of Anglo products, presumably from northern sources of supply, was increasing.

By the twentieth century, Tumacacori was no longer a frontier outpost. Southern Arizona was firmly established as part of the American economic system. Tumacacori, a national monument, was being restored and stabilized, and the twentieth century deposits consist mostly of contemporary construction debris. Nonindigenous material comprises 48 percent of the artifacts from these deposits (Table 21). The indigenous artifacts present may be intrusive or the result of activity from the surrounding community, or, more likely, were incorporated into the later deposits from strata disturbed by stabilization. Glass, still the major nonindigenous artifact recovered, comprises 62 percent of the nonindigenous assemblage recovered. The amount of metal recovered increased, but is still proportionally low. Ceramics recovered decreased from 26 percent in late nineteenth-early twentieth century deposits to 11 percent in twentieth century deposits, while the amount of Anglo wares increased from 18 percent to 32 percent. The amount of Mexican ceramics decreased from 60 percent to 32 percent.

Changes in the transportation and communication networks of Pimeria Alta are reflected not only by fluctuations in the amount of imported goods available, but also in the kinds of goods available. The inability to import certain kinds of goods resulted in the use of indigenous products as substitutes. As stated by Shenk and Teague (1975:161),
"indigenous goods were used chiefly for those commodities which were excessively fragile, bulky, or otherwise difficult to transport easily."

During the mission period, goods were carried by mule train, and the amount of heavy, bulky items such as metal would have been severely restricted. Likewise, excessively fragile items such as glass and porcelain would not have fared well on mule back. Items made of a sturdy but relatively light material, such as pottery, would have been easier to transport and more likely to survive the journey. Ceramics are the majority nonindigenous artifact recovered from mission period deposits, comprising 67 percent of the assemblage from this time period. Most of the wares recovered are sturdy earthenwares—only 3 percent are fragile oriental export porcelain. Glass comprises only 14 percent of the mission period nonindigenous assemblage, and metal comprises 19 percent. Shenk and Teague (1975:162) suggest that indigenous stone tools were used as substitutes for difficult to obtain metal tools. This situation is also apparently reflected at Tumacacori since 60 percent of the excavated stone artifacts are from mission period deposits. However, metal and stone artifacts account for only 7 percent of the mission period artifact assemblage. Metal tools were apparently scarce at Tumacacori.

During the late nineteenth-early twentieth century, the establishment of wagon freight lines and railroads facilitated the transport of nonindigenous products in general and glass and metal in particular. The proportion of glass in the late nineteenth-early twentieth century deposits increased dramatically from its proportion in late mission horizon deposits (Table 17). The proportion of ceramics recovered decreased from 67 percent of the mission period nonindigenous assemblage to 26 percent of the late nineteenth-early twentieth century assemblage. Two ceramic storage jar sherds were recovered from the later deposits but are thought to be intrusive. Metal comprises 19 percent of the late nineteenth-early twentieth century nonindigenous assemblage recovered, having increased slightly.

Changes in transportation and communication networks in Pimeria Alta from the mission period to the twentieth century are reflected in the archeological record by an increase in the quantity of nonindigenous imported goods and a change in the type of goods imported. Most of the imported artifacts for which place of manufacture is known were made in
Mexico. The persistently high ratio of Mexican-made products in the late nineteenth-early twentieth and twentieth century deposits indicates that strong supply ties with Mexico existed throughout the site's occupation. Up until the twentieth century, Tumacacori residents relied heavily on indigenous objects and materials for their daily needs, reflecting the hard life and isolation of a frontier mission community.

**Subsistence**

Floral and faunal remains, cooking equipment, and tableware recovered provided information about mission residents' diet, subsistence strategy, and food preparation and consumption practices. The organic remains are discussed in detail in Appendices B and C with a summary provided below.

As early as 1697, Indians of the middle Santa Cruz River Valley were herding cattle, sheep, and goats and raising wheat introduced into the area by Father Kino (Shenk 1976:13). By the mid-eighteenth century, ranching was the major subsistence strategy of the Spanish frontier (Brinkerhoff 1967:15-16). In 1768, Tumacacori's residents had cattle, sheep, goats, and burros (Shenk 1976:13). Farming was also important and such introduced crops as wheat, barley, and melons were grown along with the aboriginal crops of corn, beans, and squash. The mission orchards produced fruit such as peaches. However, farming was difficult, even in the riverine environment of Tumacacori, and periodic droughts are recorded (Kessell 1972:365-366). It may be that ranching was successful in the arid environment of southern Arizona because the mobile animals were not as severely affected by drought. Although ranching was a major food source, it was also a major economic factor. At Tumacacori, cattle were a main source of mission revenue. For example, in 1820, the sale of 4,000 head netted Fray Liberos sufficient funds to resume work on the church (Kessell 1972:153, 307-8). When Apache raiding declined, cattle glutted the market, deflating it and depressing the frontier economy (Kessell 1972:308).

The problems of supplying frontier settlements forced communities to be self-reliant. Locally raised food was the dietary mainstay, and local and native products had to substitute for such imported rarities
as soap, olive oil, and butter (Treutlein 1949:49, 55-56, 100). Tumacacori's subsistence assemblage consists overwhelmingly of indigenous artifacts and remains of food grown at the mission. Imported goods appear in small quantity and had restricted use.

As at Tubac Presidio, a large quantity of bone but few preserved plants were recovered. The proportion of organic remains recovered indicates that domestic animal herding was a primary food source. Wild game was never an important food source during the mission period and was apparently hunted to supplement and add variety to the diet of beef and mutton. Tumacacori residents hunted deer, pronghorn antelope, peccary, jackrabbits, and cottontail rabbits. The paucity of wild animal remains is interesting since the surrounding environment is game-rich, and it probably reflects the dangers of straying too far from the mission's protective walls. Similar wild animals were exploited during the early and late mission horizons.

Evidence from faunal remains indicates that large animals were butchered mainly with metal tools. There is some evidence that stone tools were occasionally employed in meat preparation. This is an interesting situation given that one metal knife fragment and 35 stone chopping tools were recovered from the excavation. This discrepancy could have resulted from reusing metal so that very little remained to be discarded. After having been cut up, most of the meat was boiled or braised in liquid. Roasting meat over an open fire was less common. Most of the burned bones were from large domestic animals. Smaller fauna, such as chicken and rabbit were probably cooked whole, either stewed or braised in liquid. Bones were apparently cut open and the marrow removed to make soup, a common food preparation practice in the Southwest referred to as the "menudo complex." Tumacacori's faunal assemblage indicates that residents were mainly eating boiled meat dishes, such as stews and soup.

The distribution of floral remains recovered indicates that a diverse number of crops were grown during the mission period. Besides wheat and corn, residents also grew beans, squash, melons, gourds, lentils, and peaches. Although the greatest variety of plant remains came from late mission horizon deposits, this provenience also yielded the largest quantity of plant material recovered. Mission agriculture cen-
tered around cultivation of introduced domestic crops, such as wheat, although corn, an indigenous plant, was also an important food source. The presence of exploitable wild plants indicates they may have supplemented the food supply. Grains, presumably both corn and wheat, were ground by mano and metate, aboriginal methods, and by Spanish-introduced stone milling equipment. The decrease in the number of manos and metates recovered from early to late mission horizon deposits possibly indicates that milling equipment was installed during the later period, perhaps because of the increased amount of food required to support the growing population. Wheat and corn were presumably boiled to make pinole and tortillas.

The ceramic assemblage recovered provides information about how mission residents cooked, ate, and stored their food. Imported nonindigenous ceramics were used almost exclusively for food consumption and, less frequently, for storage. Their lack of sooting indicates they were used as eating utensils, or, in the case of majolica, altar service. No metal cooking vessels were recovered from the drain excavation.

Indigenous ceramics were used for food preparation, consumption, and storage. Pfefferkorn, writing about Sonora of the 1760's, mentions native use of indigenous jars for storage and bowls for roasting maize for pinole (Treutlein 1949:150). At Tumacacori, indigenous bowls were the main indigenous vessel used for cooking. Most of the sooted sherds recovered are plainwares, indicating that these ceramics were primarily used for cooking. Decorated indigenous ceramics, with significantly less sooted sherds, were probably used for eating. The use of native wares mainly for cooking is probably a result of two factors. Transportation and supply problems on the frontier restricted the quantity and variety of nonindigenous wares reaching Pimeria Alta, and, thus, residents had to rely on local products for their needs. Also, it is likely that native cooks would use familiar utensils rather than Spanish cooking equipment, especially if the nonindigenous articles were difficult to acquire.

The above data indicate that Tumacacori's non-native residents were probably cooking with indigenous objects but eating from familiar, imported glazed tablewares. The Indian neophytes were most likely both cooking and eating from utensils they manufactured. Plainwares were
probably the ceramic most often used for cooking, although they were also undoubtedly used for food consumption since unsooted bowl, cup, and plate sherds were recovered. Decorated Piman wares were used both for cooking and as tablewares. The possibility that Spanish residents used indigenous tablewares and that Indian residents used nonindigenous tablewares cannot be discounted.

In summary, by the time Tumacacori's community was relocated (1753), Spanish-introduced domestic animals were the mainstay of both the non-native and native populations, and ranching, an introduced subsistence strategy, was a major source of both food and mission wealth. Spanish-introduced wheat and the aboriginal plant food, corn, were grown along with a variety of other crops. Food preparation was dominated by use of native-manufactured cooking utensils. Food consumption patterns apparently consisted of use of imported, nonindigenous wares by non-natives and the use of decorated, indigenous wares by natives. Meat was primarily boiled or braised for soup and stews and only occasionally roasted. Corn and wheat were ground and boiled to make pinole.

Architectural Sequence

Information on the construction sequence of the Franciscan complex was obtained from Area III deposits. These deposits apparently reflect a period of no construction when the building was neglected and allowed to deteriorate. According to documentary evidence, construction of the Franciscan complex, begun by 1802, was stalled by 1805 for lack of funds (Kessell 1972:320-322). Political and economic troubles during 1810-1820 also were apparently a factor preventing resumption of work (Kessell 1972:339). In 1820, cattle were sold for a sum sufficient to resume construction (Kessell 1972:387).

Since the old Jesuit church continued to be repaired and used during the period when construction of the Franciscan structures stopped, the unfinished buildings were presumably neglected. This period of neglect apparently appears in the archeological record as Levels 19 and 17 which seem to represent an initial erosion of plaster (Level 19) followed by the erosion of the west nave wall soil adobes (Level 17). There are reportedly other areas where uneroded soil adobes are adjacent
to obviously eroded soil adobes, indicative of a period of neglect followed by renewed construction (Tony Crosby: personal communication). If Levels 17 and 19 do represent the 1805-1820 period of halted construction, as they seem to, then the appearance of what are apparently the same deposits underneath the west nave buttress is strong indication that the transepts were removed and the buttress added after construction resumed in 1820 (Fig. 32).

**Space Utilization**

One project goal was to obtain information about plaza use—who used the area, when it was used, and what types of activities occurred there. Although excavation data provide information about plaza use, they are not definitive. Although the plaza excavation exposed deposits having artifact concentrations, no structural remains were found. The contents and nature of the deposits exposed during our test excavation nonetheless provide clues to the types of activities and natural processes that occurred in the plaza. These data necessarily restrict discussion to general plaza use, since no features were found that were identifiable with any specific activity, such as stone tool manufacture or food processing. Feature 6 and Surface 3, ash and charcoal deposits over a use surface, may be the location of a specific activity such as the firing of adobes or an open-air communal cooking area. However, it also could be an area where people disposed of ashes from hearths. It is very possible that disturbance has erased all signs of some activities. For example, early Area I deposits were probably removed when Feature 7 was formed.

The information recovered indicates that the plaza area was an area of activity from initial site occupation into the twentieth century. The plaza area was used prior to construction of the Franciscan complex, although the extent of use predating that building period could not be determined. Since the community is assumed to have moved to its present location in 1753, the use of this area could date that early. It should be noted that the present location is only presumed to have been the community's location in 1753. The community could have been located elsewhere initially and then moved to its present site sometime after 1753, though presumably before 1797-1802.
Fig. 32: Tumacacori Franciscan Mission Church Floor Plan (modified from Tovrea 1936:Plate 4).
Three basic types of activities were indicated by the deposits exposed. Area II alluvial deposits indicate the presence of some kind of water-associated activity, either natural (a depression in which water puddled or a natural arroyo) or cultural (flood farming or drainage). The exact nature of these deposits could not be determined because such a small amount of their probable extent was uncovered. Levels 11, 12, and 4 and Feature 7 all represent refuse disposal activity. Hamblin (Appendix C) notes that two-thirds of the faunal assemblage came from Feature 7, a major refuse dump, indicating that the plaza was used for dumping garbage during the mission period. On the basis of the relative positions and contents of both Feature 7 and the alternating lime ash and soil lenses, the plaza was not used as a major refuse disposal area just prior to or following the completion of the Franciscan complex, but was used during the time the mission was being built. Since the Jesuit mission was being used while the Franciscan complex was built, it would not have been unusual for the plaza area to have been used for disposal of construction and refuse debris. After the Franciscan complex was completed, use of the plaza area for refuse disposal would have ceased and would have been replaced by activities associated with the religious and governmental aspects of mission life. The Alternating Lime Ash and Soil Lenses in Area I, overlying the refuse disposal deposits in Level 4 and Feature 7, are probably sheet trash resulting from the gradual accumulation of debris and the maintenance/erosion of the surrounding structures. The composition and thickness of this deposit indicate that just prior to or upon completion of the Franciscan mission, the plaza was the scene of constant activity.

To summarize, some information about plaza use was obtained. Apparently, a major function of the area prior to the use of the Franciscan structures was for garbage disposal.

Conclusions and Recommendations for Further Research

The research goals for this project were accomplished. A stratigraphic sequence for the study area was obtained, and useful data about the mission and its residents were recovered. Information about the mission's function and position as a Spanish frontier settlement and
data on the lifestyle of its residents were obtained. Architectural sequences indicated by documentary evidence are present and distinguishable in the archeological record. Two nondestructive methods for predicting the presence of subsurface material were tested.

The plaza deposits were deep and mostly intact, and the combination of exposed stratigraphy with an analysis of the contents produced information about the lifeways of the site's occupants from the mission period into the twentieth century. Plaza deposits represent activity associated with habitation, earthmoving, and building construction, and provided information about residents' diet, activities, and material culture. Since deposits could not be physically associated with structures, dating was dependent upon the analysis of artifactual content and relative stratigraphic position. Three major time periods were represented. During the mission period, Tumacacori was a religious institution with a neophyte residential community. In the late nineteenth and early twentieth centuries, some of the structures were modified and used as a schoolhouse. During the twentieth century, the buildings were restored as a tourist attraction.

Prior to use of the Franciscan mission, some kind of water control system may have been located in the plaza, and prior to or during the Franciscan mission's construction, it apparently was a major area of garbage disposal. The paucity of nonindigenous, imported artifacts that presumably were expensive and difficult to obtain reflects the economic poverty of the residents and the Franciscan philosophy that de-emphasized the accumulation of worldly goods. It also reflects the harshness and difficulties of frontier life as well as Tumacacori's isolation from supply sources. People depended heavily on native products for their needs. Indigenous objects were mostly used in food preparation and consumption while most of the food consumed came from nonindigenous animals and crops. Ranching was a major source of subsistence strategy and revenue. Farming was also practiced, and indigenous crops were an important food source. Wild game formed a small part of the mission diet. Manufacture of fired adobe for construction also may have been a source of revenue. Acculturation occurred throughout the mission period.

A study of Tumacacori surface material shows that artifacts are being disturbed by rodent activity and exposed by erosion. This materi-
al is often washed downslope toward the southeast. Excavation data indicate that a controlled surface collection combined with a magnetic survey has high potential for use as a nondestructive method for generating reliable predictive models of subsurface deposits. The two methods are sensitive to different kinds of data, and their concurrent use increases reliability. Although further work is needed to confirm and quantify their degree of reliability, the use of these two nondestructive methods to assess and guide the testing of archeological sites could improve efficiency and aid in cultural resource management.

The most important result of this project has been to show that intact deposits are present at Tumacacori and that the site has archeological value and research potential despite more than 50 years of looting, treasure hunting, and stabilization. Much of Tumacacori is badly disturbed, and crucial deposits, such as those adjacent to structures, have largely been destroyed. However, the magnetic survey indicates that subsurface deposits and features exist in areas of the site that may be virtually untouched. For example, the west central part of the plaza excavation surface collection grid, next to the "Indian village," has high archeological research potential. The magnetic anomaly and alluvial deposits of Area II located here indicate the presence of a feature possibly associated with water control. Other areas of archeological interest are the area north of the "Indian village" between the west nave wall and the west monument boundary wall, and the area extending east and south of the plaza and south convento wing. The area north of the monument may also contain important archeological resources as indicated by magnetic survey data and a surface scatter of artifacts. I urge that any activity in these areas be evaluated in terms of negative archeological impact and that they be thoroughly investigated archeologically before any subsurface disturbance.

Though we know something about the people who lived at the mission, more information about the mission, its function and position as a frontier outpost of Hispanic America, and the daily lives of its residents can still be provided by archeological investigations. Fruitful avenues of research include investigating the mission's source of revenue, and residents' diet. Further excavation of mission period deposits could provide additional information about acculturative processes and diet to
augment that recovered during this project. The limited extent of the study area was a major problem in interpreting plaza excavation data. Additional excavation at Tumacacori would also provide data for a comparative study of Spanish colonial sites in Pimería Alta that would enhance our understanding of the Spanish colonial period in southern Arizona. Previous activity at Tumacacori has made some research problems, such as determining intrasite relationships of a particular time period, difficult to approach. However, the possibility that intact deposits exist containing information pertinent to such research questions should not be discounted, and they should be incorporated into research designs when possible.

Because previous archeology at Tumacacori has been oriented toward investigating building sequences and stabilization needs, intact deposits are most likely to be found away from structures. Future stabilization projects located in areas adjacent to extant structures where the ground is likely to have been previously disturbed present the least danger to the site's cultural resources. However, since disturbance at the site is significantly less extensive than was previously thought, these areas should also be excavated as carefully and completely as possible prior to any project requiring subsurface activity. Areas not in the immediate vicinity of structures have the greatest potential for producing significant data. When an outlying area is threatened, it should be excavated as completely as possible prior to any disturbance.

Over the years, many data have been lost at Tumacacori and investigating the site's history through its material cultural remains is difficult. Nevertheless, important data still remain that would increase our understanding of the mission as an agent of change that forever altered the lives of the people native to the Santa Cruz River Valley.
Excavations at Mission Tumacacori yielded a small sample of 50 marine shells. A minimum of eight genera are represented, all of which have been classified using the taxonomic system presented by Keen (1971). These taxa are summarized in Table 1.

All of the species identified are common inhabitants of the Gulf of California. Both Laevicardium elatum and Chione californiensis are found along the Pacific Coast as well, but it is most likely that the Tumacacori shells came from Mexican waters. Most of the species live in shallow water or in mud and sand flats where they can be gathered with relative ease. They also occur frequently in beach drift where they can be collected in quantity.

The Assemblage

The condition of the shells in the sample indicates that most were collected after the mollusc's death. With the exception of some of the Turritella snails, the shells are generally bleached of their original color patterns from exposure, probably incurred along the shoreline. Some of the valves bear burrow scars and calcareous incrustations left by subsequent inhabitants of the shells.

The species composition of the assemblage shows that bivalves outnumber univalves by better than two to one (34 to 16, respectively). However, the significance of this figure is diminished by the fragmentary nature of the more fragile clamshells, which tends to create a disproportionate total. As a result, the actual number of clam valves represented is impossible to determine, but it is undoubtedly smaller than the current figure.

Selection of shells appears to have favored two genera, Trachycardium and Turritella, which, when combined, account for 60 percent (30 pieces) of the sample. Each of the remaining genera is represented by only one or two specimens.
Table 1

SHELL SPECIES FROM TUMACACORI

Pelecypoda

Trachycardium panamense Sowerby
Dosinia ponderosa Gray
Chione cf. californiensis Broderip
Glycymeris sp.
cf. Laevicardium elatum Sowerby

Gastropoda

Turritella leucostoma Valenciennes
Olivella sp.
Cerithidea cf. albonodosa
cf. Muricidae
cf. Naticidae

The majority of the shells recovered from the excavation came from three proveniences. Feature 7, a mission period deposit, yielded the largest quantity of 19 pieces, while Level 1, an immediately subsurface unit that had been disturbed, produced 10 specimens. A collection of five shells from the surface provided the third largest sample. It is interesting to note that 14 of the shells in the Feature 7 sample are either Trachycardium or Turritella. Provenience data for other site areas and levels are summarized in Table 2.

Unworked Shell

Most of the Tumacacori shells fall into the category of "unworked." At the most, seven specimens bear evidence of having been deliberately modified, leaving a balance of 43 shells that lack clues as to their intended function. However, widespread prehistoric use of some genera found at Tumacacori suggests that some of the shells were made into pen-
Table 2
PROVENIENCE OF MARINE SHELL FROM TUMACACORI MISSION

<table>
<thead>
<tr>
<th>GENUS</th>
<th>Ground Surface</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
<th>Level 6</th>
<th>Level 7</th>
<th>Level 8</th>
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<th>Level 10</th>
<th>Feature 11</th>
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<td>3</td>
<td>2</td>
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<tr>
<td>Glycymeris sp.</td>
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<tr>
<td>Chione cf. californiensis</td>
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<tr>
<td>cf. Laevicardium elatum</td>
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<td><strong>1</strong></td>
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dants or were in the intermediate stage of pendant manufacture. For hundreds of years the most common method of using Turritella and Cerithidea involved the drilling or grinding of a hole in the shell wall just behind the aperture lip. This suspension hole placement enabled the long shells to hang vertically. However, the risk of breakage involved in the installation of the hole and the subsequent weakening of shell wall strength were two resulting problems that undoubtedly led to a high breakage rate. It is interesting to note that all 11 of the Turritella specimens, as well as the Cerithidea, lack an intact aperture lip, while several are missing one or more body whorls as well.

The badly weathered shell of a large gastropod 61 mm in length was recovered from Feature 7. The specimen consists of the columella and a small portion of the body whorl that still bears remnants of two varices. Most of the original exterior surface is badly pitted and riddled with holes and has been bleached to a gray or white color. It is probably a member of the Muricidae, or murex family, whose members are often large-shelled, colorful, and elaborately embellished. When fresh, muricids are attractive and appealing, and were among the large snail species used prehistorically to make trumpets. In this case, however, the shell had already suffered extensive deterioration prior to being picked up, and had none of the qualities that would make transporting it so far from its source worthwhile. No purpose can be proposed for such a shell, except perhaps as something unusual or intriguing to the finder.

The remaining unmodified shells are all damaged to some degree; no complete shells are present. The two fragments of Dosinia from Feature 7 both come from a right valve (probably the same one). Two small pieces of thin, platy, nacreous shell, commonly called "mother-of-pearl," were recovered. One is pearly white with no color highlights and may have come from the interior of an oyster. Fragments of similar shells were found at Tubac (Shenk and Teague 1975:145). The second piece comes from a different species, for it is yellow with rainbow highlights. Several genera in the Gulf of California bear nacreous interiors, making identification of the fragments impossible. The attractive mother-of-pearl has been used prehistorically to make beads, pendants, and cut shell ornaments, but it is delicate and fragile, making it difficult and frustrating to work.
Modified Shell

Of the seven specimens identified as having been worked, five may be considered to be pendants or beads, one is apparently complete or near completion and of uncertain function, and one is a fragment of a larger item (Fig. 1). Data on artifact provenience and dimensions may be found in Table 3. Three genera were used in the production of beads. Two of the beads were made from *Olivella* shells that had had the spires ground off to enable the beads to be strung. Two *Trachycardium* valves were used, the first of which is a small, complete juvenile specimen that has been ground through at the umbo to make the suspension hole. The other, larger valve has had the umbo chipped away to create a ragged opening. Prior to being fragmented, the shell may have been worn for a period of time, as there are two areas of pronounced polish along the otherwise irregular break. The single *Cerithidea* shell has what appears to be a remnant of a drilled hole in the largest remaining whorl. Unfortunately, the aperture lip and some of the first whorl have been broken away, making it difficult to be certain. It is also possible that the hole could have been made by one of several predatory snail species whose conical drill holes in victims' shells bear a close resemblance to those made by man.

Table 3
SHELL ARTIFACTS

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<th>Identification</th>
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<th>Width</th>
<th>Context</th>
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</thead>
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<td>6.0</td>
<td>Surface</td>
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<tr>
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<td>13.0</td>
<td>6.0</td>
<td>Feature 7</td>
</tr>
<tr>
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<td>11.5</td>
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<tr>
<td>Pendant</td>
<td><em>Trachycardium</em> panamense</td>
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<td>Feature 7</td>
</tr>
<tr>
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<td>8.5</td>
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<td>Unknown</td>
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<td>30.5</td>
<td>17.0</td>
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<td>cf. <em>Naticidae</em></td>
<td>23.5</td>
<td>9.5</td>
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</table>

NOTE: All measurements are given in millimeters.

Of the remaining two modified specimens, a single fragment of the hinge area of a *Glycymeris* shell displays some grinding; the taxodont teeth have been smoothed, and a grinding facet is present along a por-
Fig. 1. Shell artifacts. Length of a is 3.3 cm.
tion of the exterior margin. The last artifact is a fragment of a gas-
tropod valve that has been ground along all edges to form a "C" shape (Fig. 1c). One arm of the "C" terminates in a rounded shape, while the other ends with an abrupt transverse truncation. The artifact comes from the underside of the shell from the area surrounding the umbilicus. The snail from which the fragment came probably belonged to the Natici-
dae, or moon snail family, which contains a number of species possessing sturdy, globose shells bearing characteristic umbilici. Despite its finished appearance, the function of the piece is unknown.

Discussion and Conclusions

As mentioned before, all of the shell species identified from Tuma-
cacori are found in the Gulf of California. The shells may have been obtained directly on visits to the ocean by mission residents, by trade carried out over established aboriginal routes, or they could have been brought by the Spanish (Shenk and Teague 1975: 83).

In looking at the shells recovered from two contemporary sites, Tu-
bac Presidio, north of Tumacacori, and Mission Guevavi located to the south near the Mexican border, it is interesting to note that shell spe-
cies inventories are quite different. Tubac yielded artifacts made from Olivella, Conus, Vermetus, Spondylus, and Haliotis (Shenk and Teague 1975:85-85), while Guevavi shells belonged to Agaronia, Conus, or Glycy-
meris (Robinson 1976:156). Perhaps additional work at the three sites will indicate whether this pattern is merely the result of sampling problems or actually reflects definite shell preferences on the part of the inhabitants of the sites.

Despite the variety of species from these three locations, almost all of the shells were used to produce beads, tinklers, and pendants. A notable exception comes from Guevavi, where a single Glycymeris bracelet was found (Robinson 1976:156); however, these bracelets also have been known to be worn as pendants. This emphasis on beads corroborates accounts set down over the years that describe the Piman penchant for this particular ornament form. While Father Pfefferkorn resided among the Pimas and Papagos at Ati in Sonora from 1756 to 1767, he observed:

The womenfolk cover at least half their body completely down to the feet. For this purpose they use one or two deerskins which they fold around the body like a skirt and
tie fast with a strap on the abdomen. Fastened all around the lower part of this skirt, about a span above the lower edge, are little sea shells, snail shells, nails, fragments of pottery, in short any kind of collected trifle that will produce a rattling sound. Thus the womenfolk have the extreme pleasure in walking and running of making sounds like those of an approaching mule hung with bells (Treutlein 1949:190).

At Tubac, shell beads were known to persist in popularity as personal ornaments into the 1800's (Shenk and Teague 1975:83). Later, around the turn of the nineteenth century, Russell (1908:163) found that among the Pimas of the Gila/Salt rivers area, both men and women wore strings of beads from their earlobes and necks as well as around their arms for bracelets. Brave men also were entitled to wear ornaments suspended from their nasal septa, and shells were a popular choice for this purpose. However, by the time of Russell's visit, the practice of wearing the "old-time" ornaments had already been abandoned for several years.

Few additional comparative data exist on historic Piman usage of marine shells. The predominant presence of genera traditionally employed in bead manufacture in the Tumacacori assemblage, the basic, minimal modification techniques utilized, and the number of beads or pendants present as artifacts, indicate that the residents of Tumacacori shared the Piman affinity for simple, easily made ornamentation and that seashells were an important decorative resource.

ACKNOWLEDGEMENT

I would like to thank Dr. William Light, Assistant Curator of Invertebrates in the Department of General Biology, University of Arizona, for kindly making available the invertebrate comparative collection so that identification of the Tumacacori shells could be verified.
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Russell, Frank

Shenk, Lynette O., and George A. Teague

Treutlein, Theodore E. (translator)
1949 Sonora, A Description of the Province by Ignaz Pfefferkorn. Albuquerque: University of New Mexico Press.
Appendix B
THE PLANT REMAINS FROM TUMACACORI MISSION

by
Lisa W. Huckell

Tumacacori Mission was a member of the chain of missions established by the Society of Jesus in Sonora and southern Arizona for the purpose of bringing the civilizing influence of Christianity and European culture to the newly discovered peoples inhabiting the northern frontier. A critical part of the Jesuit plan for acculturating the native residents of the Pimeria Alta was the introduction of new, exotic foodstuffs. The production of ample quantities of a diverse number of new crops in conjunction with raising introduced livestock animals, such as cattle, sheep, and horses, would provide each mission with a stable economy which would permit the community to become largely self-sufficient, requiring few supplies from Mexico. Surpluses of products could be sold or traded to generate income that would provide for those items not locally available and would help defray general mission expenses. Eventually, when the missions had become flourishing economic centers, some of the profits in the form of tribute would be returned to the king of Spain by way of Mexico. In the process, the local Indians were to be cared for, receive religious instruction, and be introduced to the trades, skills, and work ethic required to make the community viable, as well as to learn general European concepts of social, civil, and religious organization (Spicer 1962:288-298).

With these objectives in mind, Father Eusebio Kino distributed many plants throughout the lands under his jurisdiction. In 1704, the Jesuit priest, Father Geronimo, was assigned to the mission of San Pedro y San Pablo del Tubutama. At this time, his superior, Father Kino, ordered "the house repaired and a good field of wheat sown and a good garden leveled off and planted with various small trees of Castile, grape vines, peaches, pomegranates, fig trees, pear trees, and all kinds of garden produce" (Bolton 1948, II:89). Two years later, Kino visited two of the villages in which the Jesuit order was establishing missions, Nuestra Senora de los Remedios and Santiago de Cocospera. Upon his in-
struction, his servants "planted in each pueblo a good garden of quinces, pomegranates, fig trees, peaches, grape vines for wine for masses, and many kinds of garden produce, in all of which the garden of Nuestra Senora de los Dolores greatly abounds" (Bolton 1948, II:165).

In addition to those crops already mentioned, Kino freely gave out seeds for the following plants as well: garbanzos, bastard chick peas, lentils, cow peas, cabbage, lettuce, onions, leeks, garlic, anise, peppers, mustard, mint, melons, watermelons, sugar cane, roses, lilies, and trees of apple, mulberry, pecan, apricot, and plum (Castetter and Bell 1942:74). The fertile soils and appropriate climate of the northern region yielded good agricultural crops, while livestock flourished on abundant wild grasses. The future of the missions seemed to be a bright and promising one in which the Jesuit expectations would be fulfilled. However, 150 years after Kino's initial visit to the Pimeria Alta at the close of the seventeenth century, an American traveler passed by the empty ruins of Tumacacori Mission and observed:

The fruit (peaches) has fallen and none to gather it. Corrals, still standing—not a living thing seen. It had a melancholy appearance. The walls of the church still stand, no roof, and only the upright piece of the cross. It looks desolate indeed (Jackson 1973:58).

The unfinished church was crumbling, the few remaining residents had finally been driven away by Apaches, and the fertile fields where wheat once waved were overgrown. Only the peach trees survived as the last living remnants of the dreams of prosperity that had once resided in the now silent village.

Although Tumacacori has been abandoned for 130 years, it still has the potential to reveal additional information about the lifestyle of those who lived there. Despite a basic, overall organizational plan of establishing and maintaining the missions on the part of the Jesuits and their Franciscan successors, there were variations at each mission that devolved from such factors as local preferences, the level of knowledge and skills possessed by the resident priest, and local environmental conditions that made each mission unique. Although general portraits of mission life exist, little documentation is available on the economies of specific missions. The records that do exist often mention only the major or most significant crops, such as corn, wheat, and beans, imply-
ing that the kinds and yields of other crops grown were either common knowledge or were not worthy of mention due to their lesser economic status. The development of new archeological techniques, such as flotation, enables archeobotanical analysis to provide more specific data on the floral basis of individual mission economy. These improved methods may produce evidence indicating which plants out of Kino's bountiful legacy were locally adopted, as well as which aboriginal plant products were important enough to see continued use. The results of the analysis of plant macrofossils recovered from the Tumacacori plaza excavation demonstrate the potential for supplementing documentary sources with archeologically obtained data.

**Methods**

Thirty-eight lots of material from the plaza excavation were submitted for analysis. The samples were divided into two basic classes: those larger specimens discovered during excavation which were packaged separately, and those smaller items obtained from the processing of flotation samples. These samples had already been screened and floated prior to receipt by the author. The larger macrofossils were sorted, measured, and identified. The flotation residues were examined microscopically, at which time all items thought to have the potential for identification were set aside. These specimens were then compared to samples contained in several collections of seed and plant remains, including the Geosciences Collection at Tumamoc Hill, the University of Arizona Herbarium, the University of Arizona Ethnobotanical Collection, and the author's personal collection. Specialists were consulted regarding some of the cultigens and unknowns in an attempt to glean as much information as possible from the sample. A summary of the plant taxa identified is presented in Table 1. All specimens are carbonized unless otherwise indicated.

**Cultigens**

A maximum of nine genera of cultivated plants were found in the Tumacacori sample. Included are corn, wheat, melons(?), squash, watermelon, beans, lentils(?), cotton, and peaches. The provenience of each genus and the number of each plant found at that provenience are shown in Table 2.
Table 1

PLANT TAXA RECOVERED FROM TUMACACORI DRAIN EXCAVATIONS

<table>
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<th>Family</th>
<th>Genus/Species</th>
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<tr>
<td>Gramineae</td>
<td><em>Zea mays</em> L. (Corn)</td>
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<tr>
<td></td>
<td><strong>Triticum</strong> cf. <em>compactum</em> Host. (Little Club wheat)</td>
</tr>
<tr>
<td>Cucurbitaceae</td>
<td><em>Cucurbita</em> spp. (squash, gourds)</td>
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<tr>
<td></td>
<td><em>Citrullus vulgaris</em> Schrad. (watermelon)</td>
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<tr>
<td></td>
<td>?<em>Cucumis melo</em> L. (muskmelon or cantaloup)</td>
</tr>
<tr>
<td>Leguminosae</td>
<td><em>Phaseolus</em> sp. (beans)</td>
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<tr>
<td></td>
<td><strong>Prosopis</strong> <em>juliflora</em> (Swartz) DC (mesquite)</td>
</tr>
<tr>
<td></td>
<td>?<em>Lens esculenta</em> Moench (lentils)</td>
</tr>
<tr>
<td>Malvaceae</td>
<td><em>Gossypium</em> Hopi Lewton (cotton)</td>
</tr>
<tr>
<td>Solanaceae</td>
<td>?<em>Capsicum</em> cf. <em>baccatum</em> L. (chiltepin pepper)</td>
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<tr>
<td></td>
<td><em>Physalis</em> sp. (ground cherry)</td>
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<tr>
<td>Rosaceae</td>
<td><em>Prunus persica</em> Batsch. (peach)</td>
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<td>Cactaceae</td>
<td><em>Carnegiea gigantea</em> (Engelm.) Britt. &amp; Rose (saguaro cactus)</td>
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<td><strong>Opuntia</strong> sp. (prickly pear or cholla)</td>
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<td>Fouquieriaceae</td>
<td><em>Fouquieria splendens</em> Engelm. (ocotillo)</td>
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<tr>
<td>Juglandaceae</td>
<td><em>Juglans major</em> (Torr.) Heller (native walnut)</td>
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<td>Amaranthaceae</td>
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<td>Ulmaceae</td>
<td><em>Celtis reticulata</em> Torr. (netleaf hackberry)</td>
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<tr>
<td>Rhamnaceae</td>
<td>?<em>Condalia lycioides</em> (Gray) Weberb. (gray-thorn)</td>
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Table 2

DISTRIBUTION OF FLORA RECOVERED FROM TUMACACORI BY PROVENIENCE

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<tr>
<th>PROVENIENCE</th>
<th>CORN</th>
<th>CRIME &amp; CUPULES</th>
<th>CUCURBIT SEED FRAGMENTS</th>
<th>MLEAN SEEDS</th>
<th>PEACH PIT FRAGMENTS</th>
<th>CERIANS &amp; ELADS</th>
<th>COMPOST &amp; FRADEIS</th>
<th>CAUCALIAE SEEDS</th>
<th>CULUMBERSE SEEDS</th>
<th>ESBOOLITA SP.</th>
<th>PERRITUS SP.</th>
<th>RESIST</th>
<th>MODERN OR INTRUSIVE</th>
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x = present
Zea mays L. Corn

Over 250 corncob, cupule, and grain fragments were recovered from the plaza excavation. Most of the sample consisted of broken grains, loose cupules, and small cob fragments that do little more than indicate the presence of corn at the mission. Four small cob fragments constitute the only portion of the sample yielding usable data. Although some loose kernels were present, their condition was too poor to determine the row number of the cob from which they came.

Three fragments of 12-rowed ears came from Level 11b, an early mission horizon deposit in Area II. Two of them are from the tip of the cob and exhibit a strong taper. The transverse cross-section is round. Damage to the surface has caused glumes and cupules to be lost, but enough measurements could be made on one cob to yield an average cupule width of 6.2 mm. The third fragment is a composite of three pieces that indicates a round cross-section. The average cupule width is 7.5 mm. The last cob fragment comes from Feature 5, an intrusive twentieth century pit. It is from the midsection of the cob and has a diameter of 17.5 mm. The cross-section is also round. Sixteen rows are present, and the average cupule width is 6.4 mm.

These cobs are in all likelihood part of what is termed the Pima-Papago supra-race of corn that includes the races Harinoso de Ocho (an 8-rowed flour corn), Mais Blando de Sonora (a flour corn), and Onaveno (a hard flint corn). These races, along with others, were grown by the prehistoric Hohokam (Cutler and Blake 1976:365-366) and, until recently, by modern Indians of southern Arizona. They produce cobs that range in row number from 8 to 16, with 8 to 12 rows the most common.

There are few early Piman sites with which to compare the corn from Tumacacori. The Paloparado Ruin, which Di Peso (1956) believes is the site of the original Jesuit visita of San Cayetano del Tumacacori, produced 12-rowed corn that compared favorably to modern Papago samples (Cutler 1956:460) and was similar in appearance to specimens from Babocomari Village (Di Peso 1951:15-19). Specimens from Quiburi proved to be substantially different, possessing a higher row number (13.3) and thinner grains. Cob fragments were also found at Tubac Presidio, although no identifications were made (Shenk and Teague 1975:145). Additional comparative data from both prehistoric and historic sites are summarized by Miksicek (1979:136-137).
Prior to the arrival of the Spanish, corn was the most important staple of the aboriginal diet. With the introduction of wheat, corn became of secondary importance as the popular new grain spread rapidly among the Pimans of Sonora and southern Arizona. At Tumacacori, as at the other Sonoran missions, corn was cultivated along with wheat (Kessell 1972:365-366, 386). It was probably raised at the mission throughout its occupation, although production would have fluctuated due to drought, Apache activity, the variable size of the resident population, and other factors.

Triticum spp. Wheat

A total of 25 partial and complete caryopses or grains of wheat were recovered. The grains display typical wheat characters, including a crease on the ventral aspect and the sloping germ or embryo area where the grain was originally attached to the spikelet rachilla. Most of the complete grains possess a well-developed shoulder or hump on the dorsal face. No brush (an apical tuft of hairs of varying shape) is visible on any of the specimens, but this may be the result of carbonization rather than a diagnostic absence. Unfortunately, the extreme heat of the carbonizing fire and post-excavational mechanical damage have obscured or removed additional diagnostic features such as color, nature of the endosperm (soft and floury or flinty and corneous), and others, leaving the general shape and size of the grains as the major source of information. However, both of these characters are altered by carbonization to as yet undetermined degrees (Stewart and Robertson 1971:381), making fine distinctions, such as species or variety, tentative at best. The figures presented in Table 3 are more indicative of a minimum size left by shrinkage and distortion rather than the original size of the grains.

The range in grain size was quite pronounced in the Tumacacori sample. The smallest grain (from Level 8) measured 1.5 mm long by 1.0 mm wide by 0.8 mm thick, while the largest (Feature 7) was 4.5 mm long, 2.8 mm wide, and 2.0 mm thick. What is more interesting than maximum and minimum size is the average size for Level 8 as compared to Feature 7 (Table 3). It is clear that a major difference exists between them. This size discrepancy may reflect nothing more than seasonal variation caused by ecological factors resulting in impoverished grains, although
the presence of large mature grains as well as small ones in the Level 8 sample, would not seem to support this possibility. However, it may also substantiate data indicating that more than one variety of wheat was grown at the mission or that a new strain of wheat either was introduced by Mexican, American, or German residents or was developed at the mission itself. Unfortunately, the temporal affiliation of Level 8 is unknown. It would be interesting to know if the Level 8 sample is contemporaneous with the large late mission horizon material from Feature 7.

Table 3
AVERAGE DIMENSIONS OF WHEAT GRAINS

<table>
<thead>
<tr>
<th>Provenience</th>
<th>Length (mm)</th>
<th>Width (mm)</th>
<th>Thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 8</td>
<td>2.25 (10)</td>
<td>1.6 (9)</td>
<td>1.2 (7)</td>
</tr>
<tr>
<td>Feature 7</td>
<td>4.1 (7)</td>
<td>2.8 (6)</td>
<td>2.0 (4)</td>
</tr>
<tr>
<td>Combined L8 and F7</td>
<td>3.2</td>
<td>2.2</td>
<td>1.6</td>
</tr>
</tbody>
</table>

NOTE: Figures in parentheses indicate the number of grains used in the computation.

Wheat is an ancient crop, with the earliest recovered archeological finds dating back to about 7500-6500 B.C. It appears to have been domesticated in Mesopotamia (Simmonds 1976:124). Over the years, the genus Triticum developed into three groups distinguished by chromosome number (haploid, tetraploid, and hexaploid), each of which contained several species (Renfrew 1973:40-67). With the exception of the tetraploid durum, the source of macaroni products, most modern wheats are hexaploid. Included in this group are spelt (*T. spelta* L.), bread wheat (*T. aestivum* L.), and club wheat (*T. compactum* Host.).

Although the varieties of wheats have proliferated in response to local selective pressures, they still can be classed into one of two groups: winter wheat or spring wheat. The distinction is based on growth habit which is largely influenced by local seasonal weather conditions. Winter wheat is adapted to mild winter conditions and is planted in the fall. Spring wheat is planted in the spring for a late summer harvest, but it can be sown in the fall in areas with mild win-
ters, such as Mexico. Generally, wherever winter wheat survives the winter, it will produce more than spring wheat types (Heyne 1963:561).

Little information exists on the varieties of wheat introduced into the New World. In 1493, Columbus brought the first wheat to Hispaniola (now Haiti and the Dominican Republic) where it did poorly (Patino 1977: 388). Wheat was introduced into Mexico in the early 1500's in the aftermath of Cortez' conquest of the Aztec empire. As the process of colonization got underway in Mexico, the Spanish monarchs, Ferdinand and Isabella, recommended that the wheat variety "tremesin" or "tremes" be sent to the new territories, as it was very successful in Andalucia. Tremes (Triticum aestivum) means "three months" and undoubtedly describes the length of time needed between sowing and harvesting. Additional Spanish varieties found in the Andean region of South America by the end of the sixteenth century were candeal (a white summer wheat), rubio (a red wheat), and barbillo (a small-bearded wheat) (Patino 1977: 413). It is possible that they also may have been sent to Mexico as well where they may have contributed genetically to the development of locally adapted strains or wheats.

Wheat cultivation was highly successful and expanded to the north from Mexico City, carried by pioneering farmers, ranchers, and missionaries. A few studies done on the arrival of wheat into the Southwest (Hendry 1931; Atkins 1980:1-63) offer some additional clues to the identity of the wheats grown in the Sonoran missions. Hendry (1931:111-113) collected adobe samples from mission buildings in California, Baja California, Arizona, and Sonora and analyzed them for plant content. Tumacacori Mission was included in the survey. Hendry found that four wheat varieties were present in the samples—two bread wheats and two club wheats. Tumacacori adobes contained Propo wheat (T. vulgare graecum Kcke. = T. aestivum) and Little Club wheat (T. compactum humboldtii Kcke.), both of which were widely grown in the Southwest during the eighteenth and nineteenth centuries according to Hendry's data. Both types are spring wheats that bear white, soft kernels. The Little Club wheat kernels are short, ovate, and humped, while those of Propo are ovate to elliptical in shape with a slight hump (Clark, Martin, and Ball 1922:130, 174-175).
An effort was made to determine whether the Tumacacori plaza samples might consist of these two varieties or represent something new, such as Sonora wheat, a white-kerneled spring wheat that was brought to Arizona from Sonora where it had been grown at least since the 1770's (Clark, Martin, and Ball 1922:126-126). It is particularly well-adapted to the hot, arid climate of Arizona, since it matures quickly; it is also known as "Ninety-Day" wheat. It is interesting to note that Propo also matures quickly, although not quite as rapidly as Sonora. In view of its excellent adaptation, it seems unusual that Sonora did not show up in Hendry's samples. However, the answer may lie with the quality and palatability of the flours produced by the two wheats. Sonora is known to yield a weak flour that is primarily used in pastry, while Propo makes a superior flour for bread (Clark, Martin, and Ball 1922:126-127, 130). Most of the current Tumacacori sample grains were sent to an agronomist specializing in the study of grains, Dr. Irvin M. Atkins, formerly of the U.S. Department of Agriculture, for clarification of the varieties present. However, Dr. Atkins (personal communication) was hesitant to offer any definite identification due to the dearth of diagnostic characters. He did state that the seeds were much smaller than noncarbonized specimens he had examined that were obtained from Landin Mission in Saltillo, Mexico (Atkins 1980:3, Figure 1A), which was built in 1747. He concluded by saying that he believed the sample most closely resembled Little Club wheat.

The alacrity with which wheat was adopted and disseminated among the Pimans was amazing. By the time of Kino's arrival in the Gila River area in 1687, he found large fields of wheat already under cultivation by the Gila Pimas. Through the years large crops were raised, often producing lucrative surpluses that were made available to Spanish, Mexican, and American visitors (Castetter and Bell 1942:114). The purchase of southern Arizona by the Americans in 1854 initiated many changes, including the introduction of new strains of wheat that have largely supplanted native varieties.

Wheat was the most important agricultural crop grown at Tumacacori. In 1798, a minimum yield of 200 fanegas (a fanega is just over two bushels) was considered necessary for roughly 200 persons (Kessell 1972:365-366). Periodic droughts and water shortages often kept the harvest down
(Kessell 1972:365-366, 386), but by 1828 enough of a surplus was grown to fulfill contracts with Tucson, Tubac, and Santa Cruz presidios. At this time, a fanega of wheat was equal in value to one cow or three pesos (Kessell 1972:430). In 1830, most of Tumacacori's four wheat fields, which were situated to the south of the mission and across the Santa Cruz River, were unplanted due to Apache raids (Kessell 1972:434). By 1843, the fields were overgrown with mesquites. Only a few residents remained to make small plantings (Kessell 1972:457-458). From this point on, repeated efforts were made to farm and resettle the mission lands. There are no records of when wheat ceased to be grown, but it could have been as early as the 1860's (Clemensen 1977:18).

Cucurbitaceae: Melons, Watermelons, Squashes, and Gourds

A total of 25 fragments of seeds from the squash family were found. Most of the specimens consist of fragmentary seed coats and kernels that offer little hope for identification below the family level. Most are probably either squash or native gourd seeds. However, three exceptions came from Level 8. Two seeds are long and thin and lack the corky margin characteristic of squash seeds. Both are 10.0 mm long, while the single relatively undamaged seed is 3.5 mm in width. They compare favorably with seeds of the modern cantaloupe, Cucumis melo L., in shape, size, and conformation. The third specimen is the basal third of a flat, ovate seed that displays a characteristic margined groove on each side near the base. It is thought to be the seed from a watermelon, Citrullus vulgaris Schrad.

Early Spanish visitors to Sonora and southern Arizona, such as Kino, Manje, and Velarde, observed that the Pimas and Papagos were cultivating pumpkins of various kinds that were probably varieties of Cucurbita pepo L. and C. moschata Duch. (Castetter and Bell 1942:101-102). Wild gourds were used as a food source as well—the seeds of C. foetidissima HBK were roasted and eaten by the Pimas (Russell 1908:70).

Melons were some of the most popular plants introduced by Europeans. They were so eagerly accepted that, like wheat, they preceded the Spanish into the new northern territory. Kino found them already growing at the village that would become the modern Papago settlement of Cocklebur, although no other white men had yet been in that vicinity.
Watermelons were one of the most important Piman crops due to their delicious flavor and their storage longevity, which enabled the Pimas to eat them six months of the year. Evidently, two varieties of Piman watermelons were grown. Seeds of this plant were also found at San Gregorio de Abo Mission in New Mexico, which dates to the seventeenth century. Here, too, the seeds sorted into two distinct types that probably represent different cultivars (Jones 1949:30).

Muskmelons or cantaloupes were probably received by the Pimans along with the watermelon; Kino and Anza saw them grown in native fields. They did not seem to achieve the popularity gained by the watermelon, perhaps due to their poor storage quality (Castetter and Bell 1942:119). Seeds of this melon were also found at Abo Mission (Jones 1949:30).

Little information exists on melons grown at Tumacacori. In 1849, a group of people led by Lorenzo Aldrich passed the deserted mission where they saw the peach orchard and some melon vines (Clemensen 1977:5). No further identifying information is given. Both watermelons and cantaloupes of good quality were grown in great quantities at San Xavier Mission to the north (Geiger 1953:8). It would seem highly likely that both kinds of melons were also grown at Tumacacori as well, a supposition tentatively supported by the plaza excavation material.

**Phaseolus sp. Beans**

Three fragmentary beans were found. The single specimen from Level 8 is about one-third of a bean with the two cotyledons still remaining together. The seed coat has been roughened by burning, and the hilum is absent. Minimum width of the specimen is 2.0 mm. The remaining two beans include a cotyledon and a cotyledon fragment. The cotyledon is missing the seed coat and has incipient splits and chipping along the margins, but it is basically complete. It is 6.2 mm long and 3.0 mm wide and displays a reniform shape. The partial cotyledon is also missing the seed coat and was too incomplete for measurements to be taken.

It is difficult to identify the beans. The general dimensions of the specimens fall well below those given by Kaplan (1956b:205, 213) for mature seeds of indigenous bean varieties that include the kidney bean.
(Phaseolus vulgaris L.) and the tepary bean (Phaseolus acutifolius Gray). The Tumacacori specimens have certainly undergone some shrinkage from carbonization, but they may have been immature originally or the products of a poor growing season. The reniform shape of the intact cotyledon is more typical of the common bean or frijol than of the blocky tepary. It is possible that these beans may be the same variety as the small-seeded reniform common bean identified by Kaplan (1956a: 460) at Paloparado (San Cayetano del Tumacacori).

Spanish accounts from the early 1700's document the growing of both types of beans by Piman farmers (Castetter and Bell 1942:91). Records for the mission indicate that beans were an important crop at Tumacacori. In 1818, 40 fanegas of beans were grown, while in 1820, a drought year, only 16 fanegas of "frijoles" were raised. The use of the word frijol suggests that the bean being cultivated was the kidney or common bean.

?Lens esculenta Moench. Lentils

Two possible lentil seeds were recovered. Both specimens are small, circular, discoidal seeds from which portions of the seed coats have been lost, exposing the two cotyledons. Diameters of the specimens are 3.0 mm and 3.3 mm. A possible third lentil is present which has a diameter of 3.5 mm, but it is too damaged to be certain. Based on their size, the specimens would fall into the smaller lentil subspecies, L. esculenta microespermae Barul., whose seeds range between 3.0 mm and 6.0 mm in diameter (Renfrew 1973:113-114).

This flavorful and nutritious legume was brought into Mexico by the Spanish and was another of the crop plants dispensed by Father Kino and other missionaries. According to the records, lentils were planted at Tumacacori. Between 1818 and 1820 the mission experienced a decline in agricultural production. By 1820 the harvest consisted of only 160 fanegas of wheat, 12 of maize, 16 of frijoles, no garbanzos, and no lentils, a yield which was far below the minimum quantity required to sustain the 196 mission residents and considerably lower than the harvests recorded for previous years (Kessel 1972:365-366, 386). It is not clear when lentil production commenced, nor is it indicated in available documents how long they were cultivated at Tumacacori, but factors such as
drought, Apache depredations, and a fluctuating resident work force undoubtedly contributed to an intermittent yield of this secondary crop, particularly during the second quarter of the nineteenth century.

**Gossypium Hopi Lewton. Cotton**

Two cotton seeds were recovered. Both had been completely carbonized. The seeds are undoubtedly *Gossypium Hopi* Lewton, the widely cultivated aboriginal species grown by the Pimas (Castetter and Bell 1942: 105).

At the time of the Spanish arrival, cotton was grown for its usable fibers and for the edible seeds (Castetter and Bell 1942:105). The fibers were made into textiles and cordage, while the oily seeds were eaten. Cottonseed flour was made into cakes which were baked by Papago women using hot stones (Castetter and Underhill 1935:46). Among the Pimas, the seeds were either pounded up with mesquite beans or were sometimes parched and eaten without grinding (Russell 1908:77).

Based on the sparse economic records available for Tumacacori and other Sonoran missions, cotton did not seem to be a significant crop. It is not mentioned in the brief inventories of crops planted or harvest yields that were sent by the resident priests to Mexico. There is no way to determine if the seeds in this sample represent limited plantings of cotton at the mission, though this seems doubtful. Cloth purchases and woven material shortages are mentioned periodically by the mission priests (Kessell 1972:304-305, 153), which suggest that local weaving and textile production were not encouraged in favor of purchasing European or Mexican products. The seeds also may have been obtained from more traditional, non-mission Indians for use as a supplementary food item.

**Prunus persica Batach. Peach**

A total of 26 whole and fragmentary peach stones and seeds was found. Of these, seven were complete. The largest intact specimen measured 23 mm long, 16.5 mm wide, and 12 mm thick. Average dimensions were 18.7 mm long, 15.5 mm wide, and 11.4 mm thick. The stones (the hard endocarp containing the seed) are small and somewhat ovoid in shape and exhibit a variable degree of surface sculpture including pitting and
folding. As the measurements indicate, they are considerably smaller in size than the stones present in modern cultivars. Unfortunately, surface configuration and size are not enough to determine the variety of the sample. Without viable endosperm that can be germinated to produce a seedling for study, it is impossible to ascertain even the basic distinction between cling and freestone (Dr. Eugene A. Mielke, Department of Plant Science, University of Arizona: personal communication).

The high esteem in which peaches were held in Europe is reflected by their early arrival in the New World. They were brought by Spanish colonists into Florida and Mexico and by the English to the Atlantic coast of North America, all of whom were loath to do without the delicious fruit in their new homelands. Once established in Mexico, peaches became a consistent feature of the expanding frontier. Peach pits have been recovered from Abo Mission and other Spanish period sites in New Mexico (Jones 1949:29-30) and are known to have been eagerly adopted by Eastern Pueblo Indians and the Hopi Indians of northern Arizona. Peaches were planted specifically at Kino's request at the Sonoran missions of Los Remedios, Tubutama, and Cocospera (Bolton 1948, II:89, 165) and were probably standard garden inclusions at the others. In southern Arizona, peaches were grown at San Xavier Mission (Geiger 1953:8), Tubac Presidio (Hinton 1954:187-188), and Tumacacori (Clemensen 1977:2-3, 5-6). Evidently the planting of a peach orchard at Tubac was a later innovation that took place after the Mexican takeover in 1821 when several types of fruit were introduced (Shenk and Teague 1975:145). Archeological evidence for the presence of peaches comes from Tubac (Shenk and Teague 1975:145) and the Sobaipuri village of Quiburi (Di Peso 1953:238), where stones have been found.

Tumacacori orchards and gardens were located just east of the mission building (Fratt, this volume: Figure 2) and were fairly extensive. In 1849, an American traveler visited the mission and found an orchard containing roughly 50 peach trees, whose seeds covered the ground (Clemensen 1977:6).

All of the peach pits recovered from the plaza excavation come from late mission horizon deposits that post-date roughly 1800. All of the readily available records that describe the peaches tend to be American journals or articles that commence in 1849. There is no indication
whether peaches were present during the early mission horizon or were a later development, as at Tubac. It is also uncertain when the trees in the orchard finally died. The presence of nine pits in Level 2 would suggest that they persisted into the early twentieth century.

Non-cultivated Plants

Representatives of 10 non-cultivated plant genera or families were identified in the Tumacacori samples. They include amaranth, ground cherry, hackberry, saguaro, native chilipepper, gray-thorn, walnut, cactus, and the grass and sunflower families.

Capsicum sp. Pepper, Chiltepin

Two seeds of the Solancaceae or nightshade family were found that bear a strong resemblance to the native red pepper Capsicum baccatum L. The flat, discoidal seeds bear remnants of a pitted surface sculpture and have pronounced indentations along the edge in which the hilum is located, but the hilum area has been damaged, making an exact match extremely difficult.

Although the small, red, globose fruits of the chiletepin were never cultivated by the Pimas and Papagos, it grows wild in the Baboquivari Mountains and in areas in Sonora. The Pimas often traded with Papago suppliers to obtain the fiery seasoning, which was dried and stored (Castetter and Bell 1942:121).

Amaranthus sp. Amaranth

Thirty-two amaranth seeds were recovered from several proveniences. The carbonized, fragmented nature of the seeds precluded a specific identification. However, when Hendry (1931:117) analyzed adobe brick samples from Tumacacori, he found Amaranthus retroflexus L. to be present.

Amaranths have been employed as food by the Papagos, who used the young plants of A. Palmeri Wats. as greens and later collected the abundant, tiny black seeds to be eaten. Although not specifically mentioned by name, Russell (1908:66-78) indicated that several types of small seeds were gathered by the Pimas to be parched and ground into flour or meal, and it is very likely that the seeds of the prolific amaranth were among them.
Although they were certainly an acceptable food source, it is more likely that the Tumacacori amaranths are by-products of natural seed dispersal from this weedy plant that is frequently an unwanted intruder in cultivated land, along roadsides, and in other disturbed contexts. Amaranths are among the wild plants growing on the mission plaza.

**Physalis sp. Ground Cherry**

Two ground cherry seeds were found. The globose fruits of this solanaceous genus are distinctive due to their enclosure within the persistent, inflated papery calyx. Although the berries are edible either raw or cooked, none of the standard ethnobotanical sources indicates that the Papagos or Pimas made use of them. In all probability, the Tumacacori specimens can be attributed to one of several ground cherry species that are frequently found as weeds in cultivated fields or disturbed ground.

**Celtis reticulata Torr. Netleaf Hackberry**

A partial stone of a netleaf hackberry fruit was found on the plaza surface. It is uncarbonized and undoubtedly of recent origin. The sweet pulp surrounding the stone is edible and is eaten by wildlife.

**Carnegiea gigantea (Engelm.) Britt. & Rose. Saguaro Cactus**

A single seed from a saguaro cactus fruit came from the excavation. The importance of the saguaro fruit in Pima and Papago culture has been extensively documented (Crosswhite 1980; Fontana 1980) and needs not be discussed here. The presence of a single seed can be accounted for by human or animal deposition and offers little insight into the role this traditional staple might have played in the economy of the mission dwellers.

**Juglans major (Torr.) Heller. Native Walnut**

Area I produced 11 complete or fragmentary shells of the native walnut. The small, thick-shelled nuts contain a sweet meat with a high oil content that has been eagerly sought by many Indian groups. Although no mention is made of Papago or Pima exploitation, it is difficult to believe that such a delicious wild crop would not have been used
by both Indians and Spaniards. Walnut trees can be found along water-courses such as the nearby Santa Cruz River, the probable source of these specimens.

Opuntia sp. Prickly Pear, Cholla

Four seeds were recovered that could be assigned to the genus *Opuntia*, which includes the chollas and the prickly pears. Cholla buds and prickly pear fruits have been a traditional staple of the Pima and Papago diet. The fruits can be eaten raw or cooked, while the mild-flavored buds are pit-steamed until tender. Birds and animals avidly search out the cactus fruits and frequently assist in distributing the seeds.

?Condalia lycioides (Gray) Weberb. Gray-thorn

A single seed of what may be gray-thorn was found. This plant, which often forms thickets on dry plains, mesas, and slopes in southern Arizona, bears single-seeded fruits that are eagerly consumed by birds but which do not seem to appeal to human tastes (Kearney & Peebles 1969: 530). However, the fruits of the related *C. spathulata* Gray are eaten raw by the Papago (Castetter and Underhill 1935:19).

Compositae. Sunflower family

Three small composite achenes were recovered. They are not similar to the edible achenes of the wild sunflower, *Helianthus anuus* L., that occurs throughout the state. These specimens are probably the scattered seeds from any of numerous weedy species in this large family.

Gramineae. Grass family

Four proveniences yielded small quantities of an unidentified grass or grasses. The samples contained fragments of leaf blades and culms, but lacked caryopses and vegetative diagnostic elements such as ligules, auricles, rachises, etc. The few culm fragments present had round transverse cross sections that never measured over 3.0 mm in diameter.

Both wild and domestic grasses were economically important. Wild grasses were often cut for hay to feed livestock, and they were frequently cut and bundled for use as thatching. Sacaton grass seeds (*Sporobolus wrightii* Munro) were also harvested by Papagos in September for food (Castetter and Underhill 1935:24).
Two important domestic grasses were raised at Tumacacori: Coast barley (*Hordeum vulgare pallidum typica* Ser.) and wheat (*Triticum* spp.). Barley was grown, soon after Kino's arrival, by the Pimas who continued to grow it for many years for seed and hay. Hendry (1931:113) found barley seeds in adobe samples from Tumacacori and found the plant to be present in 12 of 14 structures in his southwestern sample. No identifiable barley was found in the current study sample.

It is possible that the grasses recovered from the plaza excavation are remnants of wild grasses gathered for utilitarian purposes such as construction materials or for inclusion with adobe mud as the binding agent in the preparation of bricks. However, the content of Hendry's adobe samples suggests that the Tumacacori adobes were strengthened by the additions of domestic grass parts that would have been readily available as by-products of threshing the two crops.

**Wood**

Nine samples of wood were submitted to Dr. William J. Robinson of the Laboratory of Tree-Ring Research at the University of Arizona for identification. It was hoped that the charred specimens would include some of the introduced woods such as peach or pomegranate, but such was not the case. The identifiable fragments were found to be either mesquite (*Prosopis juliflora* [Swartz] DC) or ocotillo (*Fouquieria splendens* Engelm.) (Table 1), while the rest had been reduced to tiny pieces or charcoal dust that could not be identified.

Mesquite wood is a readily available fuel and has often been used in building structures such as corrals and fences. The long, slender arms of the ocotillo have been employed as roofing material and have been used to make "living fences" due to the ability of the cut stems to root in the ground.

**Discussion and Recommendations**

The flora assemblage from the plaza excavation is a beginning effort in understanding the importance of plants in mission economy. It indicates the potential still present at the mission to yield significant new data on the specific domestic and wild plants that were important to the local inhabitants. Unfortunately, the small size and condi-
tion of the sample, the difficulties with chronological placement of some of the plant-bearing strata, and the problems of sampling bias preclude all but the most general comments.

The diverse number of cultigens found in the sample supports documentary data that reiterate the importance of agriculture in sustaining the mission. Despite the fact that most of Tumacacori's wealth was embodied in livestock, it was often too expensive to round them up for sale in an indifferent or poor market (Kessell 1972:365-366, 386), leaving the residents to fall back on the mainstays of wheat, corn, and legumes to supplement the meat consumed on the premises. Cultivated foods also far outweigh potential wild foods in the sample, suggesting that the residents were successfully adapting to the new lifestyle imposed on them by the Spanish.

The current level of knowledge regarding plants used at the mission should be further augmented by future research. A larger sample from both early and late mission period contexts could reveal shifts in taste or preferences for some plants through time, when various plants were introduced to mission gardens and fields, and could show whether traditional foods were gradually abandoned or persisted through the record. Flotation techniques should further substantiate or add to the list of specific vegetables, fruits, and grains grown at the mission. Records indicate that garbanzos (Kessell 1972:386), pomegranates (Clemensen 1977:3), pears, quinces (Clemensen 1977:2), figs, oranges, lemons, and limes (Clemensen 1977:21) were present at the mission. It is noteworthy, however, that the reference to citrus was contained in a newspaper story that presented erroneous information about the church buildings and their history, and that citrus was not mentioned by any other visitor who described Tumacacori. This suggests that citrus was not actually grown there. Future researchers should watch for any evidence of these and other plants that reveal more facts about the foundation of everyday life at Tumacacori Mission.

ACKNOWLEDGEMENTS

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Clemensen, A. Berle

Crosswhite, Frank S.

Cutler, Hugh C.

Cutler, Hugh C., and Leonard W. Blake

Di Peso, Charles C.

Di Peso, Charles C. (cont.)

Fontana, Bernard L.

Geiger, Maynard, OFM

Hendry, George W.

Heyne, Elmer George

Hinton, Richard J.

Jackson, Earl

Jones, Volney H.

Kaplan, Lawrence


Kearney, Thomas H., and Robert H. Peebles

Kessell, John L.
1972 Franciscan Tumacacori, 1767-1848, a Documentary History. MS on file, Western Archeological and Conservation Center, National Park Service, Tucson.

Miksicek, Charles H.
1979 From Parking Lots to Museum Basements: the Archaeobotany of the St. Mary's Site. The Kiva 45(1-2):131-140.
Patino, Victor Manuel

Renfrew, Jane

Russell, Frank

Shenk, Lynette D., and George A. Teague

Simmonds, N. W., ed.

Spicer, Edward H.

Stewart, Robert B., and William Robertson III
Appendix C
THE FAUNA OF TUMACACORI

by
Nancy Hamblin

The Tumacacori excavations yielded a total of 8,098 bone fragments, representing a minimum of 136 individual animals. Analysis of this relatively large faunal sample was undertaken primarily to determine the kinds of animals utilized at the site. Although it was expected that domestic species such as cattle and sheep would comprise the majority of the sample, this research was also designed to evaluate the importance of indigenous fauna to the inhabitants of the mission, as well as any changes through time. Butchering methods, possible cooking techniques, and bone tools are also discussed.

Methods

The Western Archeological and Conservation Center's comparative faunal collection was used to identify Tumacacori's faunal remains. Besides the identification of each specimen, several additional observations were made. Evidence of butchering was noted, as well as whether or not the element had been sawn, chopped, or simply cut, in order to determine what kind of implement had been used, i.e., European metal tools or aboriginal stone tools. Burnt bones were also noted so that deductions might be made concerning cooking practices. Other data recorded include carnivore chewing or rodent gnawing, pathological elements, sex of the animal represented, modification for use as a tool, and cupric (copper) staining.

After the numbers of bones for each species had been determined for every provenience, minimum numbers of individuals (MNI's) were calculated. The procedure used is based on White's (1953) method of separating the most abundant element of each species into rights and lefts, using the greater number as the unit of calculation. Because this tends to introduce a slight error on the conservative side (since all left elements will not necessarily match all of the rights), modifying fac-
tors such as relative ages and sizes of the elements were also taken into account (Flannery 1968; Grayson 1973; Daly 1969; Bokonyi 1970). Thus, for example, seven right sheep humeri (two large adult, one small adult, and four immature) together with seven left humeri (two small adult and five immature) would yield a total of nine individuals, rather than seven. This method has become the one increasingly employed in recent faunal analyses (Hewitt 1975; Hamblin 1978, 1980). It should also be mentioned that minimum number calculations here represent a compromise between the maximum and minimum distinction methods described by Grayson (1973; 1974). The Tumacacori fauna were generally subdivided on the basis of vertical stratigraphy representing distinct cultural units, while horizontal excavation units were combined as much as possible. If excavation units had been used to further subdivide the fauna (the maximum distinction method), the resulting MNI's for each species would have been artificially high. Conversely, calculating the MNI's for the site as a whole without regard for distinct cultural features and levels (the minimum distinction method), would have produced a deceptively low figure.

Even though the compromise procedure used in this study would appear to produce accurate figures on the numbers of animals used at the mission, some caveats should be noted. First of all, it should be stressed that the excavation material is only a sample of the total material present at the site. Relative percentages of the various species can be used to discern major trends, but the actual numbers of animals should not be relied upon. In addition, the majority of this faunal sample is comprised of scrap, classified as large mammal (71.21 percent), artiodactyl (3.84 percent), and Bos/Equus (12.48 percent). Minimum numbers were naturally not calculated from this material since it was so very fragmentary, and it would have been impossible to know which species were being dealt with. Therefore, the MNI's in this report are necessarily conservative.

The fauna were also analyzed by time period so that any temporal change could be discerned. In particular, the degree of dependence on indigenous and domestic animals was calculated for each time period, as well as for the site as a whole. In addition, a comparison was made of the species present in functionally different areas of the site to see
whether any significant differences appeared in the fauna. Table 1 lists the animal species whose remains were recovered.

Table 1

<table>
<thead>
<tr>
<th>Tumacacori Fauna : Taxonomic List</th>
</tr>
</thead>
</table>

**Class: Reptilia (reptiles)**

**Order: Testudines (turtles)**

- **Family: Kinosternidae (mud and musk turtles)**
  - *Kinosternon* sp. (mud turtles)

**Class: Aves (birds)**

**Order: Galliformes**

- **Family: Phasianidae**
  - *Gallus gallus* (domestic chicken)

- **Family: Meleagrididae**
  - *Meleagris gallopavo* (domestic turkey)

**Class: Mammalia (mammals)**

**Order: Lagomorpha**

- **Family: Leporidae**
  - *Sylvilagus* sp. (cottontail rabbits)
  - *Lepus* sp. (jackrabbits)
  - *Lepus cf. alleni* (antelope jackrabbit)

**Order: Rodentia**

- **Family: Cricetidae**
  - *Peromyscus* sp. (white-footed mice)

**Order: Carnivora**

- **Family: Canidae**
  - *Canis* sp. (dogs, wolves, and coyotes)
  - *Canis familiaris* (domestic dog)

- **Family: Mustelidae**
  - *Mephitis mephitis* (striped skunk)

- **Family: Felidae**
  - *Felis concolor* (mountain lion)

**Order: Perissodactyla**

- **Family: Equidae**
  - *Equus* sp. (horses and burros)
**Equus asinus** (burro)

*Order: Artiodactyla*

*Family: Suidae*

*Sus scrofa* (domestic pig)

*Family: Tayassuidae*

*Tayassu tajacu* (collared peccary)

*Family: Cervidae*

*Odocoileus* sp. (deer)

*Odocoileus virginianus* (white-tailed deer)

*Family: Antilocapridae*

*Antilocapra americana* (pronghorn antelope)

*Family: Bovidae*

*Bos taurus* (domestic cattle)

*Ovis aries* (domestic sheep)

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**Results and Discussion**

It is evident that the inhabitants of Tumacacori utilized a variety of fauna. As shown in Tables 1 and 2, at least 16 distinct species are present. However, it is probable that several of these are actually intrusive animals or represent pets rather than food sources. The single white-footed mouse (*Peromyscus* sp.) and the four indeterminate rodents are almost certainly intrusive. The burrowing of modern rodents into earlier levels is a well known occurrence on archeological sites. Similarly, the two mud turtles (*Kinosternon* sp.) might easily have died at the site. The musky odor which taints the flesh of this reptile (Pope 1964) would likely have made it unpalatable as a food item. For the same reason, the single striped skunk (*Mephitis mephitis*) is also probably intrusive. The one mountain lion (*Felis concolor*) may represent a hunting trophy brought back to the site from the surrounding mountains, or alternatively, a stray animal killed at Tumacacori as it wandered too close to civilization in search of prey. At least seven individual canids are present at the site, two of which are definitely domestic dogs. One of these latter represents nearly the entire skeleton of an adult male dog about the size of a fox terrier, and it appears to have been deliberately and carefully buried. Thus, at least one of
<table>
<thead>
<tr>
<th>TAXON</th>
<th>NO. BONES</th>
<th>PERCENT</th>
<th>MNI</th>
<th>PERCENT</th>
<th>NO. BURNT</th>
<th>PERCENT</th>
<th>NO. BUTCHERED</th>
<th>PERCENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinosternon sp. (mud turtles)</td>
<td>4</td>
<td>0.05</td>
<td>2</td>
<td>1.48</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gallus gallus (domestic chicken)</td>
<td>33</td>
<td>0.41</td>
<td>16</td>
<td>11.85</td>
<td>1</td>
<td>0.12</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Meleagris gallopavo (domestic turkey)</td>
<td>1</td>
<td>0.01</td>
<td>1</td>
<td>0.74</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Indeterminate small bird</td>
<td>2</td>
<td>0.02</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Indeterminate bird (chicken-sized)</td>
<td>3</td>
<td>0.04</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Indeterminate bird (turkey-sized)</td>
<td>3</td>
<td>0.04</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sylvilagus sp. (cottontail rabbits)</td>
<td>5</td>
<td>0.06</td>
<td>4</td>
<td>2.96</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lepus sp. (jackrabbits)</td>
<td>9</td>
<td>0.11</td>
<td>5</td>
<td>3.70</td>
<td>3</td>
<td>0.35</td>
<td>1</td>
<td>0.14</td>
</tr>
<tr>
<td>Lepus cf. alleni (antelope jackrabbit)</td>
<td>2</td>
<td>0.02</td>
<td>2</td>
<td>1.48</td>
<td>1</td>
<td>0.12</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Indeterminate rodents</td>
<td>8</td>
<td>0.10</td>
<td>4</td>
<td>2.96</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Peromyscus sp. (white-footed mice)</td>
<td>1</td>
<td>0.01</td>
<td>1</td>
<td>0.74</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Canis sp. (dogs, wolves, and coyotes)</td>
<td>8</td>
<td>0.10</td>
<td>5</td>
<td>3.70</td>
<td>1</td>
<td>0.12</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Canis familiaris (domestic dog)</td>
<td>183</td>
<td>2.27</td>
<td>2</td>
<td>1.48</td>
<td>1</td>
<td>0.12</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mephitis mephitis (striped skunk)</td>
<td>1</td>
<td>0.01</td>
<td>1</td>
<td>0.74</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Felis concolor (mountain lion)</td>
<td>1</td>
<td>0.01</td>
<td>1</td>
<td>0.74</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Indeterminate large mammal</td>
<td>5,750</td>
<td>71.23</td>
<td>-</td>
<td>-</td>
<td>676</td>
<td>79.91</td>
<td>318</td>
<td>45.30</td>
</tr>
<tr>
<td>Bos/Equus (cattle/horse or burro)</td>
<td>1,006</td>
<td>12.46</td>
<td>-</td>
<td>-</td>
<td>82</td>
<td>9.69</td>
<td>274</td>
<td>39.03</td>
</tr>
<tr>
<td>Equus sp. (horses and burros)</td>
<td>4</td>
<td>0.05</td>
<td>1</td>
<td>0.74</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Equus asinus (burro)</td>
<td>3</td>
<td>0.04</td>
<td>1</td>
<td>0.74</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Indeterminate small mammal</td>
<td>3</td>
<td>0.04</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Artiodactyl (sheep, peccary, deer,</td>
<td>308</td>
<td>3.82</td>
<td>-</td>
<td>-</td>
<td>19</td>
<td>2.24</td>
<td>25</td>
<td>3.56</td>
</tr>
<tr>
<td>antelope)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sus scrofa (domestic pig)</td>
<td>2</td>
<td>0.02</td>
<td>1</td>
<td>0.74</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>0.28</td>
</tr>
<tr>
<td>Tayassu tajacu (collared peccary)</td>
<td>1</td>
<td>0.01</td>
<td>1</td>
<td>0.74</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Odocoileus sp. (deer)</td>
<td>20</td>
<td>0.25</td>
<td>10</td>
<td>7.41</td>
<td>3</td>
<td>0.35</td>
<td>3</td>
<td>0.43</td>
</tr>
<tr>
<td>Odocoileus virginianus (white-tailed deer)</td>
<td>4</td>
<td>0.05</td>
<td>1</td>
<td>0.74</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Antilocapra americana (prong-horned</td>
<td>13</td>
<td>0.16</td>
<td>6</td>
<td>4.44</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>0.14</td>
</tr>
<tr>
<td>antelope)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bos tarus (domestic cattle)</td>
<td>458</td>
<td>5.67</td>
<td>38</td>
<td>28.15</td>
<td>36</td>
<td>4.26</td>
<td>45</td>
<td>6.41</td>
</tr>
<tr>
<td>Ovis aries (domestic sheep)</td>
<td>237</td>
<td>2.94</td>
<td>32</td>
<td>23.70</td>
<td>23</td>
<td>2.72</td>
<td>33</td>
<td>4.70</td>
</tr>
<tr>
<td>TOTAL</td>
<td>8,073</td>
<td>100.00</td>
<td>135</td>
<td>99.97</td>
<td>846</td>
<td>100.00</td>
<td>702</td>
<td>99.99</td>
</tr>
</tbody>
</table>
these dogs was probably treated as a household pet, rather than as a source of food. It is not possible to determine whether the remaining five canids (Canis sp.) represent dogs, wolves, or coyotes. Their disarticulated, fragmentary condition does not permit firm conclusions to be drawn concerning their status, either as pets or as food items.

An examination of the MNI's (Table 3) reveals that overall, the seven most important animals at Tumacacori are the following:

Table 3

<table>
<thead>
<tr>
<th>Fauna</th>
<th>Percentage</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>28.15</td>
<td></td>
</tr>
<tr>
<td>Sheep</td>
<td>23.70</td>
<td></td>
</tr>
<tr>
<td>Chickens</td>
<td>11.85</td>
<td></td>
</tr>
<tr>
<td>Rabbits(^1)</td>
<td>8.15</td>
<td></td>
</tr>
<tr>
<td>Deer(^2)</td>
<td>8.15</td>
<td></td>
</tr>
<tr>
<td>Canids(^3)</td>
<td>5.19</td>
<td></td>
</tr>
<tr>
<td>Antelope</td>
<td>4.44</td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL**  
89.63% of all MNI's

These species account for nearly 90 percent of the fauna identified to at least the genus level. It is readily apparent that the domestic species (cattle, sheep, and chickens) dominate the sample, comprising over 63 percent of the MNI's, while the indigenous fauna (deer, rabbits, and antelope) total less than 21 percent. Since it is unclear whether or not all of the canids are domestic dogs, they are left out of both categories. Either way, however, their relatively small percentage has little impact on the overall dominance of the domestic species.

When raw bone counts are used to determine the most significant taxa, the overwhelming importance of certain domestic species (especially cattle and equids) becomes even clearer.

\(^1\)includes both cottontails (*Sylvilagus* sp.) and jackrabbits (*Lepus* sp. and *Lepus* cf. *allenii*).

\(^2\)includes both *Odocoileus* sp. and white-tailed deer (*Odocoileus virginianus*).

\(^3\)includes *Canis* sp. and domestic dogs (*Canis familiaris*).
Table 4
Importance of Tumacacori Fauna by Numbers of Bones

<table>
<thead>
<tr>
<th>Fauna</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large mammal</td>
<td>71.21</td>
</tr>
<tr>
<td>Bos/Equus (cattle/horse or burro)</td>
<td>12.48</td>
</tr>
<tr>
<td>Cattle</td>
<td>5.65</td>
</tr>
<tr>
<td>Artiodactyl*</td>
<td>3.84</td>
</tr>
<tr>
<td>Sheep</td>
<td>2.92</td>
</tr>
<tr>
<td>Dog</td>
<td>2.17</td>
</tr>
<tr>
<td>TOTAL</td>
<td>98.29% of all bones</td>
</tr>
</tbody>
</table>

*includes sheep, deer, antelope, and peccary in this report.

It should be noted that while the large mammal category might possibly include a few deer, antelope, or other wild species, nearly all of the fragments observed appear to represent animals of such large size that they were almost certainly cattle or equids (horses and burros).

In order to define more precisely the role of indigenous fauna at Tumacacori, all of the taxa in Table 2 were divided into the following three categories listed in Table 5: domestic species, indigenous or wild fauna, and indeterminate.

Table 5
Subdivisions of Tumacacori Fauna

**Domestic Species:**
- Large mammal*:
- Bos/Equus (cattle/horses or burros): Canis familiaris (dogs)
- Bos taurus (cattle): Equus sp. (horses and burros)
- Ovis aries (sheep): Equus asinus (burros)
- Gallus gallus (chickens): Sus scrofa (pigs)
- Meleagris gallopavo (turkeys)
*could conceivably include a few deer or antelope fragments, but appear to represent cattle or equids.

**Indigenous Fauna:**
- Kinosternon sp. (mud turtles): Mephitis mephitis (striped skunk)
- Sylvilagus sp. (cottontail rabbits): Felis concolor (mountain lion)
Subdividing the fauna in this way resulted in the following percentages:

<table>
<thead>
<tr>
<th>Category</th>
<th>No. Bones</th>
<th>%</th>
<th>MNI</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic species</td>
<td>7,700</td>
<td>95.09</td>
<td>93</td>
<td>68.15</td>
</tr>
<tr>
<td>Indigenous fauna</td>
<td>69</td>
<td>0.85</td>
<td>38</td>
<td>28.15</td>
</tr>
<tr>
<td>Indeterminate</td>
<td>329</td>
<td>4.06</td>
<td>5</td>
<td>3.70</td>
</tr>
<tr>
<td>TOTAL</td>
<td>8,098</td>
<td>100.00</td>
<td>136</td>
<td>100.00</td>
</tr>
</tbody>
</table>

It is significant that even if the large mammals were not included in the domestic species, this latter category would still comprise 1,933 bones, or 23.87 percent of all bones in the site. (The MNI's would remain the same, since large mammals represent zero individuals here.) Domestic species are, therefore, predominate no matter how the calculations are performed. Still, even the appearance of indigenous fauna in a historic site is noteworthy, especially the variety which is present here.

The distribution of fauna by time period is shown in Table 7. It is notable that the domestic species, particularly mammals, are a constant in every period. The diversity and numbers of wild fauna, by contrast, tend to vary directly with the size of the faunal sample from each period. That is, the larger the number of excavated bones in a given era, the greater the number of species which are present. From
Table 7: DISTRIBUTION OF INDIGENOUS AND DOMESTIC ANIMALS BY TIME PERIOD

<table>
<thead>
<tr>
<th>TIME PERIOD</th>
<th>FAUNA</th>
<th>NO. OF BONES</th>
<th>PERCENTAGE</th>
<th>MNI</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>domestic species</td>
<td>1,068</td>
<td>92%</td>
<td>19</td>
<td>56%</td>
</tr>
<tr>
<td></td>
<td>indigenous</td>
<td>20</td>
<td>2%</td>
<td>9</td>
<td>26%</td>
</tr>
<tr>
<td></td>
<td>indeterminate</td>
<td>77</td>
<td>6%</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>1,165</strong></td>
<td><strong>100%</strong></td>
<td><strong>34</strong></td>
<td><strong>100%</strong></td>
</tr>
<tr>
<td>ca 1750-ca 1800 (Early Mission Horizon)</td>
<td>domestic species</td>
<td>3,840</td>
<td>96%</td>
<td>25</td>
<td>58%</td>
</tr>
<tr>
<td></td>
<td>indigenous</td>
<td>22</td>
<td>1%</td>
<td>9</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td>indeterminate</td>
<td>125</td>
<td>3%</td>
<td>9</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>3,987</strong></td>
<td><strong>100%</strong></td>
<td><strong>43</strong></td>
<td><strong>100%</strong></td>
</tr>
<tr>
<td>ca 1800-ca 1850 and later to ca 1900 (Late Mission Horizon)</td>
<td>domestic species</td>
<td>650</td>
<td>96%</td>
<td>4</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>indigenous</td>
<td>5</td>
<td>1%</td>
<td>4</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>indeterminate</td>
<td>24</td>
<td>3%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>679</strong></td>
<td><strong>100%</strong></td>
<td><strong>8</strong></td>
<td><strong>100%</strong></td>
</tr>
<tr>
<td>Late 19th-Early 20th Century Period</td>
<td>domestic species</td>
<td>176</td>
<td>90%</td>
<td>4</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>indigenous</td>
<td>9</td>
<td>5%</td>
<td>5</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>indeterminate</td>
<td>10</td>
<td>5%</td>
<td>1</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>195</strong></td>
<td><strong>100%</strong></td>
<td><strong>10</strong></td>
<td><strong>100%</strong></td>
</tr>
<tr>
<td>Total Dated Proveniences</td>
<td></td>
<td>6,026</td>
<td></td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>Total Other Proveniences</td>
<td></td>
<td>1,611</td>
<td></td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td>7,637</td>
<td></td>
<td>136</td>
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</table>
this it can be deduced that there seem to have been no major temporal changes in the Tumacacori fauna which cannot be explained by fluctuations in sample size. Reference to the documentary history of the mission (Kessell 1972) would appear to confirm this. The presence of cattle, sheep, and horses is consistently mentioned in records dated 1768, 1775, 1802, 1804, 1814, 1818, and 1820 (Kessell 1972:46, 153, 319-21, 354, 365, and 386). It is perhaps significant that the only definitely identified burro and equid remains come from the late mission horizon (ca 1800 and later to ca 1900), since the few direct mentions of horses, mules, and donkeys (burros) all occur post-1800 (Kessell 1972: 354, 365, 386). Thus, the faunal remains appear to parallel nicely the written records on this point. No goats were identified from the excavated remains, although their presence at the mission is referred to by Cevallos in 1814 (Kessell 1972:354). It is not known how many there were, since Cevallos groups them in the same category with sheep. Perhaps there were comparatively few, so that their absence from the excavated remains might be merely the result of sampling error. A relatively small number of goats was also reported at the nearby mission of Guevavi in 1768 (Kessel 1972:58).

If the relative percentages of indigenous and domestic species are examined for each time period (Table 7), it is readily apparent that the latter consistently comprise the majority of all fauna. The percentage of domestic animals ranges from 90 to 96 percent of all bones in each time period, while indigenous species represent a maximum of five percent. Despite the obvious dominance of cattle, sheep, chickens, and other domestic species, Table 8 shows that the mission inhabitants continued to use wild fauna, such as deer and rabbits, throughout the site's occupation.

The excavated fauna can also be divided into several distinct geographic groups: surface collection, Area I (containing a major trash dump), Area II (containing alluvial deposits), and Area IV (associated with the west transept wall of the mission). No bone was recovered from Area III. The resulting distribution is shown in Table 8.
Table 8
Distribution of Fauna by Area Within the Site

<table>
<thead>
<tr>
<th>Division</th>
<th>No. Bones</th>
<th>%</th>
<th>MNI</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area I</td>
<td>5,445</td>
<td>67.24</td>
<td>75</td>
<td>55.14</td>
</tr>
<tr>
<td>Area II</td>
<td>1,886</td>
<td>23.29</td>
<td>46</td>
<td>33.82</td>
</tr>
<tr>
<td>Area IV</td>
<td>50</td>
<td>0.62</td>
<td>2</td>
<td>1.47</td>
</tr>
<tr>
<td>Surface Collections</td>
<td>461</td>
<td>5.69</td>
<td>8</td>
<td>5.88</td>
</tr>
<tr>
<td>Miscellaneous Proveniences</td>
<td>256</td>
<td>3.16</td>
<td>5</td>
<td>3.68</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>8,098</strong></td>
<td><strong>100.00</strong></td>
<td><strong>136</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

The fact that two-thirds of the bones and the majority of the MNI’s occur in Area I fits well with the inference that this area contained major trash dumps for the site. This is further confirmed by the amount of large mammal bone which occurs in this locality. This scrap accounts for 3,996 fragments, or more than 73 percent of all Area I bones. It also represents nearly 70 percent of all the large mammal scrap recovered from the mission as a whole.

A study of the species occurring in each area of the site shows that there is a fairly even geographic distribution of them, especially the domestic species (Table 9). However, Area I does contain several animals which do not appear elsewhere, such as the remains of turkey, peccary, mud turtle, mountain lion, and burro (Equus asinus and Equus sp.). It should be noted that each of these species occurs in such extremely low quantity (four bones or less, in every case) that their limited distribution might be simply a result of small sample size. A similar explanation may account for the single striped skunk bone which appears in Area II (and which is thought to be intrusive). The surface collection contained only one unusual species—two domestic pig bones. These were relatively modern in appearance, having been sawn in the distinctive way twentieth century butchers usually prepare cuts of pork. Uneven striations on the cut surfaces of these bones suggest a metal handsaw was used. This indicates the bones are at least 35 years old, since power saws did not become common in the Tucson area before that date (Clonts 1969:66).

A total of 702 elements (representing 8.7 percent of all bones at the site) show evidence of butchering activities. A careful examina-
Table 9

DISTRIBUTION OF FAUNA BY PROVENIENCE

<table>
<thead>
<tr>
<th>PROVENIENCE</th>
<th>TAXON</th>
<th>BONES</th>
<th>MNI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Cattle</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Large Mammal</td>
<td>373</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Bos/Equus</td>
<td>33</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Artiodactyl</td>
<td>27</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Odocoileus sp.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Chicken</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Sheep</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Lepus sp.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Canis sp.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Bird (chicken-sized)</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td>457</td>
<td>7</td>
</tr>
</tbody>
</table>

| Basal Level   | Large Mammal           | 32    | -   |
|               | Artiodactyl            | 4     | -   |
|               | Cattle                 | 1     | 1   |
|               | Sheep                  | 3     | 1   |
|               | **TOTAL**              | 40    | 2   |

<table>
<thead>
<tr>
<th>AREA I</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 2</td>
<td>Large Mammal</td>
<td>529</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Bos/Equus</td>
<td>74</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Artiodactyl</td>
<td>24</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Canis Familiaris</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Cattle</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Antelope</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Sheep</td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Chicken</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Odocoileus sp.</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Rodent</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td>679</td>
<td>8</td>
</tr>
</tbody>
</table>

| Level 3       | Large Mammal           | 434   | -   |
|               | Bos/Equus              | 96    | -   |
|               | Artiodactyl            | 7     | -   |
|               | Cattle                 | 55    | 3   |
|               | Sheep                  | 25    | 3   |
|               | Peccary                | 1     | 1   |
|               | Turkey                 | 1     | 1   |
|               | Chicken                | 1     | 1   |
|               | **TOTAL**              |       |     |

MNI = Minimum Number of Individuals

244
Table 9—Continued

<table>
<thead>
<tr>
<th>LEVEL 3—continued</th>
<th>TAXON</th>
<th>BONES</th>
<th>MNI</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;</td>
<td>Bird (chicken-sized)</td>
<td>1</td>
<td>-</td>
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</table>

| TOTAL             | 621 | 9   |

<table>
<thead>
<tr>
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<th>MNI</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;</td>
<td>Large Mammal</td>
<td>1,105</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Bos/Equus</td>
<td>153</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Artiodactyl</td>
<td>37</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Cattle</td>
<td>166</td>
<td>2</td>
</tr>
<tr>
<td>&quot;</td>
<td>Equus sp.</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Sheep</td>
<td>62</td>
<td>6</td>
</tr>
<tr>
<td>&quot;</td>
<td>Kinosternon sp.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Antelope</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Canis sp.</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Felis concolor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Chicken</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Equus asinus</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Large Bird (turkey-sized)</td>
<td>3</td>
<td>-</td>
</tr>
</tbody>
</table>

| TOTAL             | 1,547 | 15 |

<table>
<thead>
<tr>
<th>FEATURE 1</th>
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<th>BONES</th>
<th>MNI</th>
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</thead>
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<tr>
<td>&quot;</td>
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<td>112</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Bos/Equus</td>
<td>17</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Artiodactyl</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Small Mammal</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Rodent</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>&quot;</td>
<td>Sheep</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Cattle</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Sylvilagus sp.</td>
<td>1</td>
<td>1</td>
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</table>

| TOTAL             | 149  | 5  |

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<th>MNI</th>
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<tr>
<td>&quot;</td>
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<td>54</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Bos/Equus</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Artiodactyl</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Cattle</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Sheep</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

| TOTAL             | 66   | 2  |
Table 9—Continued

<table>
<thead>
<tr>
<th>PROVENIENCE</th>
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<tr>
<td>Feature 5</td>
<td></td>
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</tr>
<tr>
<td>&quot;</td>
<td>Large Mammal</td>
<td>64</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Bos/Equus</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Artiodactyl</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Cattle</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Sheep</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>83</td>
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</tr>
<tr>
<td>Feature 6</td>
<td>Large Mammal</td>
<td>115</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Bos/Equus</td>
<td>15</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Artiodactyl</td>
<td>11</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Cattle</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Sheep</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Chicken</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>Large Mammal</td>
<td>152</td>
<td>3</td>
</tr>
<tr>
<td>Feature 7</td>
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<td>674</td>
<td>-</td>
</tr>
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<td>Bos/Equus</td>
<td>120</td>
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</tr>
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<td>Artiodactyl</td>
<td>40</td>
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<td>72</td>
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</tr>
<tr>
<td>&quot;</td>
<td>Sheep</td>
<td>42</td>
<td>4</td>
</tr>
<tr>
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<td>Odocoileus sp.</td>
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<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Canis sp.</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>&quot;</td>
<td>Antelope</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Lepus sp.</td>
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<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>956</td>
<td>12</td>
</tr>
<tr>
<td>Feature 8</td>
<td>Bos/Equus</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Cattle</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Odocoileus sp.</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Surface 3</td>
<td>Large Mammal</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Bos/Equus</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>3</td>
<td>-</td>
</tr>
</tbody>
</table>
Table 9—Continued

<table>
<thead>
<tr>
<th>PROVENIENCE</th>
<th>TAXON</th>
<th>BONES</th>
<th>MNI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternating Lime Ash and Soil Lens</td>
<td>Large Mammal</td>
<td>518</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Bos/Equus</td>
<td>96</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Artiodactyl</td>
<td>17</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Cattle</td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>&quot;</td>
<td>Sheep</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Odocoileus virginianus</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Chicken</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Kinosternon sp.</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Small Bird</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td>682</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

AREA II

| Level 5                        | Large Mammal        | 66    | -   |
| "                              | Bos/Equus           | 36    | -   |
| "                              | Artiodactyl         | 7     | -   |
| "                              | Cattle              | 8     | 1   |
| "                              | Sheep               | 1     | 1   |
| "                              | Chicken             | 4     | 1   |
| "                              | Odocoileus sp.      | 1     | 1   |
| TOTAL                          | 123                 | 4     |

| Level 6                        | Large Mammal        | 325   | -   |
| "                              | Bos/Equus           | 38    | -   |
| "                              | Artiodactyl         | 18    | -   |
| "                              | Sheep               | 5     | 1   |
| "                              | Chicken             | 2     | 1   |
| "                              | Cattle              | 6     | 1   |
| TOTAL                          | 394                 | 3     |

| Level 7                        | Large Mammal        | 315   | -   |
| "                              | Bos/Equus           | 42    | -   |
| "                              | Artiodactyl         | 28    | -   |
| "                              | Cattle              | 23    | 3   |
| "                              | Sheep               | 37    | 2   |
| "                              | Dog                 | 176   | 1   |
| "                              | Chicken             | 3     | 1   |
| "                              | Odocoileus sp.      | 2     | 2   |
| "                              | Antelope            | 1     | 1   |

247
<table>
<thead>
<tr>
<th>PROVENIENCE</th>
<th>TAXON</th>
<th>BONES</th>
<th>MNI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 7—continued</td>
<td>Mephitis mephitis</td>
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<td>1</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>628</td>
<td>11</td>
</tr>
<tr>
<td>Level 8</td>
<td>Large Mammal</td>
<td>24</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Bos/Equus</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Artiodactyl</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>32</td>
<td>-</td>
</tr>
<tr>
<td>Level 9</td>
<td>Large Mammal</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>1</td>
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</tr>
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<td>43</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Bos/Equus</td>
<td>1</td>
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<tr>
<td></td>
<td>Artiodactyl</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Cattle</td>
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<td>1</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>48</td>
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</tr>
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<td>63</td>
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</tr>
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<td></td>
<td>Bos/Equus</td>
<td>25</td>
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<td></td>
<td>Artiodactyl</td>
<td>15</td>
<td>-</td>
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<td></td>
<td>Cattle</td>
<td>8</td>
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<td></td>
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<td>4</td>
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<tr>
<td></td>
<td>Lepus sp.</td>
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<td>1</td>
</tr>
<tr>
<td></td>
<td>Sheep</td>
<td>1</td>
<td>1</td>
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<tr>
<td></td>
<td>Chicken</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Sylvilagus sp.</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
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<td>TOTAL</td>
<td>122</td>
<td>7</td>
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<td>Level 11b</td>
<td>Large Mammal</td>
<td>46</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Bos/Equus</td>
<td>132</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Artiodactyl</td>
<td>12</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Cattle</td>
<td>17</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Odocoileus sp.</td>
<td>6</td>
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</tr>
<tr>
<td></td>
<td>Chicken</td>
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Table 9—Continued

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<thead>
<tr>
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<th>MNI</th>
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<td>Level 11b—continued</td>
<td>Lepus sp.</td>
<td>3</td>
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<td>Level 12</td>
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<td>29</td>
<td>-</td>
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<td></td>
<td>Bos/Equus</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Artiodactyl</td>
<td>12</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Cattle</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>47</td>
<td>1</td>
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<td>Level 13</td>
<td>Large Mammal</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Bos/Equus</td>
<td>6</td>
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</tr>
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<td></td>
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<td>1</td>
<td>1</td>
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<td></td>
<td>Cattle</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Sheep</td>
<td>1</td>
<td>1</td>
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<tr>
<td>TOTAL</td>
<td></td>
<td>18</td>
<td>2</td>
</tr>
<tr>
<td>Feature 2</td>
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<td>64</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Bos/Equus</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Artiodactyl</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Cattle</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Chicken</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Bird (chicken-sized)</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
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<td>80</td>
<td>2</td>
</tr>
<tr>
<td>Feature 9</td>
<td>Large Mammal</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Artiodactyl</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>Feature 10a</td>
<td>Large Mammal</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Bos/Equus</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Artiodactyl</td>
<td>2</td>
<td>-</td>
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</table>
Table 9—Continued

<table>
<thead>
<tr>
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<th>MNI</th>
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</thead>
<tbody>
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<td>Feature 10a—continued</td>
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<td>1</td>
</tr>
<tr>
<td></td>
<td>Rodent</td>
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<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>15</strong></td>
<td><strong>2</strong></td>
</tr>
<tr>
<td>Feature 10b</td>
<td>Large Mammal</td>
<td>9</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Artiodactyl</td>
<td>1</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Cattle</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Sylvilagus sp.</td>
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<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>16</strong></td>
<td><strong>2</strong></td>
</tr>
<tr>
<td>Feature 11</td>
<td>Bos/Equus</td>
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<td>–</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>10</strong></td>
<td><strong>–</strong></td>
</tr>
<tr>
<td>Feature 12</td>
<td>Bos/Equus</td>
<td>19</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Cattle</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Sheep</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>27</strong></td>
<td><strong>2</strong></td>
</tr>
<tr>
<td>Surface 2</td>
<td>Large Mammal</td>
<td>1</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>1</strong></td>
<td><strong>–</strong></td>
</tr>
</tbody>
</table>

**AREA IV**

| Level 15          | Large Mammal | 2     | –    |
| Level 16          | Large Mammal | 32    | –    |
|                   | Bos/Equus    | 10    | –    |
|                   | Artiodactyl  | 4     | –    |
|                   | Cattle       | 2     | 2    |
|                   | **TOTAL**    | **48**| **2**|

NOTE: Number of bones and MNI's for Area IV are x2.
Table 9—Continued

<table>
<thead>
<tr>
<th>PROVENIENCE</th>
<th>TAXON</th>
<th>BONES</th>
<th>MNI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provenience Uncertain</td>
<td>Large Mammal</td>
<td>266</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Bos/Equus</td>
<td>46</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Artiodactyl</td>
<td>13</td>
<td>-</td>
</tr>
<tr>
<td>&quot;</td>
<td>Cattle</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>&quot;</td>
<td>Sheep</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>&quot;</td>
<td>Antelope</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Canis sp.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Odocoileus sp.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>&quot;</td>
<td>Chicken</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

TOTAL 347 10

SURFACE COLLECTION

<table>
<thead>
<tr>
<th>TAXON</th>
<th>BONES</th>
<th>MNI</th>
</tr>
</thead>
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<tr>
<td>Non-Rodent-Hole-Associated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot; Large Mammal</td>
<td>193</td>
<td>-</td>
</tr>
<tr>
<td>&quot; Artiodactyl</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>&quot; Sus Scrofa</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>&quot; Lepus cf. alleni</td>
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<td>1</td>
</tr>
</tbody>
</table>

TOTAL 200 2

<table>
<thead>
<tr>
<th>TAXON</th>
<th>BONES</th>
<th>MNI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rodent-Hole-Associated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot; Large Mammal</td>
<td>241</td>
<td>-</td>
</tr>
<tr>
<td>&quot; Bos/Equus</td>
<td>11</td>
<td>-</td>
</tr>
<tr>
<td>&quot; Lepus sp.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>&quot; Lepus cf. alleni</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>&quot; Artiodactyl</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>&quot; Cattle</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>&quot; Sheep</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>&quot; Chicken</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>&quot; Peromyscus sp.</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

TOTAL 261 6

GRAND TOTAL 8,098 136
tion of these butcher marks leads to the establishment of three categories: those elements which were sawn or chopped with metal implements and those exhibiting simple cut marks (done with either stone tools or metal knives).

Table 10
Distribution of Butchered Bone by Technique Used

<table>
<thead>
<tr>
<th>Type of Butchering</th>
<th>No. of Bones</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawn</td>
<td>538</td>
<td>76.64</td>
</tr>
<tr>
<td>Chopped</td>
<td>46</td>
<td>6.55</td>
</tr>
<tr>
<td>Cut Marks</td>
<td>118</td>
<td>16.81</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>702</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

It is apparent that the majority (83.19 percent) either had been sawn or chopped with metal tools. This is to be expected, given the Spanish occupation of the site. The remaining cut marks could have been made either with aboriginal stone tools or with European metal implements; this could not be determined with any certainty from an examination of the marks. As Table 2 shows, more than 90 percent of these butchered bones are cattle, *Bos/Equus*, or large mammal scrap. Smaller fauna such as chickens or rabbits were probably cooked whole or were dismembered in such a way as to leave few obvious marks on the bones.

One of the questions which can be asked of any faunal sample composed primarily of large animals is whether the animals were killed on the hoof at the site, or whether cuts of meat were brought in from elsewhere. An examination of the skeletal elements in the Tumacacori sample shows that all parts of the body are present, particularly with respect to the domestic mammals. (Naturally, species such as mountain lion or turkey which occur only rarely in the sample cannot be expected to exhibit all the various skeletal elements.) It is notable that skull fragments, hyoids, carpals, tarsals, and phalanges are all present, for example, in the cattle, sheep, horses, deer, and antelope recovered from the site. These elements are the ones most often discarded as waste scraps after an animal has been butchered for food. This is strong evi-
dence that these species were killed at or near the site, and that meat-bearing limbs from animals slaughtered elsewhere were not imported. The detailed lists of livestock in the documentary history of Tumacacori supports this conclusion (Kessell 1972).

The numbers of burned bones can sometimes permit inferences concerning food-preparation practices. A total of 846 elements, 10.48 percent of the Tumacacori sample, was burned. Since Levels 11a and 11b, Feature 6, Feature 7, and Level 4 represent areas of the site which appear to have been burned, the burnt bones from these proveniences were subtracted. The remaining 447 elements (5.54 percent of the sample) would seem to represent cuts of meat roasted directly over a fire. The species distribution of these burned bones (from nonburned proveniences only) is as follows:

Table 11
Distribution of Burned Bone

<table>
<thead>
<tr>
<th>Fauna</th>
<th>No. Burnt Elements</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large mammal</td>
<td>395</td>
<td>88.37</td>
</tr>
<tr>
<td>Bos/Equus</td>
<td>14</td>
<td>3.13</td>
</tr>
<tr>
<td>Artiodactyl</td>
<td>7</td>
<td>1.57</td>
</tr>
<tr>
<td>Cattle</td>
<td>13</td>
<td>2.91</td>
</tr>
<tr>
<td>Sheep</td>
<td>14</td>
<td>3.13</td>
</tr>
<tr>
<td>Deer</td>
<td>1</td>
<td>0.22</td>
</tr>
<tr>
<td>Dog</td>
<td>1</td>
<td>0.22</td>
</tr>
<tr>
<td>Jackrabbits</td>
<td>2</td>
<td>0.45</td>
</tr>
</tbody>
</table>

TOTAL 447 100.00

Therefore, of the meat cooked barbecue-style at the mission, the great majority represent beef, lamb, and other large mammals. Smaller fauna were probably stewed whole or braised in liquid. In addition, 13 elements (mostly phalanges) show evidence of having been cut open and their marrow removed. This pattern is common in the Southwest and may indicate their use in soup. John Clonts (1969) refers to this as the "menu-do complex." Eleven of the elements belonged to cattle, one to sheep,
and one to deer. The single burnt dog bone may point to occasional use of these animals for food, as well as pets.

Three bone tools were recovered. Two represent deer antler flakers (Odocoileus sp.) and the third appears to be a fragmentary bone awl which could be identified only as large mammal. Although few in number, these tools imply that use of native technology had not been completely superseded by European metal implements. The two antler flakers came from early mission horizon proveniences, Levels 11a and 11b. The bone awl is from a disturbed (hence, undated) level.

Besides the two antler tools, which indicate the presence of at least one male deer, two other male animals were identified in the mission fauna. The small dog buried in Level 7 was an adult male, as indicated by the baculum or penis bone. One of the chickens possessed a bony spur on the distal end of the tarsometatarsus (lower leg bone), a characteristic present in some male fowls.

Two elements (one sheep and one large mammal) were found which had apparently absorbed copper from the soil. This attractive blue-green coloring can resemble deliberate painting, but careful examination of the bones' interior surfaces revealed that it was simply cupric staining.

There were three examples of pathology in the faunal sample. One cattle phalanx showed evidence of osteoarthritis, while a second cattle element (carpal) exhibited abnormal bone growth resulting in a pathological shape. One of the transverse processes of a sheep lumbar vertebra had been broken and rehealed at some time during the animal's life.

Finally, a count was made of the bones showing modification by animals. Less than one percent of the total collection fell into this category; nine were rodent gnawed and 13 had been carnivore chewed. From this it can be inferred that the Tumacacori bone refuse has remained relatively undisturbed by animal scavengers since its deposition.

Conclusions

As was expected, large domestic animals, particularly cattle and sheep, clearly dominated the Tumacacori faunal sample. This held true whether the fauna were analyzed by raw bone count or by minimum number
of individuals, as well as when subdivided by time period and by func-
tional area of the site. Still, there was a fair diversity of indige-
nous fauna, which must have provided a small but interesting addition to
life at the mission. Some of these wild species include deer, prong-
horn antelope, peccary, jackrabbits, and cottontail rabbits. Several
other animals were probably intrusive; it is not likely that the mud
turtle, striped skunk, rodents, or mountain lion represented food
sources to the residents of Tumacacori. At least two domestic dogs were
present at the site, one of which appears to have been deliberately in-
terred the way one would bury a cherished pet.

Examination of the butchered bones shows that the majority had been
sawn or chopped with metal implements, as opposed to aboriginal stone
tools. However, three bone tools were recovered from the sample, two
antler flakers and a bone awl.

The fact that a relatively small percentage of all recovered bones
was burned implies that most meat was prepared by boiling rather than by
roasting directly over a fire. The majority of the bones which were
burnt belonged to large domestic mammals. Thus, the smaller species
such as rabbits and chickens were probably most often prepared by stew-
ing. The presence of 13 bones which had been opened to allow removal of
the marrow seems to indicate the typical southwestern practice of making
soup from the lower extremities of large mammals, especially cattle.
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