EXCAVATIONS AT THE TUBAC PRESIDIO

BY

Lynette O. Shenk

and

George A. Teague

WITH APPENDIX

BY

James M. Hewitt

1975

ARIZONA STATE MUSEUM

ARCHAEOLOGICAL SERIES NO. 85

EXCAVATIONS AT THE TUBAC PRESIDIO

By

Lynette 0. Shenk
and
George A. Teague

With Appendix by

James M. Hewitt

Prepared for the

Arizona State Parks Board

Cultural Resource Management Section
Arizona State Museum
University of Arizona

1975

ARCHAEOLOGICAL SERIES NO. 85

PREFACE AND ACKNOWLEDGEMENTS

In June of 1974, the Arizona State Museum was contracted by the Arizona State Parks Board to develop a program for the excavation and interpretation of a portion of the historic structures at the Tubac Presidio State Historic Park. This project was initiated by State Parks as part of Arizona's participation in the national bicentennial celebration. It was initially hoped that the structures, once exposed, could be stabilized and exhibited to the public. Due to the fragile nature of the remaining architectural features, it has since been decided to backfill the site until funds are available for displaying a re-excavated, protected section.

Excavations at the site formally began in October of 1974, under the supervision of Lynette 0. Shenk, and continued for approximately 16 weeks, until late January, 1975. Because of the complexity of the site and time limitations, excavation was confined to the area occupied by the Spanish structure that once housed the commandant's residence and the military headquarters for the presidio. The program of fieldwork did entail sufficient exploration of the site to ensure that interpretive, managerial, and research problems could be considered in some depth.

The authors are extremely grateful to the many people who, through their conscientious efforts, made the data collection, materials analysis, and final report preparation possible. Special gratitude is due to Dennis McCarthy, State Parks Director and Wallace F. Vegors, Assistant Director, for their support of this project, and to Hollis Cooke, Head Ranger of the Tubac Presidio State Historic Park, and Glen Miller, also a ranger, for their courteous assistance through all phases of our work. Mr. Miller also served as Field Assistant, gathered pertinent historical background data on the site, and performed field-surveying and mapping chores. Acknowledgement should also be given here to J. Cameron Greenleaf who was responsible for preliminary test excavations at Tubac.

Mr. Donelly D. Cassidy plotted the site through aerial photography and assisted in initiating the grid system on the site.

Thanks are also due to a very able crew who endured anything but perfect conditions and deserve every compliment; to Barbara Kranichfeld, as laboratory supervisor; and to the Tubac Historical Society for providing very helpful laboratory volunteers.

A number of people aided in the material analysis by examing artifactual specimens from Tubac. Our appreciation is extended to James Ayres, David Doyel, Bernard Fontana, Laurens Hammack, Emil Haury, Robert Herskovits, Bruce Huckell, Randy McGuire, Stanley Olsen, and Sharon Urban.

We also wish to acknowledge the assistance of the Arizona State Museum staff for final preparation of this report: Charles Sternberg, draftsman; Helga Teiwes-French, photographer; Susan Brew and Melinda Curry, typists; Kathleen Clarke, editor; and Dola Moore, bookkeeper.

Stanley Olsen, zooarchaeologist, Arizona State Museum, supervised the analysis of the faunal remains from Tubac.

Very special appreciation is extended to R. Gwinn Vivian, as principal investigator, and to Lynn S. Teague, as project director, for administering the Tubac undertaking. Ms. Teague also collaborated on the research design and preliminary editing.

To all of these people, the writers acknowledge a debt of gratitude.

CONTENTS

Figures

Tables

Chapter 1

INTRODUCTION

The site of Tubac was first recorded on October 29, 1941, by E. B. Danson and L. R. Caywood. In their site survey, Danson and Caywood reported surface findings of indigenous and "Mexican" pottery wares along with other artifactual and architectural remains. The presence of these materials and a large mound, next to a 20th-century schoolhouse, indicated to them that this was indeed the locus of the "old Spanish Presidio."

The Presidio

Webster's New World Dictionary defines a presidio as a "fortified place; military post; fort; garrison." According to Ted Warner, the military defense of the northern frontiers of New Spain served three specific purposes: the protection of Hispanic settlements and missions against possible revolts by the "pacified" indigenous population; defense against marauding raids by Indians who had not submitted to Spanish rule; and defense of the borderlands against foreign powers (Warner 1966: 5). The most successful approach to border defense was the development of a system of forts and military towns placed at strategic points along the frontier. Warner states:

> This line of fortified places resembled those used by the Romans for the protection of the empire, and lines of castles established in Spain during the invasions by the Moors. These forts were called presidios, from the Latin term presidium, meaning a garrisoned town or fortress (Warner 1966: 6).

The early presidios varied little in design and construction. They were usually located near good farming land and were built on high ground utilizing a construction pattern learned from the Moors (Faulk 1969: 22-28).

Tubac initially took the form of a garrisoned town rather than a fortified structure. Buildings were situated in a haphazard fashion. Probably because of the uncertainty of the fort's permanency, no protective wall surrounded the town. The line of frontier presidios was not stable, and was constantly revised as Spanish settlement advanced.

Tubac as a military installation and as a civil community encountered many problems during the site's long occupation span. The Spanish Crown was remiss in its administration of New World outposts, and the presidial system broke down more than once as a result of inadequate funds and incompetent commanders. These failings were intensified by the Apache. While the presidio was usually able to withstand attack, it could not halt the wave of Indian raids into the Spanish frontier. Settlements were repeatedly deserted and reoccupied as military support fluctuated. The campaigns of the presidios against indigenous enemies were seldom successful.

However, it was an internal issue stemming from the Crown's neglect that ultimately effected the downfall of the presidial system. The inability of the presidios to supply the frontier adequately with needed goods and equipment undermined the morale of troops and citizens who were often without essential commodities. Methods of supply posed the most difficult and persistent problems faced by these frontier institutions.

Location and Resources

Tubac is situated in the valley of the Santa Cruz River, on its west bank, at an altitude of 3,000 feet above sea level. Located to the west are the Tumacacori Mountains, a rugged and bare range reaching an altitude of about 5,000 feet. The eastern wall of the valley is formed by the vast Santa Rita Mountains which attain a height of over 9,000 feet. Tubac has been described as sitting "at one end of what may be termed a semi-amphitheater of valley and mountain" (Hinton 1954: 189). The site's location in relation to major features can be seen in Figure 1.

The physiographic setting of Tubac was described by Engineer Nicolds de Lafora during his 1766 inspection tour with the Marques de Rubí of the frontier presidios:

> On the 20th we traveled eight leagues toward the northwest (from Guebabi Mission) slightly north through the valley of the preceding day and always skirting the river. It is well-wooded by cottonwoods on its banks and the rest of the plain has many mesquites and other trees. The surrounding hills are quite bare. Among them, on the right, can be seen the Santa Rita range with its very high peak, and that of San Cayetano, remarkable as a refuge for the enemy after their forays (Kinnaird 1958: 108).

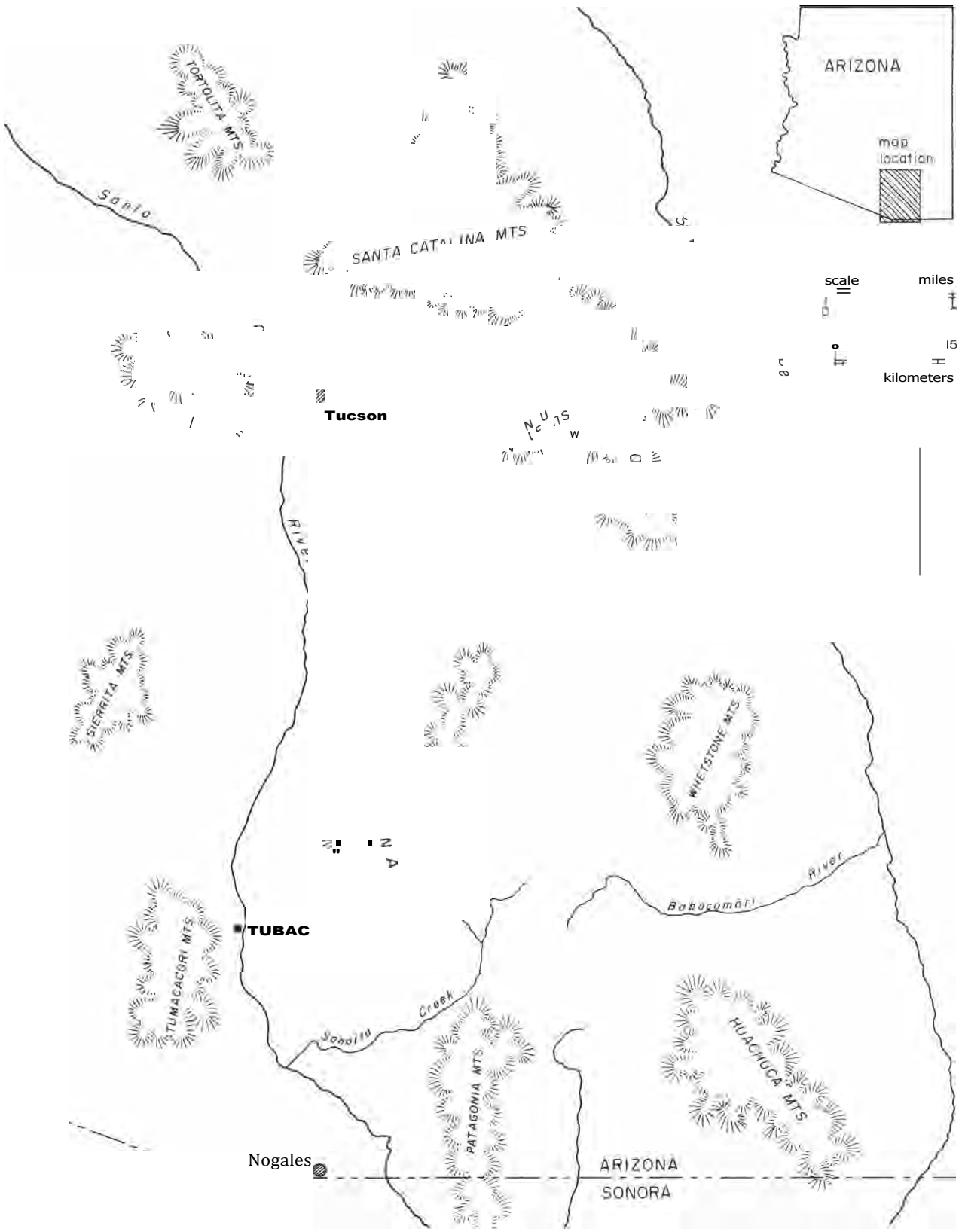


Figure 1. Location of Tubac and related area.

Strategically located on the northern frontier, Tubac also enjoyed access to water and irrigable land. In addition there was an abundance of natural grass pasture for the livestock on the nearby hills and valley slopes between the mountains and the river floodplain (Dobyns 1959: 417).

History of Excavations

The section of the town of Tubac in which this project was conducted was incorporated into the Arizona State Parks system in 1957. Two excavations were carried out by park rangers although not in the area of the presidio. The first of the diggings exposed two burials located approximately four meters apart on the east side of the Santa Cruz River. This work was conducted by Alan K. Lester in November of 1971. Lester was also responsible for further excavations in the area during 1972 and 1973. In the course of his investigation he discovered a late-19th-century residential structure. This house site is located several hundred feet south of the presidio grounds.

The excavations conducted by the Arizona State Museum at Tubac State Historic Park had two objectives. First, we hoped that the site would provide information that would further clarify our knowledge of life on the Sonoran frontier. Second, we directed the excavations in such a way that an interpretive exhibit could be developed at the site.

For that reason, excavations were concentrated within the area occupied by the headquarters building of the Spanish presidio. This U-shaped structure was constructed during the 1750s. Half of the building served as the commandant's residence and half was the military headquarters for the fort. Although this area constitutes only one part of an extensive site, the range of information obtainable is broad, and the questions which this information might answer are by no means exclusively military in nature.

The presidio at Tubac was a military residence with a long history of occupation by various groups representing the cultural diversity of southern Arizona during the historic period. The area in which the presidio was situated was occupied before the construction of that structure and after its abandonment. During the periods which bracket that of the presidio proper the community did not serve military purposes. The cultural and functional history of the site can be summarized as follows.

I. Habitation

1730s - 1751: Piman rancheria and Spanish mission ranch

II. Military occupation

1752 - 1776: Spanish occupation of the presidio

1787 - 1821: Pima Indian Company

1821 - 1854: Mexican garrison

1862 - 1865: Intermittent occupation by the U.S. Cavalry

III. Mining

1855 - 1861: Sonora Exploring and Mining Company

IV. Public facilities

1900s: Tubac town school

1900s: Tubac State Historic Park

Over this long period of occupation there were few times when the area was not in use, and these times were of short duration. Understandably then, the site is archaeologically complex. Stratigraphic levels representing the various occupations are present along with associated features, architecture and artifacts. The evidence of early occupation has often been disturbed by the activities of later occupants.

Assuming, as does all archaeological research, that a site's material culture reflects patterns of cultural behavior, we interpreted our findings in light of Tubac's cultural and functional diversity. By examining the material evidence we hoped to answer two basic questions about Tubac's occupants. How did the inhabitants of the site interact with their natural environment? How did they interact with their cultural environment? These inquiries are directed at problems of adaptation and acculturation respectively. Two modes of evaluation were employed in resolving these questions: an analysis of individual site occupations and a comparison of successive occupations. These research aims are fully delineated in Chapter 3.

Chapter 2

HISTORICAL BACKGROUND

The advancing Spanish frontier reached the area of Tubac in 1701 when direct missionary attempts to alter the lifestyle of the local Tchoowaka Indians began (Dobyns 1959: 55). By the 1730s the first European settlers were established at Tubac as supervisors of a mission farm and visita. A visita was "a community visited more or less regularly by a priest from a nearby mission" (Dobyns 1962: 6). The farm operated there as part of the Jesuit empire which had come into existence on the Sonoran frontier. Spanish overseers lived at the nearby Indian rancherfa with their families (Dobyns 1959: 64-65). On November 21, 1751, however, the conversion of the northern Pima came to an abrupt end (Dobyns 1959: 77).

Although normally a compliant people, the Pima Indians arose simultaneously on November 21 against Spanish authority which was mainly in the hands of the missionaries. This was a revolt against the whole colonial system, but it was initiated by a few more specific problems: the appropriation of Indian lands; the punishment system of the missionaries; and an affront to Chief Luis by Father Ignacio Keller at Soamca (Bents 19)49: 14). "Initial contact accompanied by material benefits for the natives, increasing Spanish demands and controls, violent native reaction, Spanish retaliation, and final sullen acceptance of domination--the cycles of Spanish conquest had run their familiar course in the Pimería" (Kessell 1970: 117-118). As Spicer indicates in Cycles of Conquest (1962: 16), this pattern was repeated many times throughout the period of Spanish frontier involvement.

As a result of the rebellion a garrison was created in Pimerfa Alta. On April 1, 1752, a company of 50 men under the command of Captain Juan Tomás de Belderrain was activated. The garrison took up temporary headquarters at Santa Ana, a predominantly Spanish settlement located south of San Ignacio, while opinions were heard from military officers and frontier Jesuits concerning the permanent location of the fort (Kessell 1970: 125).

A decision was made by Governor Ortiz Parilla in June of 1752, and by the following January the new presidio was formally established at the place of Luis' surrender--Tubac (Kessell 1970: 125). The original Piman population had fled the site during the uprising, and it is likely that the Spanish troops initially occupied the abandoned native structures. Exactly when construction of the Royal Fort of Saint Ignatius began is not known.

The primary military mission of the new outpost was to divert the troublesome Apache. Shortly after the Pima Revolt, the southern Athapascan became a serious threat to the northern Piman and frontier Spaniards (Dobyns 1959: 168). The campaigns of the Tubac cavalry consisted mainly of retaliatory raids following Apache or Seri incursions. Dobyns indicates that troops participated in a minimum average of five forays annually through the first 24 years (1752-1776) of the fort's existence (Dobyns 1959: 194).

During the garrison's defensive actions against the Indians, a presidio complex and pueblo were under construction. Captain Juan Toms de Belderrain retained command of the Tubac garrison until his death in the late 1750s. The commander's domicile, the headquarters, and the original troop quarters were all built, or at least begun, under his direction. By 1763 Juan Bautista de Anza had assumed the position of commandant (Bents 1949: 39). Anza was wealthy enough to purchase the captain's quarters which his predecessor had built (Dobyns 1959: 249).

The population of Tubac between 1754 and 1757 numbered 411, including the garrison (Bents 1949: 22). In addition to discouraging Indian raids, the presidio endeavored to amass near the fort civilian settlers who could eventually protect themselves, thereby freeing the garrison to move north with the frontier (Dobyns 1959: 306).

By 1766 Tubac was already a large town center by frontier standards. Tubac's earliest map, dating from that year, indicates the presence of 49 dwellings south of the military headquarters with 11 structures to the north. The fort offered no protective barrier to the local residents, and the town grew up as a straggling line of small adobe buildings.

On December 20, 1766, the MarqueS de Rubí arrived in Tubac on his inspection tour (Kinnaird 1958: 108). Strengthening defenses along the northern frontier of New Spain was an important objective at this time. Charles III therefore had

commissioned the Marque's to inspect all presidios in the viceroyalty and make recommendations for improvement (Kinnaird 1958: 1).

While Rubí examined the post at Tubac, Lieutenant Joseph de Urrutia paced off distances for a map of the installation (Fig. 2). As indicated by the map and the field marshal's notes:

> Tubac has no inclosure or fortifications at present nor was it allotted any funds for this purpose . . . because of the uncertainty as to its permanency (Kinnaird 1958: 23-24).

Rubí knew the need for protecting the long frontier with the small military force available. Thus a new, shorter defense line was established by the relocating of 12 presidios. Since Rubí believed that Tubac now had a population large enough to protect itself, the Tubac garrison was to be transferred to "the banks of the Santa Cruz," to Tucson (Kinnaird 1958: 38).

Life at these early presidios was not easy. At Tubac the years 1777 to 1783 were particularly trying. Troop payment was small. All manufactured goods were ordered for the citizenry by the commandant, an unreliable agent (Dobyns 1959: 223). Armament for the post in 1766 consisted of four useless cannons (Dobyns 1959: 206); weapons were the lance, the musket, and the broad sword, again mostly of poor quality (Faulk 1971: 53). Early troops did not even wear a semblance of a uniform until after 1766 (Dobyns 1959: 214).

Although the Crown encouraged agricultural settlement, there were few enthusiastic farmers on the Sonoran frontier. Cattle ranching was the main pursuit with some mining of high-grade ores also practiced.

In January, 1774, Anza led the first military expedition from Sonora to upper California. While he was away the Saint Ignatius company transferred from Tubac to Tucson, sometime in the fall of 1766 (Bents 1949: 42). Only a small detachment was left behind for the protection of the citizenry. The Tubac community decreased sharply in population at this time to around 150 residents (Dobyns 1959: 410). The settlers sent numerous petitions for a restoration of the presidio or at least for more troops. The basic reason for their discontent was the ever increasing threat of Apache raids.

Requests for increased military protection went unanswered and people began to leave for safer settlements. In April of 1779 even the few remaining troops returned to the Tucson post. Others continued to drift away and by 1783 Tubac was definitely abandoned (Dobyns 1959: 425-426).

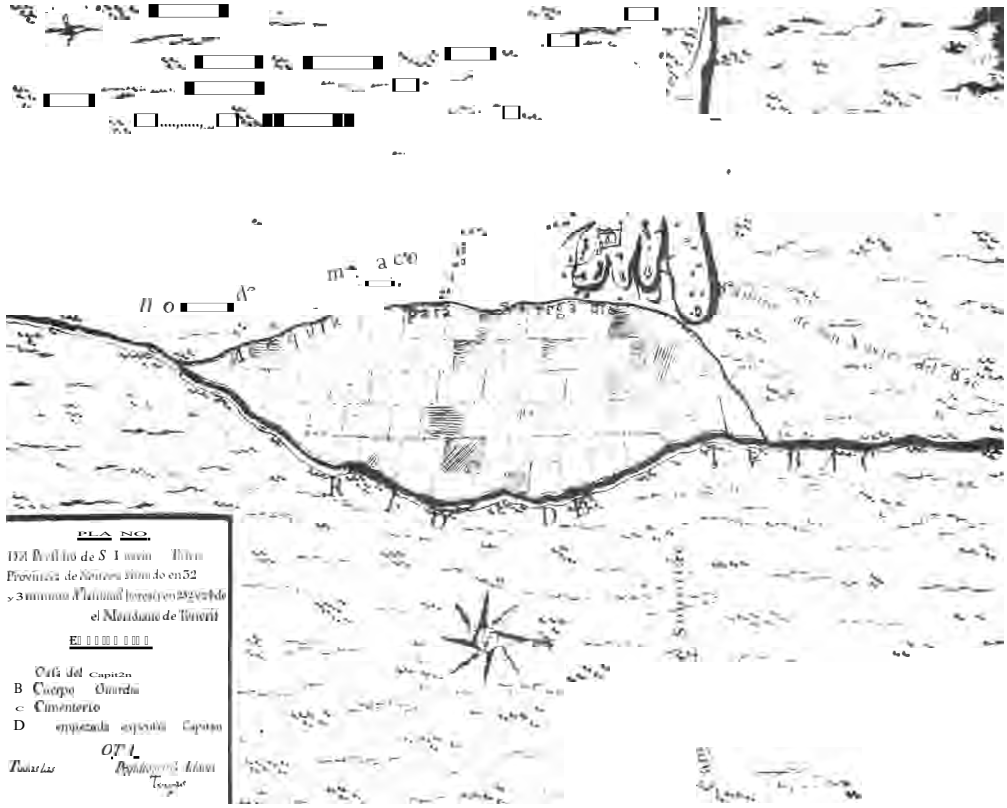


Figure 2. Lt. Urrutia's 1766 map of the Presidio.
(Courtesy Arizona State Museum)

Figure 3. J. Ross Browne sketch of Tubac, 1864. By permission from Adventures in the Apache Country, J. Ross Browne, Tucson: University of Arizona Press, Copyright 1974.

The initiation of a new Apache policy in 1786 led to the transfer of the Pima Indian Company from Buenavista to Tubac in 1787. Tubac was closer to the frontier and the presidial garrisons had begun to conduct offensive attacks against the Apache. Thus the aid of the Pima Company was required (Dobyns 1959: 433). With their transfer the name of the outpost became the Royal Fort of Saint Rafael at Tubac.

The company was multi-tribal in composition, and members were among the most acculturated Indians living in Sonora. Garrison strength consisted of 84 officers and men including one commanding lieutenant (Dobyns 1959: 442). This post commander also served as political and military judge for the entire community (Dobyns 1959: 446).

A "Great Offensive" in 1788 brought about the surrender of the southern Athapascan bands and effective pacification of the frontier (Dobyns 1959: 664). As a result, however, the military power of frontier presidios was no longer needed and the forts declined from non-use. Tubac was no exception.

While the presidio was slowly deteriorating as an active military installation, the surrounding community began to expand outward from the post and flourish. Since the Apache had been more or less quelled, more lands could be claimed for ranching. Mining exploitation also boomed. The mission at Tumacacori kept the post supplied with grain and meat for the remaining troops (Dobyns 1959: 490). Despite peaceful frontier conditions, involuntary servitude continued in practice by both the Spanish officers and the members of the Pima Indian Company just as it had with the earlier garrison.

In the fall of 1821, the colonial government was dissolved when Mexico achieved political independence from Spain. The royal fort at Tubac ceased to exist until its re-establishment in 1824 by the Mexican government. The garrison remained, however, and the process of conversion from imperial to republican status was an orderly one (Dobyns 1959: 516).

The military situation on the northern frontier changed little with Mexico's political independence. The Pima Indian Company continued to comprise the Tubac infantry. On the whole, presidial garrisons came to Mexico practically intact. During the period of transition, there were continued and efficient military operations on the Sonoran frontier (Dobyns 1959: 533-540). By the mid-1830s, however, problems began to arise. The resurgence of the southern Athapascan resulted in numerous desertions at the outposts. The

population of the entire frontier was decreasing as settlers fled from continual Apache harassment.

An internal breakdown of the presidial system was also in progress, resulting primarily from problems with troop payment and a lack of responsible command. Frontier soldiers were resorting to selling their own weapons in order to feed themselves. It is no wonder that by 1840, the actual complement on duty at Tubac numbered only 30 men (Dobyns 1959: 562).

Initially, after Mexican independence, the citizens of Tubac enjoyed a civil government that had never existed in colonial times (Dobyns 1959: 571). Because of the long period of peace between the Apache and the Spaniards from 1790 until just after 1830, the population reached approximately 400 by 1840 (Dobyns 1959: 592).

Economic production also boomed during the political transition. Farmers intensively cultivated the same cereal grains that they had in colonial times. Horticulture also became popular in the Santa Cruz Valley, and several varieties of fruit were grown at Tubac (Dobyns 1959: 577). If there was a limiting factor on agricultural production at Tubac, it was the existence of thriving farming communities to the south (Dobyns 1959: 578). After independence, just as earlier, the ranching of beef cattle and horses prospered.

However, this condition of general affluence lasted only until about 1832, when the Apache population settled at the forts again began to raid the settlers. With a troop strength of only 30 men by 1840, the Tubac post was an excellent target. Apache raids began to pick up during 1846, 1847, and 1848 (Dobyns 1959: 610).

The year 1849 marked the greatest triumph of the Apache on the Sonoran frontier (Bents 1949: 79). The settlers from Tubac and Tumacacori moved north to Tucson and Bac after a full-scale Apache assault killed a number of people (Dobyns 1959: 611). Reasons for the abandonment of Tubac include the Apache raid, the withdrawal of the remaining troops, and the news of the discovery of gold in California in late 1848 (Dobyns 1959: 612).

While it was unoccupied from 1849 to 1851, Tubac served as a waystation for forty-niner emigrants heading west, and as a landmark guide for military surveyors traveling throughout the border country (Dobyns 1959: 620). The Gadsden Purchase was soon to come, and American surveying parties visited the deserted town in September, 1851, and July, 1852 (Bents 1949: 84). Reports by

travelers indicate that Tubac was "another ruined Mission" (Dobyns 1959: 616) and a "collection of dilapidated buildings and huts" (Bents 1949: 84).

In the fall of 1851 a Mexican military colony was established at Tubac with a population of less than 100 residents (Bents 1949: 85). The idea was to create a military complex that would resemble the royal Spanish presidio of earlier years. United States citizens continued to pass through Tubac on the southern route to California, and were encouraged by the post commandant to settle there.

Problems again arose for the newly formed community. Imported goods were heavily relied upon, and provisions were in short supply. A group of Mormons were persuaded to farm on a commercial basis at Tubac in 1852, but were forced out by drought (Dobyns 1959: 624). Little farming was attempted in 1853.

Even the Indian campaign was going badly. The Tubac garrison began fighting the Apache as early as March, 1852. The military colony's encounters with the Indians were mainly defensive in nature, however, and the Tubac forces were repeatedly defeated by the hostiles. Tubac was virtually starving as the Apache attacked supply trains on route to the town (Dobyns 1959: 631-635).

An attempt was made to revive the colony in July of 1853. A peaceful Apache rancherfa was moved from Tucson to Tubac in order to strengthen the new post. There were no farming tools, arms, or ammunition available for the Apache who now constituted the largest part of the Tubac population. These new residents remained at Tubac only one year (Dobyns 1959: 627). By September 15, 1854, only a few Mexican soldiers were stationed at Tubac.

On June 29, 1854, the United States acquired all the land now in Arizona south of the Gila River. News of ratification of the Gadsden Purchase Treaty reached Tubac in September. The area had already witnessed the passage of surveyors for a railroad from the South to the Pacific Coast (Dobyns 1959: 638). Now that the treaty was finalized, Mexican troops gradually withdrew from the tract, and the Tubac garrison repositioned itself to the south. Tubac was again an abandoned village by early 1855 (Bents 1949: 87).

Shortly after the Gadsden Purchase, American enterprise began to penetrate the new territory, searching out its natural resources. Charles D. Poston and Hermann Ehrenberg visited the area early in 1855 with the purpose of determining its wealth. Poston, in a personal narrative, reports on the town:

> Arriving in the Valley of the Santa Cruz, we found the old town of Tubac abandoned by its Mexican garrison and the population which had

> been dependent upon them for protection against the Apache Indians, the most fierce and barbarous tribe of which we have any account. As the houses in Tubac were in a tolerably good state of preservation, we occupied them for headquarters during the ensuing winter, and passed the time in exploring the surrounding country for silver mines . . . . In the course of a few months several hundred people had gathered around Tubac and engaged in planting; the mines developed wonderful richness; and traders from Sonora, New Mexico, and California came to supply all our wants. . . .(Browne 1974: 252-254)

Poston returned to Tubac in 1856 as superintendent of the Sonora Exploring and Mining Company. The town was established as the company headquarters for the vicinity, and was soon partially rebuilt. Poston reported to the home office that Tubac "is the very center of the mineral region in our territory, and has probably 150 silver mines within sixteen miles" (Hinton 195)4: 186). Many of these mines had evidently been worked by the Spaniards and Mexicans in a rudimentary fashion.

In 1858 or 1859, the mining company brought in a printing press and started a weekly paper, The Arizonian. This was the first newspaper to be established in Arizona. The population of Tubac at this time numbered about 800, one-sixth of whom were Americans (Hinton 195)4: 186-187). Tubac was the "head-quarters of civilization in the Territory" (Browne 1974: 149).

But once again misfortune plagued the town. This scene of activity and enterprise, often interrupted by Apache raids, abruptly ended with the outbreak of the Civil War. The federal troops protecting Tubac were withdrawn in 1861, leaving a population of only 25 to 30 persons behind (Hinton 195)4: 187).

In 1864, J. Ross Browne and Poston, now a U.S. Colonel, visited Tubac. Browne describes the town as follows:

> There was not a living soul to be seen as we approached. The old Plaza was knee deep with weeds and grass. All around were adobe houses, with the roofs fallen in and the walls crumbling to ruin. Door and windows were all gone, having been carried away by the Mexicans three years ago (Browne 1974: 1)47).

According to Browne, Tubac was "now a city of ruins--ruin and desolation wherever the eye rests" (Browne 1974: 1)49). Browne's image of the town plaza as he sketched it in 1864 is seen in Figure 3. The face of the presidio's altered north wing is seen to the left, with the town church in the background.

Tubac would be reoccupied in the years to come, and though repeatedly abandoned during its lifetime, the town has survived to this day.

Chapter 3

RESEARCH PROCEDURE

Research Aims

Balancing the documentary record against the material evidence of a historic site requires first a systematic investigation of artifactual material before an attempt at reconstruction can be made. At a minimum the archaeologist tries to establish the identities of spatial and temporal units within a site. Identification and interpretation of the architecture and facilities of a site are made, artifacts are analyzed in terms of function, technology and style, and the site's history is inferred. In addition, many archaeologists are concerned with the patterns ofintra-site settlement and subsistence.

At Tubac we attempted to reconstruct the culture-history and past life-ways. We also tried to identify the nature of human adaptation and inter-action. Specifically we examined community function, communication and transportation, and social interaction as seen in acculturation and in class and caste differentiation.

These inquiries were based on the generally accepted premise that patterns of cultural behavior are reflected by material culture. Because of the cultural and functional diversity of the site, our investigations were pursued by examining individual site occupations and comparing successive occupations.

The choices available to any one of the cultural groups that occupied this site in procuring items of material culture involved various factors: availability of materials, utility of various technologies, and culturally determined preferences for particular materials, designs or technological concepts. These factors may have operated differently with respect to different functional categories or material culture. Human behavior is normally more conservative with respect to some kinds of activities than others.

The central hypothesis of our research suggests several lines of investi-gation, which are developed later.

> Technology and resource utilization at Tubac are directly related to the following elements: the function of the community, the

development of networks of communication and transportation, and patterns of social interaction between cultural groups.

The following corollary hypotheses represent alternative perspectives to the processes of acculturation and adaptation, but are not mutually exclusive.

Community Function

The changing function of the Tubac community may have influenced the degree to which various resources and technologies were utilized. Although never completely specialized, various emphases were present in the kinds of activities in which site occupants engaged. Test implications supporting hypotheses are concerned with the composition of the assemblage in terms of relative proportions of varying functional types. Discovery of these types is necessary in order to define the extent of specialization observable through material culture, in comparison with that indicated by the historical records.

Unfortunately, the small size of the sample at Tubac, especially regarding functionally distinct artifacts, precluded any attempts to pose tests for specialization at the site. We were therefore unable to pursue this area of investigation any further.

Communication and Transportation

The following hypotheses are concerned with the direction of acculturation and adaptation.

I. The process of acculturation was dominated by a trend toward adoption of non-indigenous characteristics by the Indian population and retention of existing characteristics by the intrusive groups. Thus the principal restriction on adaptation to non-indigenous materials and artifact designs would have been their availability, which was dependent on the development of communication and transportation networks.

II. The process of acculturation was not characterized by a unidirectional tendency to adopt or retain non-indigenous materials and technology.

Historical records are available that indicate the extent to which lines of communication were established, making it feasible to import non-indigenous goods and materials. The way in which the site occupants made use of communication networks is proposed as an indicator of interactive processes. Test implications in support of Hypothesis I would include: (a) a significant

correlation between the development of reliable routes of communication and transportation and the quantity of non-indigenous goods present at the site; (b) use of indigenous goods chiefly for those commodities which were excessively fragile, bulky, or otherwise difficult to transport easily; (c) use of non-indigenous goods for all commodities which were easily transportable, given the state of the communication networks at any one time; and (d) maximum reuse of non-indigenous materials.

Hypothesis II would be supported by: (a) a low correlation between the rate of development of trade routes and the quantity of non-indigenous goods utilized; (b) a low correlation between ease of transport and the quantity of specific kinds of non-indigenous materials or artifacts; and (c) failure to maximize reuse of non-indigenous materials except in cases of obvious utilitarian superiority.

Social Interaction

The specific patterns of social interaction involved in the process of acculturation and adaptation are of great interest. At Tubac we sought to acquire data that would deal with the mechanisms of acculturation and with the processes of caste and class leveling.

Acculturation

It is often believed that the culture of intrusive European groups tends inevitably to supercede that of the indigenous Indian groups. The preceding hypotheses reflect this supposition, examining whether in fact indigenous traits were retained only through necessity, when materials and tools of the intrusive populations were not accessible. The hypotheses that follow do not make this assumption, but reflect the need to identify mechanisms that may have led to the exchange of ideas and materials between the groups involved.

Central to these propositions is the assumption that acculturation is most readily evidenced through comparison of change in male-related and female-related artifacts. This assumption has been advanced hypothetically by both Deetz (1963) and Deagan (1973). Deetz's model deals with evidence for acculturation in the Spanish mission system, while Deagan's model has to do with the process of *mestizaje,* intermarriage and concubinage, as a mechanism for

acculturation in the Spanish presidial system. Implications for these hypotheses are similar. In both cases, male-related indigenous artifacts disappear, female-related objects are retained, and items of European technology gradually supplant those of indigenous tradition.

With the above implications in mind, we tested for the presence of acculturative change at Tubac, and sought to learn which of the acculturative mechanisms, missionization or mestizaje, was dominant. We formed the following hypothesis:

> Given the historical record of intercultural relationships at Tubac, we expect that by the time of establishment of the Tubac presidio, acculturative change will have taken place among the indigenous inhabitants of the Tubac area as a result of missionization. If this is the case, the character of the material assemblages will have stabilized, and little change will be seen between the material culture of the presidio Early period (1750-1800) and the presidio Middle period (1800-1850). If, on the other hand, acculturative change has been minimal prior to the establishment of the presidio, significant change will be seen in the artifact assemblages between the Early and Middle periods. If this latter obtains, we posit mestizaje as the dominant acculturative mechanism at Tubac.

This hypothesis was tested against the occurrence of categories of artifacts reflecting both typically female-related activities and male-related activities. Food-processing equipment, for example, is assumed to relate to female activities, while such items as horsegear and weaponry are assumed to reflect male activities.

Caste and Class Relationships

Significant caste and class distinctions were recognized on the Sonoran frontier during the Spanish colonial period. It has been argued that, following Mexican independence, caste and class differences diminished (Dobyns 1959: 546).

We examined the archaeological record at Tubac for correlates of change in caste and class relationships. Subsequent interpretations led to the development of a testable hypothesis. The data available was, however, inadequate for testing at present.

Summary

At Tubac research was directed with the aims of reconstructing culture-history, reconstructing past lifeways, and interpreting various features of

human adaptation and interaction. Functional and historic schemes were devised. Several hypotheses regarding communication and transportation and acculturation were tested. A hypothesis of site function was not tested due to data limitations. A hypothesis regarding caste and class distinctions was devised by inference from the Tubac data.

Method and Technique

The general location of the Tubac presidio has long been known in local tradition, although surface exposures of architectural features have been lacking during this century.

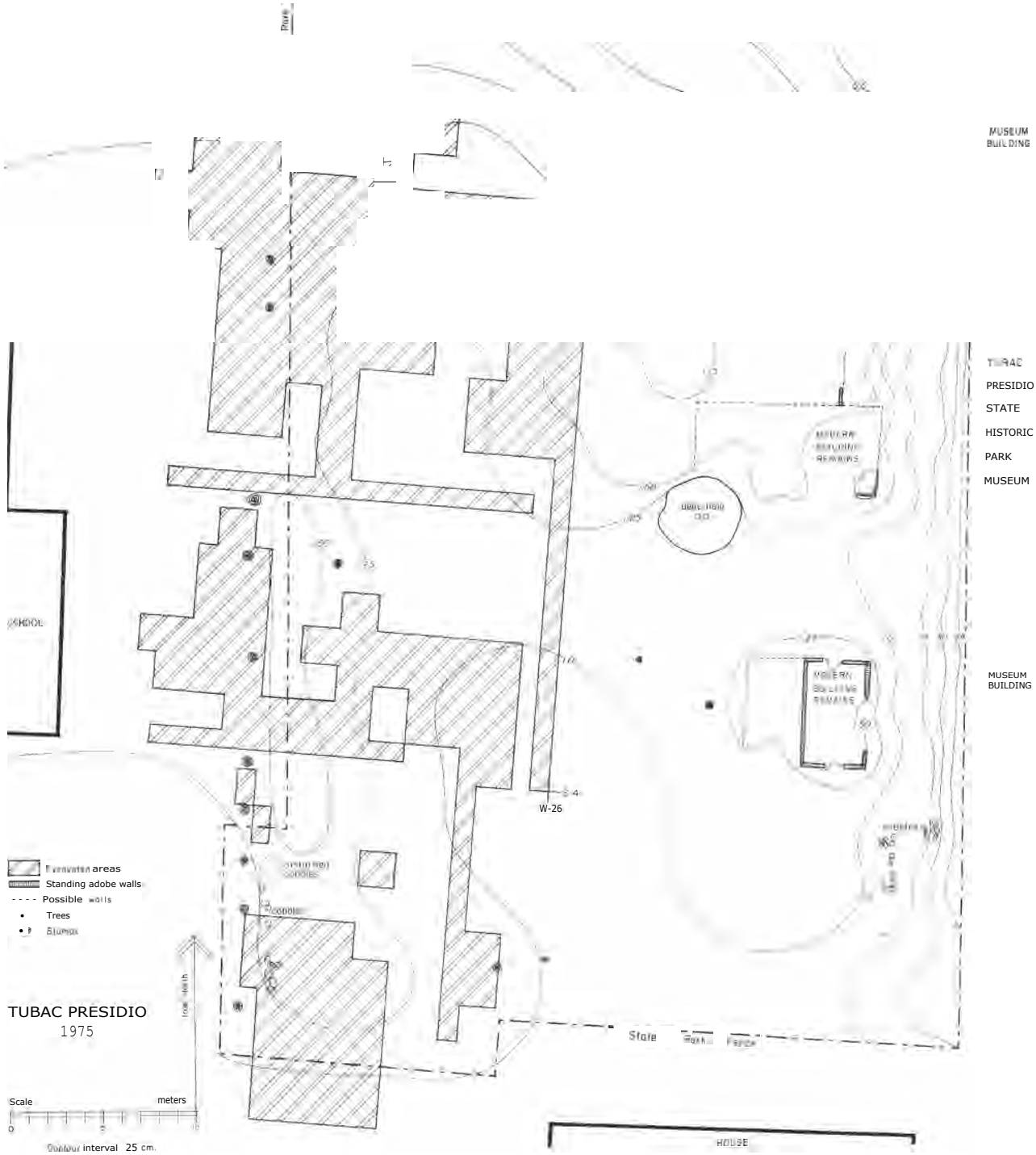
In 1941, E. B. Danson and L. R. Caywood, then of the Arizona State Museum, visited the town of Tubac and recorded the presumed location of the presidio. This location was given added confirmation in late 1974 by superimposing aerial photographs of the Tubac area upon Urrutia's 1766 map of the presidio and environs.

Excavations by the Arizona State Museum commenced in October, 1974, and ended in February, 1975. Excavations were preceded by the imposition of a horizontal metric grid, and by controlled, systematic surface collections taken from non-randomly selected two-meter-square units. A base map showing man-made and physiographic features was drafted. This map was elaborated as excavation progressed (Fig. 14).

Controlled cross-trenching provided a sectional view of site deposition, and further trenching and surface stripping revealed, initially, a part of the north wall and portions of plastered plaza surfaces. Site definition continued through the use of meter-wide trenches as well as two-meter-square search areas. Both trenches and search areas were expanded into larger horizontal units as the situation dictated. Architectural remains, such as rooms, as well as other features, such as trash pits, were dug as integral units, but were mapped and recorded within the encompassing grid system.

Vertical control was maintained by removing deposits in natural levels, unless these levels were more than 20 cm thick. In this case, the deposits were subdivided vertically into levels of arbitrarily defined thickness.

Fill was removed by shovel, while features were defined with trowels and other small tools. All excavated earth was put through screens covered with one-fourth-inch mesh hardware cloth. No recovered artifacts were discarded.


MUSEUM BUILDING
TUBAC
PRESIDIO
STATE
HISTORIC
PARK
MUSEUM
MUSEUM BUILDING
W-26
Excavated areas
Standing adobe walls
Possible walls
Trees
Stumps
TUBAC PRESIDIO
1975
Scale
meters
Contour interval 25 cm.
State Park Fence
HOUSE

F 4. **M** **T** .

Profiles of vertical exposures, such as trench walls, were recorded by both pen and camera. Features and horizontal units also were mapped and photographed.

All artifacts are to be stored at the Tubac Presidio State Historic Park. Duplicate copies of field and laboratory notes will be found at the park and at the Arizona State Museum.

Chapter 4

ARCHAEOLOGICAL CONTEXT

Architecture and Features

Materials and Style

> The adobe house is usually simply rectangular in form, flat-walled and flat-roofed, with little window space. If larger it takes the form of an L, T, or U. . . . A space partly enclosed by the house may be completely enclosed by an added adobe wall forming a "patio". . . . The universality of this as a desert form is evidence of fitness to environment. The thick adobe walls, roof and floor are effective insulation from the glaring heat of the desert. . . . (Hoover 1935: 238)

It can be said that Spanish colonial architecture was equally Spanish and Indian; that is, Spanish in plan and Indian in methods of construction (Newcomb 1937: 36). Indigenous structural traits include simple, flat facade and roof, vigas, heavy walls, and adobe material. To this structure the Spanish added certain improvements in practice due to new requirements, better tools, and a broader background of construction experience (Sanford 1950: 92).

Introduced changes included the use of bracket capitals, wooden doors, window frames, portales, and the patio plan. The Spanish also initiated the use of precast adobe bricks, mixed with straw and allowed to dry in the sun (Stewart 1970: 11). As a result, thicker and higher walls were possible, leading to increased roof spans. Adobe walls constructed in this manner were stronger and more durable than those supporting the original native structures (Morrison 1952: 187).

House size varied considerably, depending upon the means of the occupant. House types ranged from simple one- and two-room structures with no patio, to large multi-room dwellings like those at Tubac. The character of this combined architectural style was all the same, however: rectangular masses with flat roofs and soft contours, usually one story in height (Sanford 1950: 93).

At Tubac there was a blend of domestic and presidial architectural motifs. As noted previously, this structure was built in the 1750s by then-commandant

Juan Tomas de Belderrain. Half of the structure was to be his house; half was to be utilized as the general headquarters for the presidio. This was no walled fort, like the later presidio at Tucson. It was not until 1772 that formal regulations were instituted making the construction of such fortifications uniform.

The command post at Tubac was U-shaped, probably remaining open on the south side. A passageway, or zaguán, through the north wall separated the headquarters and domicile sections of the building. This opening also provided easy access between the inner presidio courtyard, or plaza, and the town square, just to the north. Such a floor plan was not an unusual 18th- and 19th-century Spanish technique.

Excavations at Tubac were limited to the west wing, portions of the north wing, and the plaza area. The section in which most of the digging occurred probably served as the commandant's residence. This side is the larger half of the structure, and Urrutia's 1776 map (Fig. 2) does indicate the captain's patio" extending off of the west wing. Therefore, the site is more a domestic household in nature, rather than a military fortress.

The commandant's household occupies the entire west half of the main structure, and consists of approximately 10 rooms. The west wing is 49.8 m long and 6.0 m to 6.3 m wide, formed by a chain of single rooms. The north wing expands to a width of two rooms, and measures 28.8 m, interpolated length of entire north face, by 9.9 m wide. The structure juts at the northwest corner, a result of these two walls joining at an 80-degree angle. This corner plan was typical of presidial structures, and it allowed visual sightings along both wall facings (DiPeso 1953: Fig. 3)4; Gerald 1968: 30-36). Records also indicate the presence of a two-story bastion or tower situated in this corner. Refer to Figures 40, 41, and 42 for architectural reconstructions.

It should be noted, however, that it is not unusual to find less-than-precise building methods utilized in early Spanish structures. Shenkel has indicated in discussion that such was the case at St. Augustine, Florida. Without modern surveying and construction aids, buildings were set up to follow the natural landscape, which did not always accommodate 90-degree angles and parallel walls.

Wall Construction

In most, but not all cases, adobe walls are situated on stone footings. These footings are composed of unmodified cobbles, and include several fragmentary and whole manos and metates in their make-up. The stones, with an adobe-mortar bonding agent, are laid on the natural contour of the land to act as a leveling device and supportive base for the walls above. In several sections, the first tier of brick sits directly on the basal ground level, or has only a thin adobe pad beneath it. The basal level is considered to be the red, cobbly natural ground surface present prior to presidial construction (Fig. 5). Wall partitions, in all cases, have a cobble footing which is situated slightly higher, 10 cm, than the outer structure wall in the west-wing rooms. This indicates their addition following the construction of the exterior walls. Where completely exposed, footings average 80 cm in width and between 15 cm and 40 cm in depth, for the outer walls; and approximately 45 cm in width for the wall partitions. Stones are of irregular shapes, with more massive cobbles found beneath the center of the outermost west wall. For footing variation see Figures 6, 7, 8, and 9.

Walls were constructed of adobe bricks and a mortar adhesive, whose dissimilar clay types are evidenced by the different colors of the two substances. Individual bricks measure 60 cm by 30 cm by 10 cm, with a moderate range of variation. As a further leveling aid, the lowermost tier of bricks was placed, in most cases, on a thin mortar pad situated between these bricks and the stone footing or ground surface. This first tier was laid by placing two bricks with their long axes parallel to one another and to the wall. A single brick was then laid perpendicular to these, its 60 cm length forming the wall thickness. Beside that brick, two more were laid parallel to the wall, and the process was repeated for the length of the wall (Fig. 10). A layer of mortar separated the tiers. In the upper tier the pattern was alternated. Two parallel bricks were placed on top of the lower perpendicular one. The wall was thus cross-bound for added strength. Inner room walls are only 30 cm thick and unfortunately their method of construction could not be discerned from the remaining stubs. Wall height at present consists of only one to three tiers of brick (Fig. 11).

It could not be determined if house corners were bonded. However, it was ascertained that adobe partitions merely abut the exterior structure walls.

Figure 5. Cobble basal level as seen below Early floor in Room 4.

Figure 6. Cobble footing, south wall Room 12.

Figure 7. Cobble footing, east wall Room 6.

Figure 8. Cobble footing, west wall Room 6.

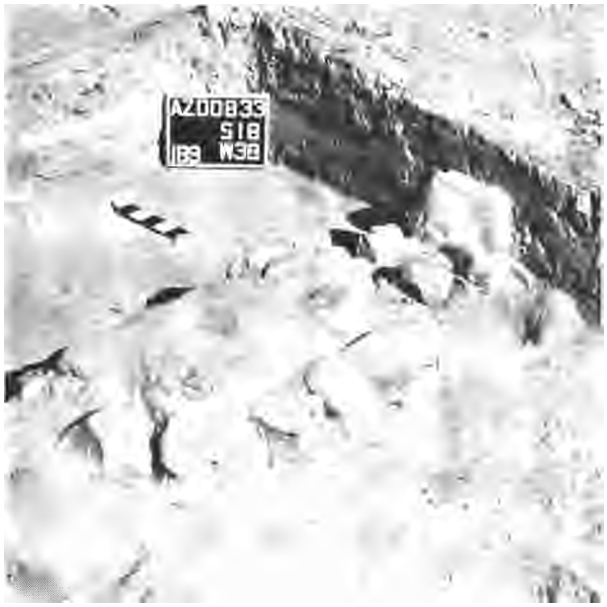


Figure 9. Cobble footing, Room 1-2 wall partition.

Figure 10. Wall brick patterning, lowermost tier.

Figure 11. The condition of remaining walls was usually very poor, as seen here.

Evidence of wall plastering occurs in many places in the form of debris; and plaster of 1 cm to 2 cm in thickness still remains intact on the north wing walls, interior and exterior. It is likely that the entire building was plastered at one time.

No definite doorways were noted in the structure. This absence is probably due to the nature of the present walls at the site. The remains of the walls are low stubs, barely 10 cm high in some places; the adobe matrix itself is soft, moist, and amorphous, with distinct bricks rarely discernible. For that reason, gaps in the walls, if they did still exist, would have been almost impossible to define. A possible entranceway was seen connecting Room 5 and Room Outlier 1, and will be discussed in the treatment of the individual rooms.

Roof Construction

The Spaniards constructed roofs much as the Indians did, by spanning the interior space with vigas, horizontal beams of mesquite and oak. Although posts were sometimes used as extra roof supports, no evidence of postholes exists inside the structure. Therefore, timber long enough to rest on opposite walls was procured, these beams probably having been set parallel to the short axis of the rooms. The vigas were covered with smaller pieces of wood, usually ocotillo branches, crossing the larger beams at right angles. Adobe earth or bricks were then loaded on top of these latias in order to keep out the rain and provide insulation (Bunting and others 1964: 7).

Almost nothing remains of roofing at Tubac. Debris and fall in only a couple of rooms could be identified as once belonging to the ceiling, and even this identification was speculative as only adobe remained. Timber was not easy to come by in Tubac, and had to be hauled a number of miles from the mountains east of the town. As a result, abandoned structures were often robbed, almost down to the ground. Roofing timber, adobe bricks, doors, window frames--many available construction materials went into later buildings. In fact, some current residents of Tubac are proud to announce that their homes are constructed of bricks and other items from the presidio." This is one of the main reasons why so little physical evidence of the site remains today.

Floors and other use surfaces were variable in construction, and therefore are discussed with individual room descriptions.

Rooms

Room 1. This room was fully exposed, and is a rather small area, measuring only 4.72 m wide and 2.44 m long. The adobe walls could be identified on three sides; only a cobble footing remains of the room's east wall. The walls are preserved to a height of approximately 22 cm on the south and west faces; the north partition wall consists of a cobble footing with adobe slough on top, and the wall itself could not be defined precisely. The remaining walls contain no traces of plaster. No doorway entrance to Room 1 was noted (Figs. 12, 13).

Three floors are superimposed, one over another. The upper use surface is situated below adobe fall. It is a simple floor of compacted humus and debris, fairly level, but hard to define. The floor represents a Late-period use level (1850-1900).

A Middle-period floor (1800-1850) was uncovered several centimeters below the upper one. It was constructed by puddling adobe in a layer over the lower room floor. The surface is level and uniform, and is situated on a plane with the top of the partition wall footing and the mortar above the south wall's bottom brick course. The floor exhibits a burn area in the southeast section of the room.

The lower floor (pre-1800) lies 10 cm to 18 cm deeper and is a compact humus surface, speckled with plaster. Because of time limitations, only a small section of the floor was exposed. It is rough, uneven, and difficult to define. The footing of the wall partition protrudes close to 18 cm above the floor. La Purisima Mission also displayed this interesting arrangement (Deetz 1963: 183).

Room 1 contains an indented space created in the west wall at the southwest corner by the absence of an adobe brick. The gap is 60 cm long and 40 cm deep, and contains several large stones. The feature may represent a corner hearth, although little evidence of burn was seen. The cobbles are situated on a plane slightly above the lower floor. An oblong Late-to-Modern trash pit, 2.80 m by 0.70 m, cuts through all stratigraphy in Room 1 (Fig. 14).

Rooms 2 and 3. Room 2 was completely excavated, and is 6.0 m long and 4.8 m wide. The room's west wall is still intact, and is preserved to a height of 22 cm or two brick tiers. The east wall and north partition wall are

Figure 12. Southwest corner of structure showing Rooms 1 and 2. Note Early- and Middle-period floor levels.

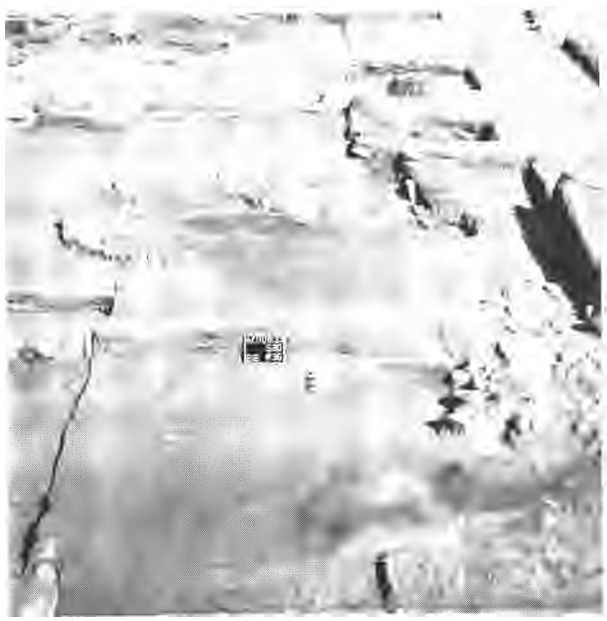


Figure 13. Rooms 1 and 2. Little remains of west-wall facings. Note different floor levels.

Figure 14. Room 1 corner indentation (hearth?). Note recent trash pit in background.

partial and identified by cobble footings. No plaster remains on the west wall, although plaster debris was seen in floor-fill zones. Again, no doorway entrance was discovered (Figs. 15, 16).

Room 2 contains a double floor. The upper floor is constructed of adobe, and speckled with plaster. The entire surface was plastered at one time. It is a compact and level floor, but is uneven in several places due to wear. Fill above this floor includes ash and plaster debris. This floor relates to the Middle-period surface discussed in Room 1, and is also on the same level as the top of the partition-wall footings. Two features were noted on the floor. The first is a small firepit in the northwest corner, 90 cm long by 40 cm wide. The feature consists of loose humus, ash, charcoal, and a few small cobbles. Wall adobes behind the hearth are fired. The second feature is a horseshoe-shaped cobble alignment with shoe arms comprised of one layer of stone which is 72 cm wide and 10 cm high (Fig. 17). The feature is open to the southeast, but may have been a complete ring originally. A modern trash pit has disturbed this area of the room. Its maximum width is 2.8 m and its inside width is 1.4 m.

The only plausible explanation for this alignment is that it may have been used as a saint's grotto. Grottos are sometimes seen as low cobble semi-circles which are open on one end to house statues. Room 2 was possibly open on the plaza face during this period, the east room wall having been removed.

Another floor is situated 20 cm below the upper surface. Only a small area of the lower floor was exposed. It is also composed of compact adobe, and represents an early, pre-1800, occupation level. This floor is also lower than the upper limit of the partition footings, as is the case with the lower humus surface in Room 1. Fill between the floors is loose and is mottled with ash, plaster and adobe debris.

Features include Middle-period (1800-1850) and Late-period (1850-1900) trash-pit intrusions in the southeast section of the room, and fill dumpage, possibly backdirt from a nearby modern privy, in the room's northeast corner.

Room 3 was only partially excavated, and its north partition wall was set arbitrarily in order to facilitate artifactual analysis by room blocks. The room is then 7.36 m long and 4.72 m wide. A section of the west wall is still intact, and is 22 cm high; the east wall is delineated by a two-meter-long line of cobble footing. No evidence of plaster on the walls or of a

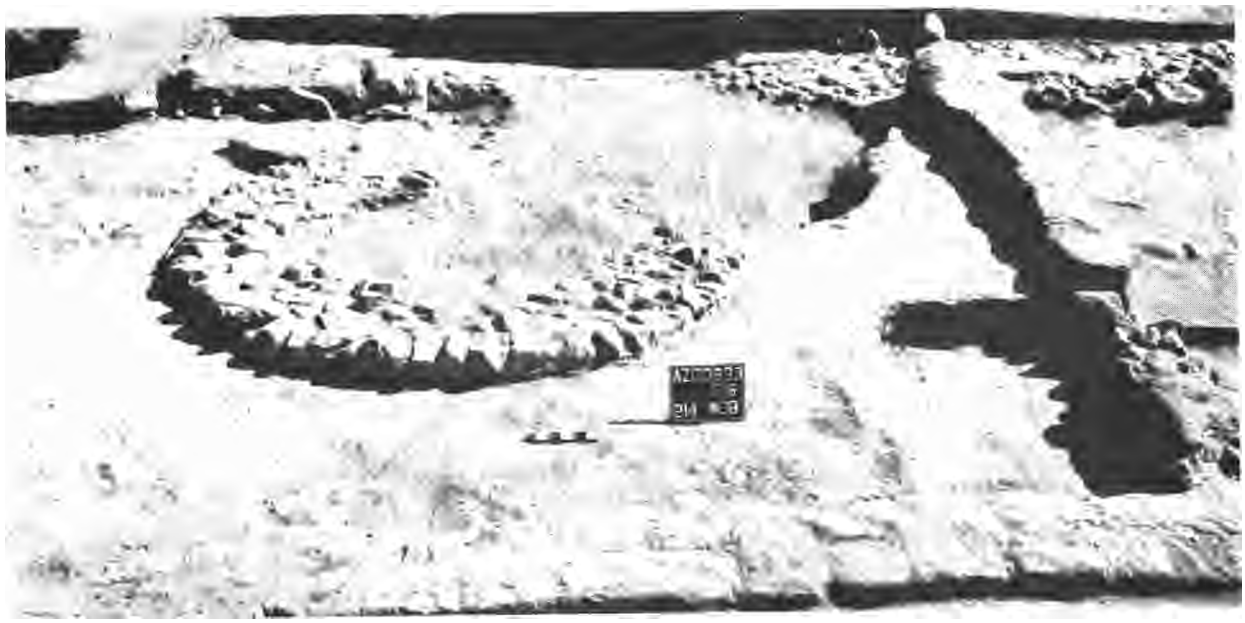


Figure 15. Room 2 with semicircular "grotto." Section in lower right excavated to lower floor. Upper floor disturbed by later trash pit.

Figure 16. Room 2-3 wall partition.

Figure 17. Room 2 closeup of cobble "grotto" feature.

passageway remains. Large amounts of plaster debris occur in floor fill, however. Room 3 also exhibits double floors, identical to the floors in Room 2.

Room 4. Room 4 was partially excavated, and was seen to be in fact two rooms, one superimposed on the other. This room evidently collapsed at some time, and was subsequently rebuilt. The room was shortened, utilizing the west and east wall stubs of the original structure as a base support for new cobble footings. Walls were then added on the new footings and a new south partition footing. The original room is 7.6 m long and 4.8 m wide; the reconstructed version is 4.4 m long and 4.8 m wide. Only one to two brick tiers remain of the early room's east and west walls; the north partition wall is identified by a short wall stub, 15 cm high, and cobble footing; the later walls are represented by cobble footings. No traces of plaster are present on the existing walls and no doorway to Room 4 was noted (Figs. 18, 19, 20).

Two floors were uncovered in this room. The upper floor is related to the rebuilding phase, and represents a Middle-period occupation. The surface is uneven and plastered, having been constructed of puddled adobe, which is now laminated. The cobble wall footings extend 10 cm above this floor. A Late-period trash pit intrudes through the surface near the southwest corner of the upper room. The pit is oval, 70 cm long, and of unknown width.

The lower floor relates to the larger, Early-period room, and only a small area of the surface was exposed. It is situated 12 cm below the upper floor, and is also composed of adobe, although no evidence of plastering remains. The floor is level and even, but several rock outcrops are present.

Two features were noted on the floor. A small pit in the surface contained loose humus and a glass bottle base. The pit is 36 cm in diameter and located near the northeast corner. A hearth is present in the room's northwest corner. The dump included a large amount of ash and charcoal. Placed on top of the pocket is a granite slab, possibly a metate fragment, which has been fire cracked. The hearth is semicircular with a radius of 50 cm.

Rooms 5 and 6. The partition wall between these two rooms, if one existed, was not discovered in our excavations. The only place such a wall could have survived is under an intact section of ground used as a wheelbarrow balk. A dividing wall has therefore been interpolated here in order to create more meaningful room blocks. Only a very small section of Room 5 was exposed due to

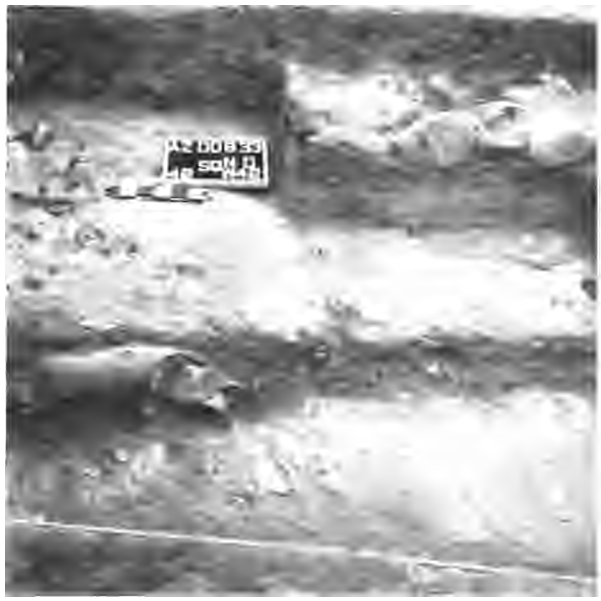


Figure 18. West wall of Room 4. Note cobble footing placed above older wall stub.

Figure 19. Room 4, east wall, upper cobble footing.

Figure 20. Overhead shot of Room 4, showing Middle-period footings on top of original structure's walls.

time limitations. The room is 6.88 m long, 4.8 m wide, and was identified by an adobe wall stub or cobble footing on the west side preserved to a height of 15 cm, a small section of footing on the east face, and the previously discussed Room 4-5 wall partition. There are no traces of plaster on the existing wall remnants. A possible doorway was noted between Room 5 and Room Outlier 1 situated to the west. The only supporting evidence is a humus-filled gap between the adobe wall bricks, approximately 1 m wide. The passage is located 1.84 m from the room's southwest corner and is not centrally fixed.

Only one floor was uncovered in Room 5 (Fig. 21). The surface is constructed of uneven plastered adobe, and small cobbles protrude through it. The floor is on a plane with the top of the outer wall footings, but is lower than the partition-wall support stones. Floor fill above contains a small ash pocket in the center of the room measuring 45 cm by 30 cm. This feature may represent a hearth which was used after debris began building up on the floor. The plastered floor in Room 5 was initially related to an Early-period occupation (1752-1800).

Room 6 is smaller than 5, being only 5.92 m long and 4.8 m wide. Its walls could be identified by cobble footings on the west, north, and east sides. The cobble footing along the west face is quite massive and appears to have been built to bear weight. It possibly added an extra support base for the corner fireplace which will be discussed later. There is no evidence of plaster in the room, and no doorway was noted (Fig. 22).

Room 6 also contains but one notable floor surface. It is composed of compact humus, and is mottled with charcoal and ash specks. This floor is not easily defined and it is possible that the floor-fill layer above may represent other living surfaces as well, as material debris was built up. Fill consists of humus, charcoal and ash, and evidence of intensive burning. It is likely that Room 6 was occupied for some time, even though separate floor levels are not distinguishable. The lower surface is on a level with the upper footing limit.

An interesting hearth is located in the room's northwest corner. It is an Early-period type, transitional between the indigenous corner hearth with a semicircular adobe or cobble lip, and the Spanish adobe-brick corner hearth (DiPeso 1953: 67, 102, 140). The hearth in Room 6 is associated with the humus floor discussed above. It is a semicircle lined with two rows of small cobbles

Figure 21. Adobe floor in Room 5. Iron rod in center is a modern fence post.

Figure 22. Room 6, bordered by cobble footings. South wall of Room 12 can be seen at top.

Figure 23. Corner hearth, Room 6. Cobble lip surrounds shallow basin.

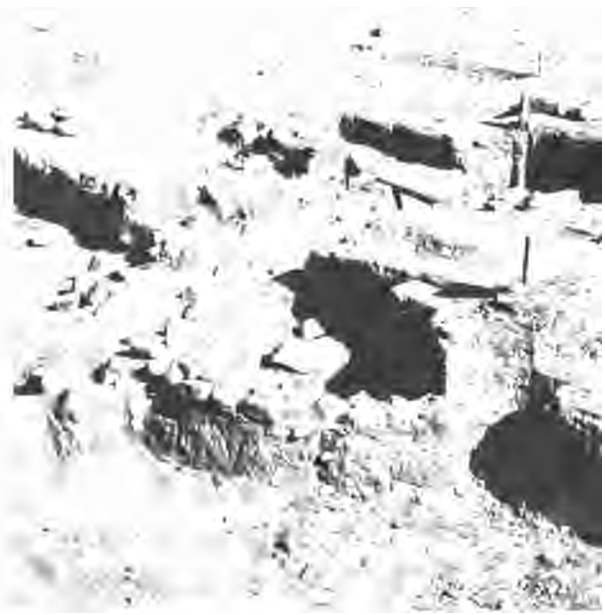


Figure 24. Corner hearth, Room 6. Note double brick wall behind.

in a single layer, forming a lip. The pit basin is shallow, 10 cm deep. It contained charcoal, ash, bone, and a couple of flat cobbles. The radius of the hearth is 80 cm. Situated between the hearth and the west room wall is the remnant of a combination fireplace backing and platform feature. This secondary row consists of four bricks, 240 cm long and 30 cm wide. The bricks directly behind the hearth are fired, and probably provided extra protection for the room's outer wall. The additional ledge, 120 cm by 30 cm, extending out from behind the hearth may have served as a work bench. The original height of the feature is unknown. The occurrence of a constructed hearth, platform, and the mottled humus floor indicates that Room 6 was utilized as a kitchen, beginning with the building of this structure in the 1750s (Figs. 23, 2)4).

Rooms 7 and 8. Rooms 7 and 8 were only partially exposed. Room 7 is 4.6 m long and 4.88 m wide. The room is bounded by cobble footings on the south and west sides. A section of adobe brick on a cobble footing represents the north partition wall. The east walls of Rooms 7 and 8 are absent due to a late trash—pit disturbance, but have been interpolated. The existing wall stub between the two rooms is preserved to a height of 25 cm. No traces of wall plaster remain in Room 7; some wall plaster is still intact on the south partition face of Room 8. No doorways were noted in either room. Rooms 7 and 8 are the only rooms in this wing without access to the inner patio or zaguán.

Only one floor level was uncovered in Rooms 7 and 8. The surface is constructed of compact dark humus, and is fairly even. The floor in Room 8 is speckled with plaster debris. Both floors are on a plane with the footings' peak, and lower than the top of the dividing-wall footing. They were initially Early-period occupational surfaces. Fill above the floor in Room 7 contains a number of ash pockets, and is soft and coarse due to tree-root disturbance.

The north partition wall of Room 7, at its northwest corner, exhibits several fired bricks jutting from the wall face. A number of large cobbles are situated along the inner edge of the west-wall footing, perhaps acting as a backing for another corner hearth (Fig. 25).

Room 8 is located in the northwest corner of the presidio structure and is 4.24 m long by 4.88 m wide. Adobe wall stubs and cobble footing are preserved on the north and west sides to a height of 25 cm. Apparently this corner was the locus of a two-story bastion, or tower, erected sometime between 1787 and 1848, according to a Sonoran Mining Company report sketch drawn by Poston

Figure 25. Corner hearth in Room 7. Note cobble backing (left) and fired adobe bricks in north wall facing.

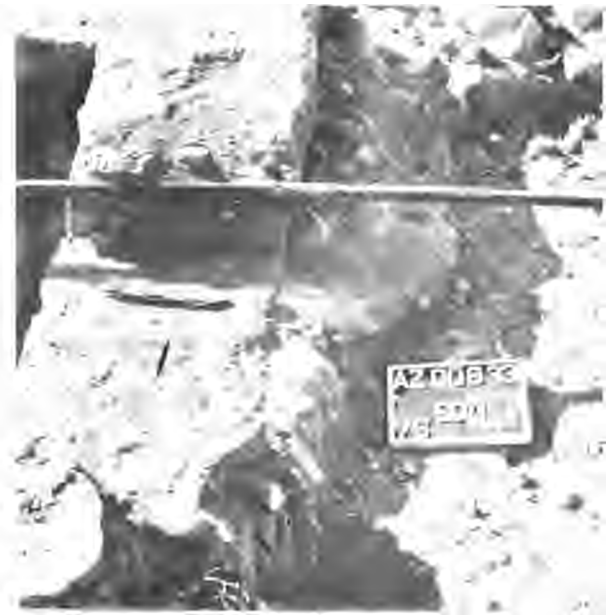


Figure 26. Northwest corner of Room 8 and main structure. Secondary footing remains along outer wall can be seen at top.

Figure 27. Rooms 12 and 11, looking north.

Figure 28. South wall, Room 12, in relation to upper adobe floor. Note wall fall on surface, at top.

(Dobyns 1959: 65)-i). Since the bastion was constructed after the initial building phase, we were not too surprised to find relatively small cobble footings in the area of this corner. The only physical evidence supporting its existence is a secondary cobble foundation along the outer edge of the corner footings. Secondary footings are seen elsewhere in the site, however, and will be discussed in detail later (Fig. 26).

Rooms 9 and 10. These two rooms extend to the east off Rooms 7 and 8, ending at the zaguán. Except for a short disturbed section of the north wall of Room 9, no physical evidence of the architectural design of the rooms remains. A large Late-period trash pit has disturbed the entire area. Room 9 is 4.32 m long and 5.2 m wide at room center. Room 10 is 4.0 m long and 4.56 m wide at room center. These are projected dimensions.

This completes our discussion of the commandant's quarters.

Rooms 11 and 12. Only two rooms belonging to the military headquarters were excavated. Rooms 11 and 12 are situated to the east of the zagudn. Room 11 was only partially exposed and is 4.16 m long and 4.4 m wide. Room 12 was fully excavated and measures 4.08 m long by 4.4 m wide. Adobe wall sections are preserved to an average height of 30 cm on the east, south, and north sides of Room 12, and on the north, west, and south sides of Room 11. The south partition face in Room 11 shows evidence of having been patched near the base with cobbles and fill. The east wall of Room 11 has been projected, as has the west wall of Room 12, the latter because of trash-pit disturbance. Both rooms have traces of plaster on the remaining walls. This plaster is painted red in Room 11. No doorways were noted (Figs. 27, 28).

A Late-period trash pit has caused much disturbance in both rooms, ripping out walls and floors. Only one floor was encountered in Room 11. The surface is rough, uneven adobe. Only a very small section remains intact. A small ash pocket, 30 cm by 40 cm, was located just above the floor near the room's southeast corner. It was initially utilized during the Early period.

Room 12 exhibits a double floor. The first is constructed of adobe, and is a hard, even surface speckled with plaster (Fig. 29). This Middle-period floor is situated on a plane with the top of the south wall footing. A shallow pit depression was noted in the floor, near the center of the south wall. The circular pit is lined with plaster, and is 56 cm in diameter and 6 cm deep.

Figure 29. Room 12 upper adobe floor. Surface is speckled with plaster.

Figure 30. Room 12 lower floor of plastered adobe.

Figure 31. Room Outlier 1. Note Room 4-5 dividing wall at top center.

The upper floor has been puddled on top of a lower surface, only several centimeters below. The lower, Early-period floor is also composed of adobe, and has been plastered and painted a reddish color (Fig. 30). The floor is very level, but appears gouged where the plaster has popped off from wear. The floor is situated below the wall footings' upper limit. Due to time limitations, a section only 1 m by 2 m could be exposed.

Room Outliers

Urrutia's 1776 map of the Tubac Presidio (Fig. 2) indicates the presence of two structural extensions off the west side of the main building. The first is a small block room, located near the center of the west wall, which we have termed Room Outlier 1. The second, Room Outlier 2, encompasses a larger area indicated on the map as the "captain's patio." The existence of both these annexes has been verified by the archaeological record.

Room Outlier 1 was only partially excavated, and is 4.4 m wide and was interpolated to be 7.2 m or 10.4 m long. The reason for the discrepancy is that there are only two sections still unexcavated where the north room wall could have existed. The room is identified by a small cobble footing on the west; the joint Room 5 wall on the east; an interpolated north face; and a wall stub and footing on the south side preserved to a height of 23 cm. A contrasting clay type was used in the construction of this last wall, indicating its addition after the initial building phase was complete. No evidence of wall plaster remains. The passageway connecting Room 5 and Room Outlier 1 has already been discussed, and tends to indicate that Room Outlier 1 was not accessible from the outside. Spanish architecture generally does not allow for inner access through doorways in the outer walls (Fig. 31).

Only one floor level exists in the room. It is an even, compact clay surface on a plane with the bottom brick tier of the east face, yet lower than the south footing limit. Below the floor level is part of a large primary trash pit containing loose fill with bone, fired adobe and rock, and charcoal debris, along with indigenous potsherds.

Room Outlier 1 was added to the main structure, as an afterthought, sometime between the building's initial construction in 1752 and Rub's inspection tour, and the resulting engineer's map, in 1766. Differing construction materials and the existence of a trash pit below the Early-period floor lead to

this conclusion. Probably the kitchen is nearby in Room 6, and this area was originally a dumping place for garbage. A room, possibly intended for storage, was then built over the pit conceivably when Commandant Anza occupied the domicile in 1763.

Only a very small area of Room Outlier 2 was exposed. The only identifiable wall remnant uncovered is a small cobble footing extending west of the northwest building corner. Urrutia's map indicates that the south borderline ties into the southern wall of Room Outlier 1, thereby resulting in an overall length of 24 m for the outlier. The width is not known, as the room's original boundaries have been covered by a 20th-century schoolhouse (Fig. 32).

Room Outlier 2 contains no well-defined floor layer. A use-area surface is designated by an accumulation of artifacts just above the basal level. Charcoal and ash are present in this Early-period layer near the northwest corner.

It seems very likely that Room Outlier 2 was not an enclosed, walled room. The area involved is just too large. This was a substantial work area, or perhaps a private patio, in the form of an open ramada. Some type of wall of unknown height was present along the north side or building front. Perhaps a low adobe-brick wall enclosed the entire outer periphery.

The Plaza

The inner plaza, or patio, is enclosed on three sides by the U-shaped quarters. The existence of a fourth wall and gate fortifying the plaza on its south end could not be verified as this area is now occupied by a house and fenced yard. The plaza is constructed of laid adobe bricks, forming a level but worn surface. The upper face of the bricks is covered with a thin clay cap beaten into place by use and weathering. As a consequence, all evidence of brick patterning has been eliminated. Mortar lines between individual bricks are apparent in excavation trench profiles, however (Fig. 33).

Patio bricks were laid on top of the basal level, one to two layers thick. Cobble support foundations were first placed beneath the work surface by filling narrow trenches with cobbles and puddled adobe, much as support beams are sometimes set beneath plank floors today. The spacing of these north-south footings is not known, as the plaza surface itself was only excavated in a few test loci (Fig. 34).

Figure 32. Northeast corner of Room Outlier 2.

Figure 33. Plaza surface of adobe brick with clay cap.

Figure 34. Adobe and cobble plaza footing. Note double brick patio surface in profile.

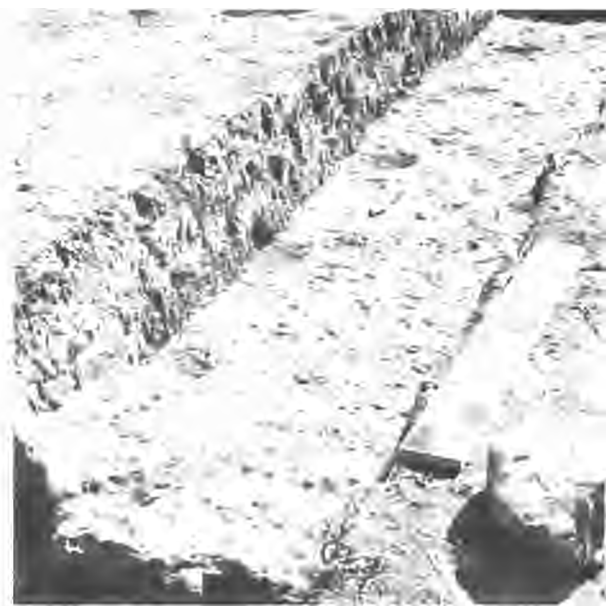


Figure 35. Posthole alignment in plaza surface.

In two such sections, near the extreme northern and southern ends of the plaza, this surface is two brick tiers thick with a mortar pad between. The upper layer is on a plane with the rest of the patio surface. We therefore believe that the plaza was doubled in these, and perhaps other areas in order to compensate for the natural ground contours.

The Zaguán

A zaguán is an entranceway that leads from the main gate of a house to the inner patio, and thus to individual rooms. Such passages were large enough for wagons to pass through, and were usually roofed over like the rest of the structure rooms (Bunting and others 1964: 16).

A zaguán exists in the north wing, acting as a dividing space between the living and military quarters, as well as providing front access. The zaguán was interpolated to be 3.1 m wide and 9.8 m long.

The only physical evidence of its location is the definite turn taken by the north wall, to the south, at the northwest corner of Room 11. Both front and side walls are exactly the same. A damaged wall also exists at the northwest corner of the passageway. A later wall addition--narrower; different brick size; contrasting clay type--closed off the zaguA on the exterior, creating another room in the north wing during the Middle-to-Late period (Fig. 39). The J. Ross Browne sketch (Fig. 3) shows the north presidio wing after its alteration during the 1850s. The map indicates that either at this time, or perhaps earlier, the zaguan was enclosed. Other modifications made during the occupation by Colonel Poston included the cutting of exterior doors and windows in the main building (Dobyns 1959: 655).

Features

Several features considered to be inherent to the rooms themselves, such as hearths, have already been discussed in the treatment of individual rooms.

Postholes. Eight postholes were discovered in the plaza surface, in a more or less north-to-south line. Six of the holes averaged 15 cm in diameter, while two specimens have more the form of pits, being 30 cm and 50 cm in diameter respectively. The holes are spaced on the average of 70 cm from each other (Fig. 35). One excavated specimen contains a fine grainy soil, adobe chunks,

Figure 36. Secondary cobble wall foundation, along outer west wall of Room 8.

Figure 37. Remains of secondary wall footing along outer north wall of Room 11. Note plaster on wall facing.

Figure 38. Oval "cistern" pit in area of Room 12. Feature cuts through all stratigraphy into basal level.

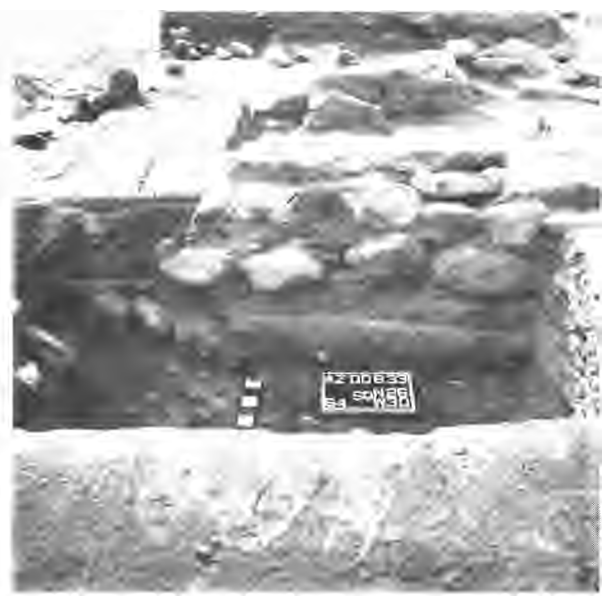


Figure 39. Zaguán enclosing wall with secondary footing stones along outer edge.

charcoal, and small decayed wood fragments. The hole extends 20 cm below the plaza surface, tapering inward as it descends. It is possible that the posts once situated along this line supported a ramada roof extending from the east wing of the military headquarters.

Secondary Foundations. Secondary cobble foundations are located for short distances along the exterior edge of the north wall, opposite Room 11, and of the northwest corner walls, opposite Room 8. These footings were probably used for buttressing walls, which were constructed to stabilize deteriorating adobe wall sections. The foundation at the northwest corner may have served also as a double support for the second-story tower placed here sometime between 1787 and 1848 (Figs. 36, 37). Similar wall buttressing was utilized at La Purísima Mission in California (Deetz 1963: 176).

Cistern. An oval pit was uncovered in the limits of Room 12, and excavated. The pit is 1.8 m long and 0.9 m wide. The hole, when initially dug, cut through upper fill and adobe floor layers down into the rocky basal level. Depth of this feature is 1.3 m. The pit is filled with a cobble-and-humus matrix, and contained almost no artifactual materials (Fig. 38).

It is believed that during the Late-to-Modern period, this pit was dug as a water catchment. The presidial structure was evidently in collapse by this time. The cistern may possibly be related to the 1912 construction phase on the site.

Trash Areas and Pits. Trash pits of varying sizes are present in all occupational strata at Tubac, with the most destructive occurring during the Late and Modern phases.

An early circular pit was located beneath the plaza surface, extending 48 cm into the basal level. The excavated feature, 70 cm in diameter, contained only one artifact, a copper brad. It appears to have been dug and then refilled with the same cobbly soil. It is possible that the pit was used either by the native or Spanish element in the area, prior to presidial construction, for the storage of perishable goods.

Another early trash area was located along the outer north-wing wall. It contains a gravelly, loose fill and is 60 cm in diameter and 20 cm to 25 cm in depth.

Four small trash areas occur in the plaza surface; these are for the most part shallow, circular depressions. The first is a small trough feature, 55 cm in length, of an unknown width, and 30 cm in depth; the second is 30 cm by 28 cm by 16 cm, and is a semicircular pit with tapering walls, bottoming out in the basal level; another feature is 20 cm in diameter and 11 cm in depth; the last is irregularly shaped, 60 cm by 55 cm by 13 cm.

It appears that early inhabitants of the site disposed of their trash along the exterior walls and in the patio area.

Two noteworthy Middle-period trash areas were uncovered. A 10 m long by 10 cm thick lense of sheet trash was located along the outer north wall. Its overall width is not known. The fill contains slag, ore, and charcoal and is probably associated with mining. Another rather large pit is situated near the south end of the west wing, intruding into Rooms 1 and 2. The pit is 15 cm to 25 cm in depth and of unknown size. An excavated section, 4 m by 4 m, shows no vertical stratigraphy. This refuse pit was formed after the abandonment of this end of the site, or perhaps during a temporarily-unoccupied period.

Trash areas abound in Late- and Modern-period contexts. A very large pit disturbance occurs on the northern end of the site including sections of the plaza and Rooms 6-12. The pit ripped out walls, floors, and all meaningful stratigraphy. It was then filled with trash debris, and no vertical stratigraphy is evident. One possible explanation is that the feature was a barro pit, supplying materials for the construction of the adobe structures, dating from 1910, and now partially standing on the site. The pit is 15 m long, at least 15 m wide, and 20 cm to 60 cm deep, extending slightly into the basal level at its deepest points.

Another large trash pit is located on the south end of the site, disturbing the west wing. It is approximately 6 m in diameter and 10 cm to 40 cm deep. This pit has been dated to the 1920s and contained a great deal of artifactual material. These recent trash depositions, along with two privies located near the south end, probably relate to the early-20th-century occupation of the site.

Another small trash zone along the outer north wall is probably associated with the Middle-period sheet trash in the same area, but of a later time. It is 60 cm in diameter and 20 cm deep and may also be related to mining.

A 1 m-by-2 m section of another later trash pit was excavated along the outer west wall, near Rooms 3 and 4. The area is badly disturbed to a depth of 60 cm.

A pipeline installed sometime during the early 1900s was also responsible for disturbing a section of the site. Its trench ran north-south along the outer west wall of the presidio. The pipe was a watering line for a series of trees planted, coincidentally, along the top of the wall stub.

Architectural Reconstruction

In 1752 a garrison of 51 men, including the captain and officers, arrived in the area of Tubac with the purpose of creating the Royal Fort of Saint Ignatius. The Spanish troops, at this time, probably dispossessed the Indians occupying the Piman rancherfa in the vicinity, and used their dwellings as temporary shelter until adobes could be made and permanent buildings constructed. It was decided to build a simple utilitarian structure, combining the military headquarters and the commandant's domicile. Other necessary dwellings such as storehouses, barracks, and the post store were erected nearby.

The Spanish royal fort in all phases of its existence must be described as a domestic site, both in its activity and architecture. High ground was chosen and the main structure was laid out following the natural contours of the land. Stone footings were used where needed.

Boudreau (1971: 28) states that adobe bricks can be produced at a rate of one ton per man-day. Bricks of the size utilized at Tubac would have weighed 66 pounds each, meaning that one man could have made 30 bricks in a working day (Sparks 1951: 2). Bricklayers can usually set roughly 100 square feet of wall during this period (Sparks 1951: 4). It can therefore be estimated that to make and lay the bricks of the basic U-shaped shell at Tubac took approximately 450 man-days. This figure does not include the time-consuming tasks of material procurement and detailed work such as cutting windows and doorways, however.

No evidence of any fortification was discovered in our excavations, and this structure cannot be compared to the massive post-1772 walled presidios such as Terrenate (DiPeso 1953) and Tucson. Tubac supposedly had a defense wall after 1787, and perhaps future investigations will prove or disprove its existence. Even so, in the 1750s this structure must have been impressive by frontier standards.

The architectural plans of the western half of the presidio structure are reconstructed in Figures 40, 41, and 42. Each map covers a different occupational period: Early, 1750-1800; Middle, 1800-1850; and Late, 1850-1900, including early-19th-century disturbances. These reconstructions are based on the physical data uncovered and on Spanish architectural style. In unexcavated or disturbed sections, walls have been either projected or interpolated.

Early Period

During the Early period of occupation, all 10 rooms of the commandant's domicile were in use as were the two rooms excavated in the military headquarters (Fig. 10). Six of the rooms contain adobe floors (2, 3, 4, 5, 11, 12), and in two cases (5, 12), these floors are plastered. The remaining rooms exhibit plain dirt surfaces. The existence of a paved patio in such an outer frontier post is possibly an index of the wealth and accustomed lifestyle of its early occupants, Commandants Belderrain and Anza.

While the presidio's construction began under Belderrain in the 1750s, it was not necessarily completed under his command. It is possible that the presidio was built in stages. This could possibly explain why room dividing-wall footings are higher than the earliest floors. It seems likely that some time after the initial building period or perhaps as a continuing project, another construction phase took place in which Room Outlier 1 and at least a few rooms' dividing walls were erected. The completion of the structure could possibly have occurred under Anza's command after 1763.

Middle Period

The Middle-period plan (Fig. 41) indicates that the presidio has already undergone several changes, with rebuilding and patching taking place in several rooms. Rooms 1, 2, 3, 4, and 12 have new adobe floor surfaces. A major job of reconstruction has taken place in the area of Rooms 3 and 4. The east, south, and west walls of Room 4 have been rebuilt, and the room subsequently shortened. Perhaps this section had collapsed prematurely.

Between 1776, with the transfer of the Tubac garrison to Tucson, and 1787, with the Pima Company occupation, this main structure was abandoned. It is likely that by 1787, the house was in need of renovation. It may have been

Tubac - 50

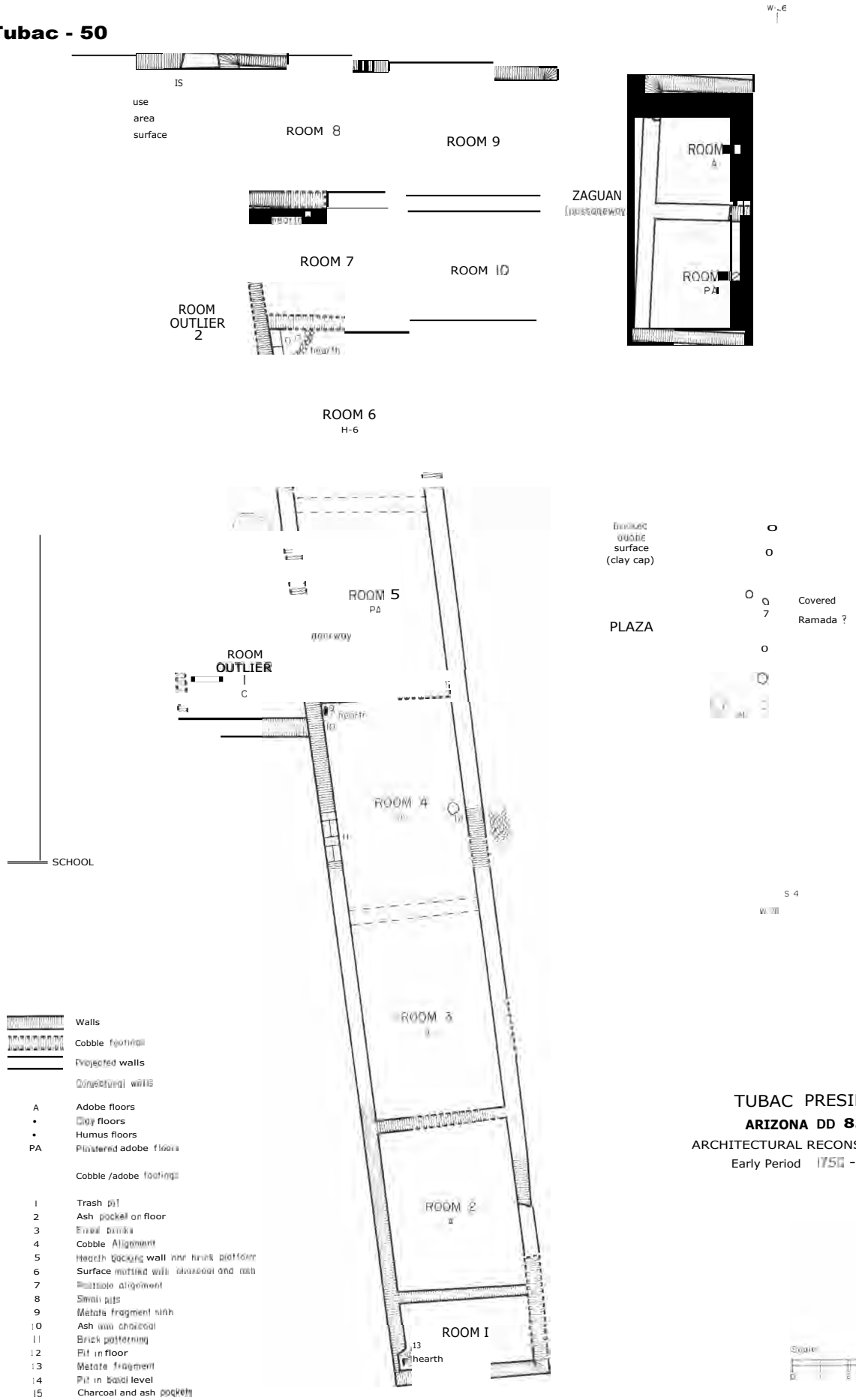


Figure 10.

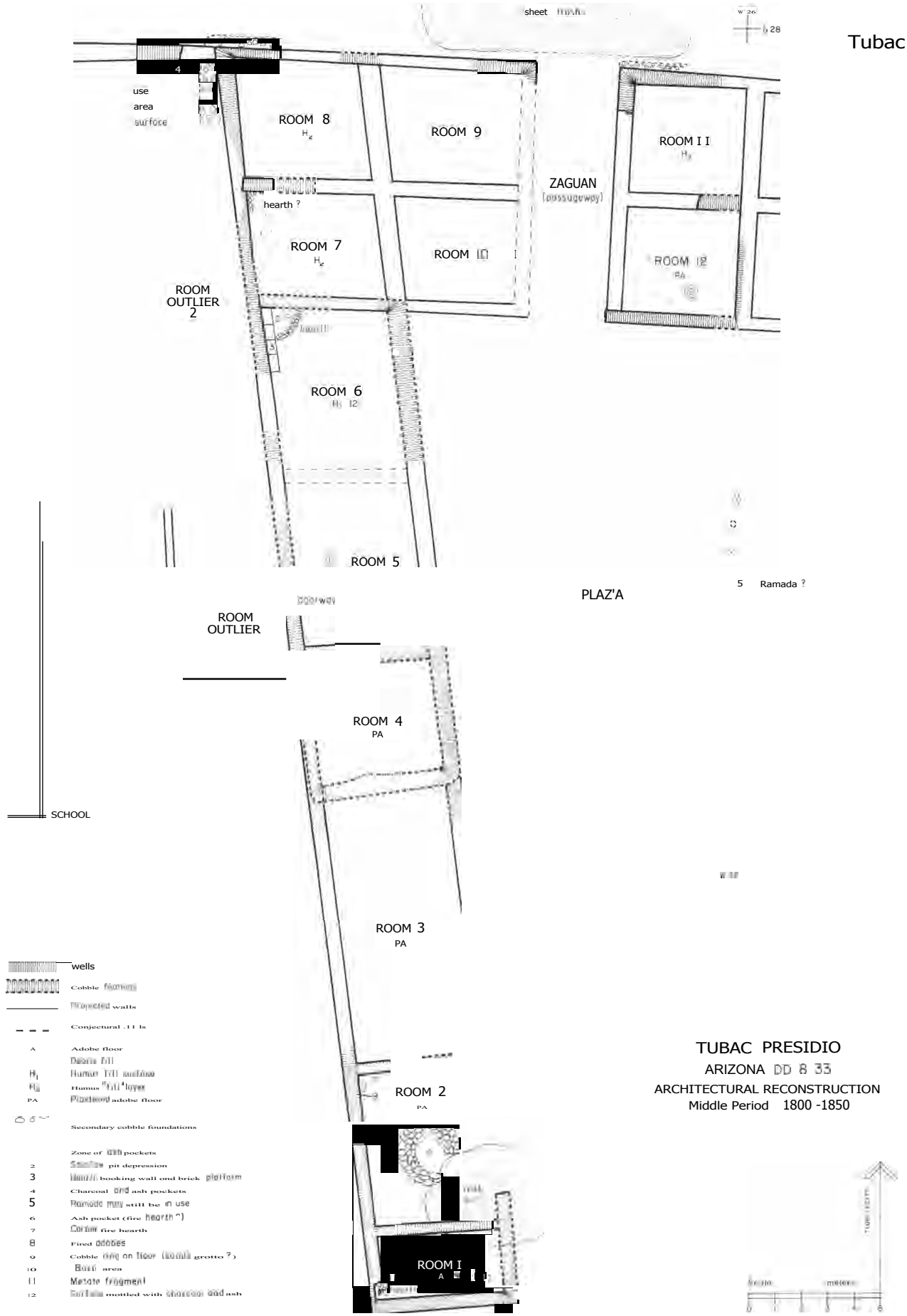

use
area
surface
ROOM 8
ROOM 9
ROOM I I
ZAGUAN
(passageway)
hearth ?
ROOM 7
ROOM 10
ROOM 12
ROOM
OUTLIER
2
ROOM 6
ROOM 5
5 Ramada ?
PLAZ'A
doorway
ROOM
OUTLIER
ROOM 4
PA
SCHOOL
ROOM 3
PA
ROOM 2
PA
wells
Adobe floor
Pitted adobe floor
Secondary cobble foundations
Ash pocket (fire hearth ?)
Fired adobes
Cobble orig on floor (kiva ? grotto ?)
Burn area
Metate fragment
ROOM I
TUBAC PRESIDIO
ARIZONA DD 8 33
ARCHITECTURAL RECONSTRUCTION
Middle Period 1800 -1850

Figure 41.

Tubac - 52

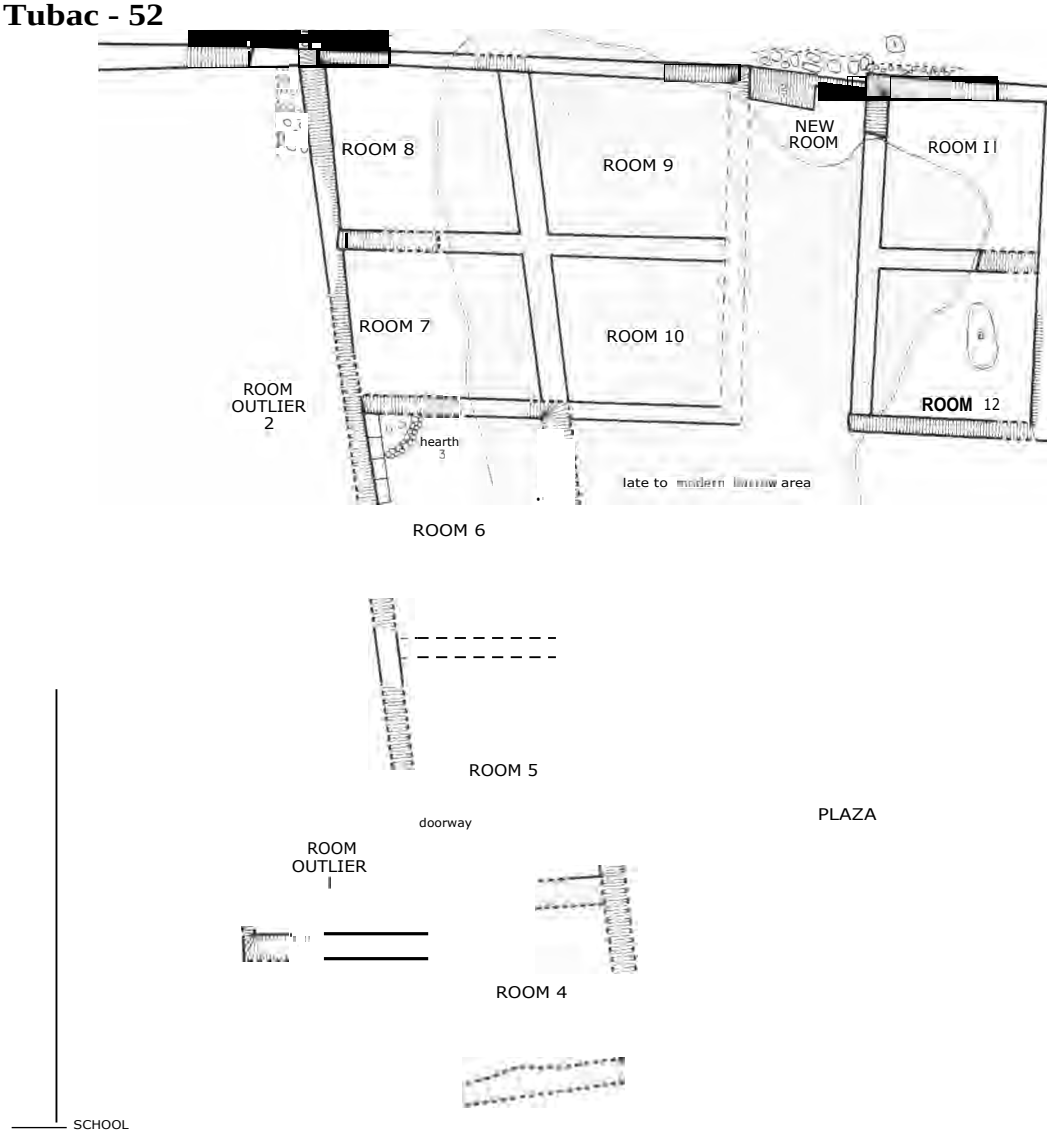


Figure 42.

at this time that a great deal of reconstruction occurred. As this occupational phase continued until well after 1800, these use levels can be considered a Middle-period development.

Late Period

It is likely that by 1850 a large part of the structure was in disrepair, and therefore abandoned. The mining company arrival in the 1850s did make part of the building suitable for habitation, however. The north wing, as seen in the Browne sketch, is definitely altered (Fig. 3). By this time the zaguan was enclosed, and other changes had taken place in this wing. No definite Late-period floor surfaces were uncovered; however, a very large Late-to-Modern barro pit has disturbed the entire area.

A Late-period use surface of humus did exist in Room 1. So, evidently the southern end of the west wing was also being utilized. Once again a trash pit, dating to 1920, has disturbed the area.

The architectural specifics of the presidio have been described in detail. This section serves to summarize the changes that occurred in the century-plus lifespan of the headquarters building through its periods as the Royal Forts of Saint Ignatius and Saint Rafael, as the Mexican presidio and Mexican military colony, and as a base for the Sonora Mining Company. It was a term of recurring occupation and abandonment, reconstruction and disintegration.

Intra-site Stratigraphy

The stratigraphy encountered in the excavations at Tubac is quite complex. Vertical control was often made difficult by subtle matrix changes and stratum intermixing. One factor contributing to this intermixing is the relative shallowness of cultural deposits, considering the occupational span at Tubac. Digging to a depth of 60 cm was sufficient, in most cases, to reach the basal level. Abundant disturbances like trash pits also made stratigraphic control difficult.

Figure 43 illustrates this problem as it occurred near the north end of the plaza. The trench profile indicates the presence of 11 stratigraphic lenses between the surface and the basal, sterile, zone, only 50 cm below. A complete break can be viewed on the left side of the profile where a trash pit intrudes

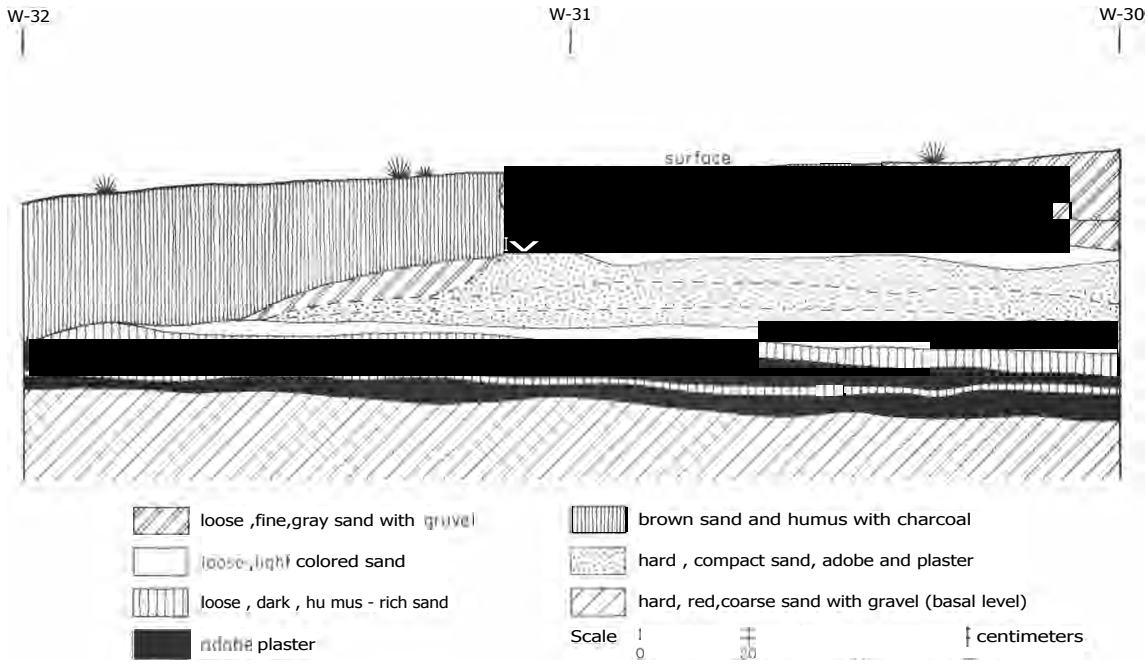


Figure 43. Profile of a section of the plaza along line N 12.

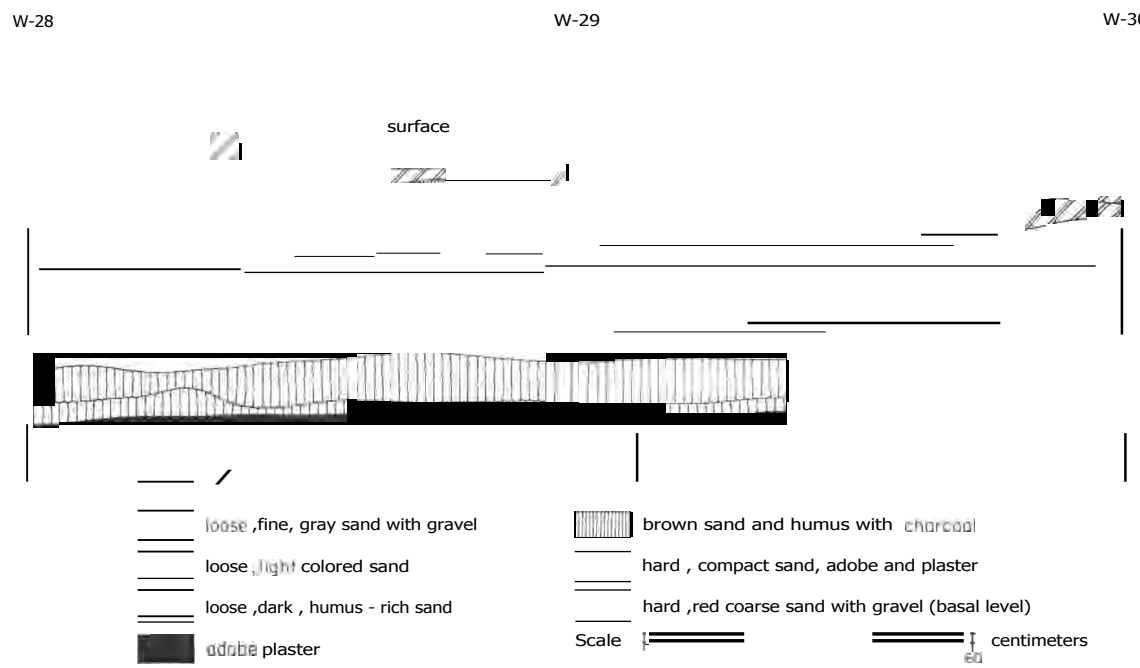


Figure 44. Profile of a section of Room 12 along line N 14.

through all cultural layers. Figure 44 pictures the depositional strata encountered in Room 12.

A system denoting depositional units was developed in order to enable us to equate and to define strata from various areas of the site. The following categories were devised:

I. Primary-refuse deposits
II. Secondary-refuse deposits
III. Non-refuse deposits

Our distinction between primary and secondary refuse is adapted, with modification, from Schiffer (1972). This distinction is explained more fully in the section of this report entitled "Spatial Organization." Briefly, primary refuse consists of deposits incorporating artifacts believed to have been discarded or abandoned at the locus of use, while secondary refuse consists of deposits containing artifacts which were transported for discard. The non-refuse category includes deposits which do not contain artifacts, or which contain them only fortuitously, like adobe structure walls.

Among primary-refuse deposits are the following:

Room-floor contact – artifacts or features in contact with a floor surface.

Room-floor fill – deposits, such as humus, charcoal, or ash which accumulated on a structure floor during the term of occupation.

Use-area contact – artifacts or features in contact with a use-area surface, such as a plaza surface.

Use-area fill – deposits built up on a use-area surface during its term of occupation.

Secondary-refuse deposits include the following:

Sheet trash – a gradual build-up of trash deposits forming a thin layer or sheet over large sections of the site. This category includes the uppermost surface zone.

Post-occupational fill – sand, fill, debris, and trash deposited in rooms, or on use-area surfaces, subsequent to their abandonment. At Tubac abandoned rooms may have been used as dumping spots by inhabitants of other sections of the building still being occupied.

Trash-pit fill - contents of pits excavated for the purpose of refuse disposal, or pits utilized for that purpose, such as barro pits.

Trash-dump fill - concentrated deposits or refuse.

Among the non-refuse deposits are the following:

Structural debris - adobe wall debris, roof fall, and melted adobe along with other building rubble such as plaster.

Structural wall - articulated sections of fallen wall, or wall stubs.

Structural floor - occupational surface of packed or plastered adobe or humus.

Basal level - ground surface prior to any construction activities. At Tubac this level is composed of a red, very hard, sandy, and gravelly soil.

Non-occupational fill - fill, usually consisting of eolian or colluvial sand deposits, which accumulated undisturbed during periods of abandonment.

In addition to the categories above, there are disturbed provenience areas where strata have been disarranged by subsequent intrusions such as pits and pipeline trenches.

The above units make up the intra-site stratigraphic units excavated at Tubac. Actual profiles have already been illustrated. In order to facilitate a better understanding of our classification system, an idealized stratigraphic cross section is formulated in Figure 45. This profile hypothetically cuts through plaza, room, and structure-exterior depositional units. The relative position of specific categories is indicated and the chart may be referred to as needed. This profile is a perfected ideal; in reality, depositional context was rarely this clear cut.

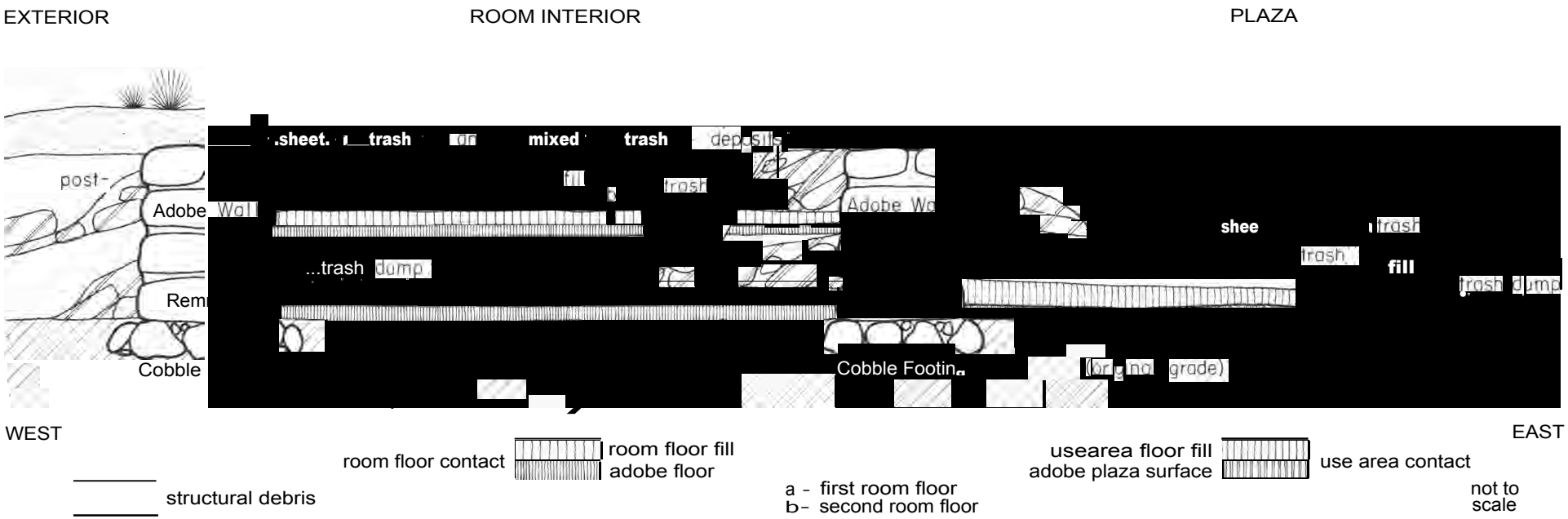


Figure 45. Idealized stratigraphic cross section. View from west to east through the west wing.

Chapter 5

INDIGENOUS ARTIFACT ASSEMBLAGES

Introduction

Artifacts are organized into two sets of assemblages, indigenous and non-indigenous. The distinction is based on the sorts of technology employed in the manufacture of objects. Indigenous artifacts are those made of materials, and by techniques, familiar to inhabitants of the American Southwest prior to European contact. The remaining artifacts, such as those of metal and glass, reflect the technical procedures of European industry after 1750.

Clearly, as different groups of people became familiar with one another's artifacts, distinctions blurred. For example, non-Indian soldiers and ranchers could, and doubtless did, make gunflints in the indigenous manner. Nonetheless, such a gunflint would still be considered a part of the non-indigenous, European technological sphere.

The distribution of artifacts in time is denoted in another way. At least six separate occupations occurred at Tubac from 1750 to 1900 but, in view of the nature of the deposits, we considered ourselves fortunate in recognizing even relative periods of deposition. Using as tools stratigraphic superposition and diagnostic artifact associations, we were able to assign depositional units to three arbitrarily devised time periods, Early (1750-1800), Middle (1800-1850), and Late (1850-1900). These specific time-period terms are capitalized in the text to distinguish them from such relative terms as "earlier levels." Artifacts recovered from modern, post-1900 contexts were not analyzed. However, artifacts clearly of 20th-century manufacture which were found as intrusive inclusions in earlier deposits are reported.

The spatial locations of artifacts are given in accordance with conventions already established in the sections of this report which deal with architecture and intra-site stratigraphy.

Ceramics

Introduction

At Tubac no whole or reconstructable vessels of indigenous pottery were found, but 16,872 sherds were recovered. Of these sherds, 99 percent are of what Fontana described to us as Piman Plainware and Piman Redware. Sherds in the remaining fraction are either of decorated plainware and redware, Piman Red-on-brown ware, and Piman Black-on-red ware, or of imported, decorated pottery.

Analysis of historic period indigenous pottery in Papaguerla is difficult. Fontana and others (1962: 135-136) found many traditional procedures, such as temper and rim-form analysis, to be unproductive when dealing with contemporary Papago Indian pottery. Further, they hold that there are difficulties in establishing ethnic distinctions even when dealing with modern Pima and Papago pottery (Fontana and others 1962: 136).

Given these difficulties, we welcome the more general term "Piman wares." We take it that the Tubac Piman wares share identity in form, technology, and style with such pottery from Papagueria as modern or recent Papago Indian pottery (Fontana and others 1962; Haury 1950: 344-346), modern Pima Indian pottery (Hayden 1959: 10-16; Russell 1908: 124-137), and Sobaipuri plainware and redware (DiPeso 1953: 147-153, 157-159).

Terminology and classifications here are after Shepard (1956) except in the description of rim forms and design elements, which will follow Colton (1953: 43-44, 47-48).

Description

Piman Plainware. Of the total indigenous pottery sample, Piman Plainware comprises 85 percent with 14,296 sherds. Of these sherds, 93 percent are from the bodies of vessels, 5 percent are from jar rims, 1.8 percent are from bowl rims, and 0.2 percent are from plate rims. Thirteen percent of the sherds are sooted on exterior surfaces.

As we have said, the Tubac Piman Plainware seems identical with Sobaipuri Plainware, which has been defined and described in detail by DiPeso (1953: 148-153). The salient characteristics of the Tubac sherds are summarized in the following discussion.

The pottery was made by the paddle-and-anvil technique and bases were modeled over gourds or inverted pots which were sometimes covered with cloth (Fontana and others 1962: 58; Hayden 1959: 13). Evidence for this technique at Tubac is seen in the characteristic anvil impressions on some sherds and in the cloth impressions seen on the interior of three sherds. In addition, two objects were found which are believed to be fragments of molded and fired clay anvils. Such anvils were reported in use by Yuman potters during this century (Rogers 1936: 10, Plate 4).

Technical features are extremely variable. Paste color ranges from brown to black. Temper and inclusions may comprise small or large sand grains, crushed stone, or vegetal materials; however, some sherds have no inclusions at all. A carbon streak from oxidized organic inclusions is usually present.

Pots were often polished on the interior, but seldom on the exterior. No slip was used. A few examples of intentional interior smudging were noted. Two sherds have cob impressions, but no tooling was noted. Specific vessel forms are unreconstructable, but jars, bowls, and plates were made in this ware. There are three fragments of large strap handles, and one fragmentary foot ring.

Jars range in thickness from 5 mm to 12 mm at the rim. Rim diameters range from 18 cm to 47 cm and average 32 cm. Rim forms include straight, recurved, and rim-coil forms (Colton's types IA3, 1B8, IC4 with coil, IIA3, IIB3, IIB4, IIB10). Of the 677 jar-rim sherds, 21 percent are sooted on the exterior.

Bowls range in thickness from 3 mm to 10 mm at the rim. Rim diameters range from 14 cm to 60 cm and average 33 cm. Rim forms include straight, slightly recurved, incurved, and occasionally rim-coil forms (Colton's types IA3, IA4, 111A3, IIIB)4). Of the 267 bowl-rim sherds, 22 percent are sooted on the exterior.

Plates average 8 mm in thickness at the rim. The plates are flat to slightly concave and the edge is usually beveled from the bottom of the outside. The exterior is left rough while the interior is usually polished. Basket impressions were seen on the exterior of two plate fragments. Plate diameters range from 23 cm to 38 cm and average 28 cm. Of the 36 rim fragments, only one is sooted.

Piman Redware. With 2,396 sherds, Piman Redware represents 14 percent of the total indigenous sample. Of these sherds, 83 percent are from the bodies of vessels, 5 percent are from jar rims, 11.8 percent are from bowl rims, and

0.2 percent are from plate rims. Fourteen percent of the sherds are sooted on the exterior surfaces. A detailed description of Sobaipuri Redware, which we consider synonymous with Piman Redware from Tubac, appears elsewhere (DiPeso 1953: 158-159). Characteristics of the Tubac Redware sherds are identified as follows.

Technologically, the redware at Tubac is much the same as the plainware. Paste color ranges from red-brown to the more common black core which is apparently derived from organic, horse manure temper (Gerald 1951: 4). Surface color is predominantly red, but occasional misfiring produced a buff or brown color, and fire clouds are not uncommon. A red slip is present, sometimes about 1 mm thick, and sometimes so ephemeral as to invite the speculation that suitable clay bodies may have been floated rather than actually slipped (Shepard 1956: 191). Slip is generally applied to all surfaces, but on two jar-rim specimens the slip extends only about 20 mm down into the interior of the vessel.

Vessels are always well polished on the interiors and are polished to some extent on the exterior. In rare cases vessels were intentionally smudged on the interiors. There are two fragments of large strap handles, one lugged rim sherd, and one fragmentary foot ring in the redware collection.

While complete vessel forms cannot be reconstructed, it was inferred from rim forms that jars, bowls, and plates were made in this ware. Jars ranged in thickness from 4 mm to 12 mm at the rim. Rim diameters range from 13 cm to 52 cm and average 31 cm. Rim forms include straight, recurved, and very rarely, rim-coil forms (Colton's types IA)4, IA4 with coil, IB3, IIB3, IIB4). Of the 278 bowl-rim sherds, 14 percent were sooted on the exterior.

Redware plates are similar in all ways to plainware plates except that one redware sherd has a scalloped edge. Plates average 8 mm in thickness at the rim and 28 cm in diameter. Of the five rim sherds, one is sooted.

Piman Red-on-brown Ware (Fig. 48). This pottery is identical with Piman Plainware with the exception that painted designs appear on the exterior surfaces. While logic might dictate the term "red-on-plain," semantics decree otherwise, hence the term "red-on-brown." The 122 sherds of this ware comprise 0.7 percent of the total indigenous ceramic assemblage. Of these sherds, 89 percent are from vessel bodies, 0.8 percent are from jar rims, and 10.2 percent are from bowl rims. No plate rims were found.

Figure 46. Piman Black-on-red pottery. Maximum dimension upper left, 39 mm.

Figure 47. Polychrome pottery. Maximum dimension upper left, 30 mm.

Figure 48. Piman Red-on-brown pottery. Maximum dimension upper left, 59 mm.

The paint was composed of ground minerals suspended in a watery vehicle. Ethnographically in Papaguerla red hematite was used, mixed with mesquite gum (Fontana and others 1962: 77).

Analysis of design pattern and style was not possible due to small sample and sherd size. The largest sherd has less than 20 cm^2 of surface area. However, certain design elements and motifs can be extracted.

Among design elements are straight, curved, and wavy lines, both wide and fine, and fine-line chevrons. One design motif consists of parallel banding with either straight or wavy lines. In one case these bands start at, and run parallel with, the vessel rim. Another motif features multiple lines intersecting a common line at right angles. Other motifs include concentric circles and nested and laterally repeating chevrons.

Piman Black-on-red Ware (Fig. 146). This pottery is identical with Piman Redware with the exception that painted designs appear on exterior surfaces. This ware constitutes 0.2 percent of the total indigenous assemblage with 39 sherds. Of these sherds, 82 percent are from vessel bodies, 10 percent are from jar rims, and 8 percent are from bowl rims. No plate rims were found.

The paint was composed of carbon-based pigment and varies from fugitive gray to thick, dark black. Ethnographically in Papaguerla mesquite bark or gum was used to make paint (Fontana and others 1962: 77; Hayden 1959: 15; Russell 1908: 127).

Small sample and sherd size precluded analysis of design pattern and style. The largest sherd has less than 25 cm^2 of surface area. However, certain design elements can be extracted.

Among design elements are straight and curved wide lines and straight fine lines. One design motif consists of parallel banding with straight lines. In one case these bands start at, and run parallel with, the vessel rim. Concentric circles are another design motif.

Polychrome Pottery (Fig. 147). Only 19 sherds of this pottery were found at Tubac, comprising 0.1 percent of the total indigenous ceramic assemblage. Of these sherds, 79 percent are from vessel bodies and 21 percent are from bowl rims. Only bowl forms are represented in the sample, and it seems that the sherds are from at least four separate vessels. No sherds from jar rims or plate rims were found. None of the sherds are sooted.

Paste color ranges from white to gray, and paste inclusions are present in the form of fine sand and finely crushed sherds. All sherds have a thick white or cream-colored slip, usually crackled, on all surfaces. Designs are painted with black, mineral-based paint. Two sherds have red-painted interiors.

While limited sample and sherd size prevents analysis of style and design pattern, certain elements and configurations can be noted. Straight and curved fine lines, solid and split triangles, and circles and dots are incorporated in several patterns. Design motifs include bounded diagonal hatchures, bounded diamond cross hatchures, dots in circles, and parallel lines, or lines and triangles in parallel. In three cases the elements form double bands on rims.

Although aware of the problems inherent in assigning pottery-type names to small sherd samples, we are convinced that all of the polychrome sherds found at Tubac were produced during the historic period in the Acoma-Laguna-Zuni area of what is now New Mexico (Harlow 1967: 3-4).

Stylistically the design motifs are most similar to those occurring on both Acoma Polychrome and Kiapkwa Polychrome (Frank and Harlow 1974: Plate XXIV, Fig. 149). Danson (1946: 28) reported finding one "Acoma Black-on-white" sherd at Tubac during a survey of the Santa Cruz Valley. The sherd Danson reported was probably Acoma Polychrome.

Distribution in Time

About 16 percent of the sherds are from Early-period proveniences, 45 percent from Middle-period proveniences, and 39 percent from Late-period proveniences. These figures are, of course, not directly comparable due to differences in sampling-domain size and differences in population densities through time. What is clear, however, is that large quantities of ceramic vessels were always in use at Tubac, whatever the composition of the occupying groups from the mid-18th century through 1900.

Sherds from the rims of jars, bowls, and plates are in the same ratio to one another whatever the time period, leading us to suggest that the vessel-type composition within the ceramic assemblage at any given time was about the same. However, function may have varied slightly. About 14 percent of the sherds are sooted on the exterior, indicating use as parts of cooking vessels, in both Early and Middle periods. This figure declined slightly in the Late period to about 12 percent of the total. The smaller, less permeable redware

vessels became more popular through time, being represented by 8 percent of the Early-period sherds and 18 percent of the Late-period sherds. In addition, the incidence of decorated sherds remained the same in Early and Middle periods, but declined to half that frequency in the Late period.

Haury (1950: 350) notes that on recent Papago red-on-buff vessels, there are two styles, heavy line and narrow line. He also notes that narrow-line designs were later in time, late 19th and early 20th centuries, than were heavy-line designs, which he places earlier in the 19th century (Haury 1950: 350).

At Tubac, we found similar patterns of heavy-line and narrow-line designs among the Piman Red-on-brown Ware, which we take to be equivalent to Haury's recent Papago red-on-buff, and we set out to determine temporal distributions. Analysis of a small sample of sherds confirmed the expectation that narrow-line work would tend to be later in time, and supported Haury's speculation that heavy-line designs would occur in pre-1800 context.

In evidence, of the sherds with heavy-line designs, 25 percent are from Early-period proveniences (1750-1800), 45 percent are in Middle-period contexts (1800-1850), and only 5 percent have Late-period (1850-1900) associations. The remaining heavy-line sherds are from surface or disturbed proveniences. Conversely, of the narrow-line sherds, 30 percent have Late-period associations, while only 10 percent are from earlier contexts. The trade pottery, Acoma or Kiapkwa polychrome, was found distributed in about equal measure in Middle and Late proveniences, with no Early-period associations.

Distribution in Space

The Tubac plainware and redware sherds are distributed among virtually all provenience units, occurring with highest frequency, as might be expected, in trash pits, trash dumps, and post-occupational fill. Upon inspection, there seem to be no statistical differences in the discard pattern. Sherds from vessel bodies, jar rims, bowl rims, and plate rims have about the same ratio to one another whatever the provenience unit. Similarly, decorated ceramics are discarded in no special way, with broken jars and bowls distributed in the same manner as the utility wares. A functional interpretation of patterns of sherd discard and abandonment will be found in the section of this report devoted to spatial organization.

Conclusions

The indigenous ceramics from Tubac, with the exception of imported polychrome pottery, are remarkably similar technologically. All the Piman Plainware and Piman Redware, some 99 percent of the sample, was used and discarded in much the same fashion. The major technical difference is in surface treatment. Simply put, the unslipped plainware is more friable and permeable than the slipped redware. Other features are identical except for a difference either in firing or in paste composition which makes the carbon streak or core more pronounced in the redware.

The lack of whole vessels makes statements about form tentative at best. If we may make reference to comparable collections (DiPeso 1953: 147-153, 157-159; DiPeso 1956: Fig. 43), then we would expect that the Tubac pottery assemblage comprises large and small storage jars, water jars, cooking jars and bowls, and eating utensils in the form of small jars, bowls, and plates.

In general, while average rim diameters of plainware vessels and redware vessels are about the same, the plainware vessels were probably larger. In evidence of this we note the high percentage of body sherds, 93 percent, in the plainware collection. The assumption is that larger pots, when broken, produce a higher ratio of body sherds to rim sherds than do smaller vessels. The proportions of body sherds to rim sherds in the redware collection are 83 percent to 17 percent. The possibility of differential breakage patterns was considered, but we noted that the average sherd size and weight for both plainware and redware is the same, about 15 gm.

Again, speaking generally, it is likely that the majority of plainware vessels were in the form of jars, while the majority of redware vessels were bowls. In evidence, jar rims are more than twice as frequent as bowl rims in the plainware collection, while the converse is true in the redware collection, even though both plainware and redware pottery share similar ranges and averages in vessel aperture size.

The reconstruction of pottery function is difficult at best, and more so when no whole vessels are present. Among the modern Papago we find that there are many different vessel forms which are elaborately and specifically categorized; however, we find as well that "there are no apparent cultural strictures on the relation of form and use, and any pot that will do for any purpose is made to do so in practice" (Fontana and others 1962: 18).

On the other hand, we expect that to find grease stains or soot on the exterior of sherds indicates that the vessels from which these sherds came were used as cooking vessels at some time in their cycle of use. If this is the case, both plainware and redware were used as cooking vessels as much as they were as other kinds of vessels. A nearly equal percentage of each ware is sooted on the exterior. In addition, within each ware jar rims are only slightly more likely to show evidence of cooking use than are bowl rims. For another view of sooting, see DiPeso (1951: 110).

To arrive at some index of ceramic-related behavior, we chose to form subjective, and often arbitrary, functional categories of our own. For this purpose, we consider that cooking vessels are indicated by exterior sooting on rim sherds and that eating utensils are indicated by unsooted bowl-rim sherds and unsooted plate-rim sherds. The distribution and interpretation of these categories will be found in the section of this report which deals with spatial organization.

Stone Artifacts

Introduction

At Tubac we found 779 stone artifacts comprising ground-stone tools, flaked-stone tools, and tool-manufacture debris. The artifacts were analyzed in order to determine, among the various forms of archaeological variability (Binford 1968; Speth 1972), those variables which would reflect raw-stone procurement, the technical treatment of this stone to produce tools, the function of the tools produced, and the degree of regional interaction implied by stylistic similarities. In a later section of this report, attention will be devoted to the distribution and associations of those activity sets which include stone tools.

Terminology and Classification

The classificatory scheme employed here is class-descriptive and is based on formal-functional, attribute-level, inferences as suggested by Fitzhugh (1972: 71). Metates are defined as nether grinding implements worn by the application of a superior grinding tool, such as a mano (Weaver 1972: 91; Woodbury 1954: 50).

Metate subclasses include trough and flat forms. Manos are defined as tabular pieces of stone held in the hand and rubbed back and forth on a metate in a reciprocal motion (Woodbury 1954: 66). The functional implication drawn from ethnographic analogy is that both metates and manos were used primarily in the processing of food. Handstones, like manos, are pieces of tabular stone which demonstrate evidence of use as grinding tools. They differ in that they tend to be smaller and are usually made of fine-ground, water-worn cobbles. Suggested functions are pottery polishing, food grinding, and plaster smoothing.

In the flake-tool production process, primary flakes and primary flakes from the exterior or cortical surface, called cortical flakes, are forced from a core, a mass of raw material. If the primary flakes are further modified into formal tools, secondary flakes are forced from the primary flakes. If the tool is bifacially finished, small flakes with overlapping wide, shallow scars, called biface thinning flakes are produced. These distinctions are considered important since they provide a potential for reconstructing the routing of tool manufacture with a site.

It is granted that distinguishing primary from secondary flakes on a technologically objective basis is difficult, if not impossible. Therefore, the following operational definition is offered. Primary flakes must be of a size consistent with that of finished tools; secondary flakes will be smaller than the flakes used as bases for finished tools.

Primary and secondary flakes may, of course, be used without further modification as they come from the parent material, in which case they are classified as utilized flakes. A flake exhibiting casual edge resharpening which follows the angle formed at initial detachment is called a retouched flake.

Classes of formal tools, on the other hand, present evidence of regular and extensive retouch which changed the angle of the working edge significantly from that which may be projected to have existed at initial flake detachment. The classification of formal tools conforms with formal-functional inference, as has been stated before. Criteria for these inferences were drawn from ethnographic analogy and from consideration of the form and characteristics of use-edges, as treated in studies made by Wilmsen (1970) and Gould and others (1971). Observations of edge-wear patterns also contributed to the categorizing of formal tools.

Scrapers are flakes which have been retouched to form an obtuse edge angle. They are usually worked unifacially. Side scrapers are retouched along

an edge parallel to the long axis of the flake. End scrapers are retouched perpendicular to that axis. Multi-side scrapers are retouched on more than one side.

Cutting tools are similar to scrapers except that acute edge angles have been produced. Unifacial knives are formed through unifacial retouch, while biface knives are produced by bifacial retouch.

Chopping tools comprise, at Tubac, a class of flake choppers. These tools are similar to biface knives, but are larger in all dimensions and are crudely worked. Edge-angle values fall midway between those for scrapers and cutting tools. These tools are inferred to have been used for light chopping and cutting.

Specialized tools are tools of particular function. At Tubac this includes biface drills and notched flakes. Drills have diamond-shaped cross sections, flanged bases, and subparallel sides exhibiting heavy wear. They were probably used for drilling holes in wood or bone. Notched flakes are flakes modified to produce small, deep concavities in the sides. The inferred function is that of specialized wood or bone working, as in shaft dressing and smoothing.

Projectile points are supposed to have been used to provide sharp ends for projectiles. They tend to be symmetrical and to have been modified at the base to facilitate hafting.

Tool blanks are defined as flakes which have been grossly modified, either bifacially or unifacially, into an uncompleted semblance of one of the formal tool types.

Description

Metates. One whole metate and eight metate fragments, representing nine distinct metates in all, were found. Five metates are of the full trough form, while the other four are flat metates. Two of the metates are made from small, flat, conglomerate boulders, while the rest are made from flat granite boulders or slabs. Only one specimen, a full trough metate, was trimmed to shape by pecking and grinding; the others are unmodified except for repeated pecking on the grinding surface. One specimen is heavily indented in the center of the grinding surface, suggesting use as a substitute mortar. Extrapolating from existing fragments, the dimensions of the Tubac metates would be as follows. Flat metates would be 30 cm long, 20 cm wide, and 8 cm thick, and would have effective grinding surface areas of about 400 cm^2 each. Trough metates would be

about 65 cm long, 35 cm wide, and 10 cm thick, and would have effective grinding-surface areas of about 1,000 cm^2. All metates are in initial or intermediate stages of use. Examples of full trough and flat metates are illustrated in Figures 49:d and 50.

Manos. Ten manos were found at Tubac, all but two of which are broken. Eight are made of granite cobbles and two are made of basalt cobbles. Three of the manos are shaped to the common rounded-rectangular form by pecking and grinding; the others are unmodified except through use. Average length is 19.8 cm; average width is 9.8 cm, and average thickness is 4.7 cm. Five of the manos show the beveled outer-edge wear which is taken to indicate use in a trough metate (DiPeso 1951: 135). Two manos show grinding wear on both flat surfaces, while the others are ground only on one side. All are of a thickness to have permitted further use, barring breakage. Examples of manos may be seen in Figure 49:a, c.

Handstones. Three handstones were recovered at Tubac. All three are oval quartzite cobbles which have fine striations and are polished from use on the flat faces. Average dimensions are 7.3 cm by 6.6 cm by 2.8 cm. A handstone is illustrated in Figure 49:b.

Cores. Twenty-four cores were found at Tubac. Five are of chalcedony, 13 are of chert, four are of quartzite, and two are of the sort of obsidian known colloquially as "Apache tears." Six cores possess a single striking platform, seven were struck on more than one face, three were worked from a common edge to form a bifacially-shaped core, and three cores are globular in shape, with all opportunity for further flake removal having been exhausted. In addition, there are five small, single-striking-platform cores of the kind which have been defined elsewhere (Teague 1975) as micro-cores. The average maximum dimension of the micro-cores is 22 mm; the average maximum dimension for the other cores is 57 mm. All the cores but one have cortical surfaces remaining, and all save the three globular cores retain the potential for further flake removal. None of the coresshowsevidence of use as tools, and no formal class of core tools is present.

Debitage. At Tubac 640 flakes were recovered. A summary of flake types and material types is given in Table 1.

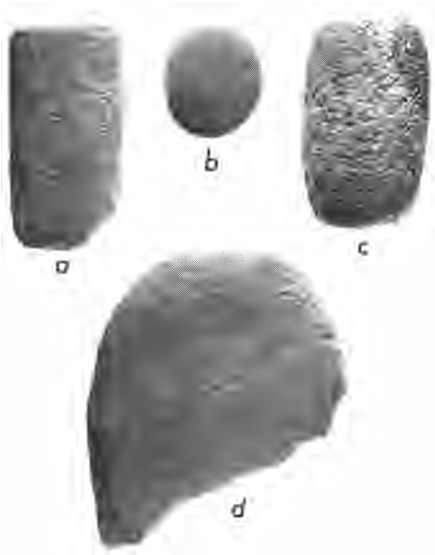


Figure 49. Manos and metate. Length of a, 180 mm.

Figure 50. Metate. Length, 510 mm.

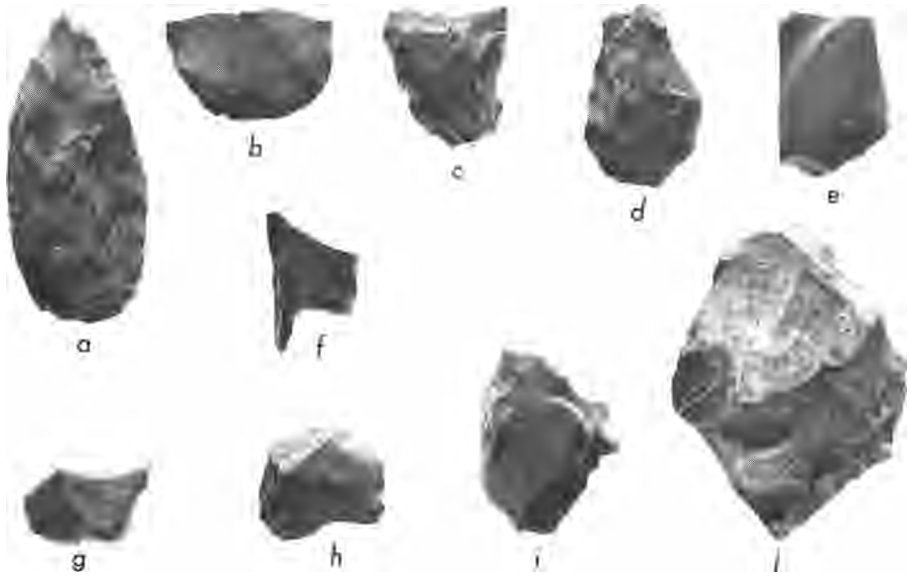


Figure 51. Flaked-stone tools. Length of a, 71 mm.

Table 1

Flake Types

Material Type	Cortical	Biface Thinning	Primary	Secondary	Percent of Total by Material
Chalcedony	6	4	18	50	12%
Chert	44	18	100	232	62%
Silicified Wood	1	1	7	4	2%
Quartzite	37	1	35	66	22%
Andesite	1	0	4	0	>1%
Rhyolite	1	0	1	0	>1%
Obsidian	0	0	3	6	1%
Percent of Total by Flake Type	14%	4%	26%	56%	

Of the 640 flakes, a sample of 10 percent was chosen for an analysis of technological attributes. Of the flakes in this sample which possess intact striking platforms, 73 percent have been struck from unprepared cores, while 27 percent of the striking platforms have been ground or crushed prior to flake detachment, as evidenced by minute step fractures.

The sample also was examined for indications of heat treatment as a flint-working technique. No such indications were found. In addition, an attempt was made to arrive at an index of systematic flake-production techniques. It was felt that the more systematic the core-reduction process, the higher would be the proportion of regular, geometrically-contrived flake forms. At Tubac, 74 percent of the flakes are irregular or asymetrically-conchoidal, while only 26 percent assume regular geometric forms such as rectangles and triangles. One specimen is in the form of a true blade; its production is considered fortuitous.

A further index of systematic core reduction was believed to be the degree to which the axis of flake detachment follows the axis of detachment of previous flakes. Accordingly, those flakes in the Tubac sample which possess the scars of previous flake removals were measured. In less than half the cases, 46 percent, the axis of flaking corresponds within 30 degrees to the axis of previous flaking.

Flake Tools

Utilized Flakes. Forty flakes from Tubac show evidence of utilization in the form of micro-spalling, grinding, or polishing along one or more edges. Four of these flakes are cortical, 24 are primary, and 12 are secondary. Seventy percent are of chert, while the rest are of chalcedony, silicified wood, quartzite, andesite, rhyolite, or obsidian. The effective or utilized edge length ranged from 10 mm to 65 mm and averaged 27 mm. The use-edge angle ranged from 18 to 75 degrees and averaged 38 degrees. It is inferred that 24 of the flakes were used as cutting tools, while the remaining 16 were used as scrapers.

Unifacial Tools and Retouched Flakes. Twenty-five unifacial tools and retouched flakes were recovered at Tubac. The majority, 60 percent, are of chert, 20 percent are of chalcedony, and the rest are of either quartzite or obsidian. Twenty-two of the tools were shaped by percussion and three were shaped by the pressure technique. The majority were made on primary flakes. The inferred function for 20 of the tools is scraping. Three tools are believed to be cutting implements. Two tools, the notched flakes, are specialized tools probably used for dressing wooden or bone shafts. A synopsis of unifacial-tool and retouched-flake attributes in given in Table 2. For illustrations of uniface tools, see Figure 51:c, e, f, g, h, i.

Biface Tools

Knives and Choppers. Six bifacially-flaked stone knives and one bifacially-worked flake chopper were found at Tubac. All were made on large, primary chert flakes and were formed by direct percussion techniques, although two of the knives were also retouched by the pressure method. Of the knives, the average dimensions are 34 mm by 24 mm by 8 mm. The average effective-edge length is 52 mm, and the average use-edge angle is 26 degrees. The flake chopper measures 46 mm by 56 mm by 18 mm, and has an effective-edge length of 56 mm and a use-edge angle of 55 degrees. For illustrations of biface tools, see Figure 51:a, b, d, j.

Biface Drill. One bifacial chert drill was found at Tubac. Dimensions are 26 mm by 10 mm by 5 mm. The drill was shaped entirely by direct percussion, is diamond-shaped in cross section, and has sub-parallel sides with an expanding or flanged straight base. The drill is illustrated in Figure 52:h.

Table 2

Unifacial-Tool and Retouched-Flake Attributes

	Retouched Flakes	End Scrapers	Side Scrapers	Multi-side Scrapers	Unifacial Knives	Notched Flakes
Number	5	4	5	8	1	2
Average length (mm)	41	30	32	28	48	29
Average width (mm)	22	23	20	22	22	26
Average thickness (mm)	9	10	9	9	12	15
Average effective-edge length (mm)	38	21	34	42	45	20
Average use-edge angle	51	66	62	68	25°	55°
Edge form:						
Straight	1	2	1	2	1	
Concave				4		2
Convex	4	2	4	2		

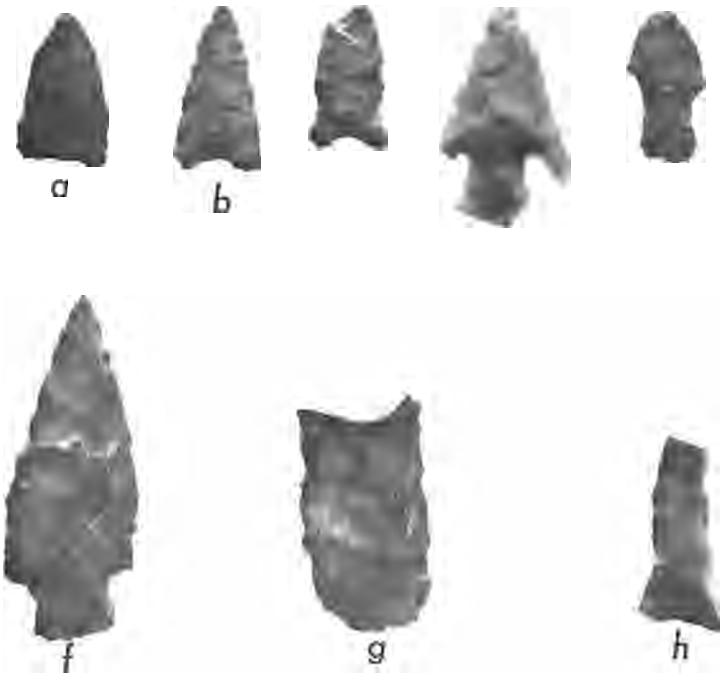


Figure 52. Projectile points and drill. Length of a, 20 mm.

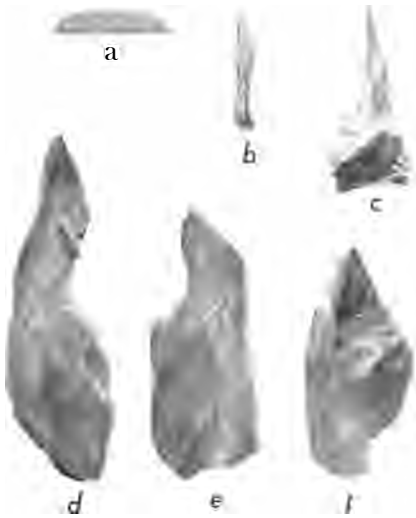


Figure 53. Bone tools. Length of a, 44 mm.

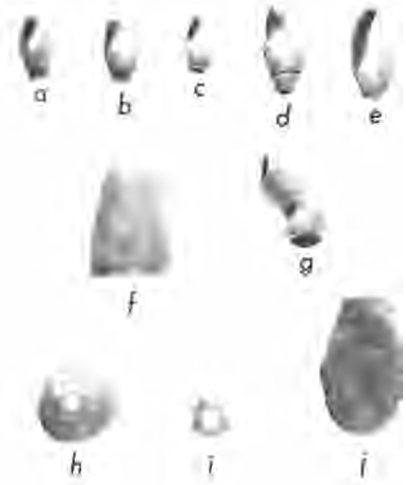


Figure 54. Shell beads. Length of j, 26 mm.

Projectile Points. Seventeen projectile points and projectile-point fragments were found at Tubac. As stated in the introduction to this section, typology will proceed on a site-specific, formal-descriptive basis. Conventions of description are after Irwin-Williams and Irwin (1966: 65). Descriptions and attribute summaries follow.

Tubac Type 1 (Fig. 52:a)

Number: 3
Form: Expanding stem, straight or slightly curved base.
Average dimensions: 19 mm by 9 mm by 3 mm
Material: Fine-grained slate 1, chert 1, chalcedony 1
Technique: Thin flakes pressure-trimmed around the edges. Flake scars do not extend across the face.

Tubac Type 2 (Fig. 52:b)

Number: 4
Form: Elongated triangle, with slightly expanding stem and concave base.
Average dimensions: 20 mm by 10 mm by 3 mm
Material: Fine-grained slate 1, chert 2, chalcedony 1
Technique: Bifacial pressure flaking, forming a strongly biconvex cross section.

Tubac Type 3 (Fig. 52:c)

Number: 2
Form: Slightly expanding stem with shallow lateral notches and indented base.
Average dimensions: 21 mm by 12 mm by 4 mm
Material: Chert 1, chalcedony 1
Technique: Percussion shaping with final trimming and notch addition by pressure technique.

Tubac Type 4 (Fig. 52:d)

Number: 1
Form: Expanding stem with deep corner notch and straight base.
Dimensions: 32 mm by 18 mm by 4 mm
Material: Chert
Technique: Percussion, with notches added by pressure.

Tubac Type 5 (Fig. 52:e)

Number: 1
Form: Slightly expanding indented stem with a rounded shoulder and straight base.
Dimensions: 22 mm by 10 mm by 3 mm
Material: Chert
Technique: Percussion, with final trimming by pressure.

Tubac Type 6 (Fig. 52:f)

Number: 3
Form: Very slightly expanding stem with convex sides and abrupt shoulders formed by deep corner notches.
Average dimensions: 52 mm by 20 mm by 6 mm
Material: Chert 2, rhyolite 1
Technique: Percussion, with notches added by pressure.

Tubac Type 7 (Fig. 52:g)

Number: 1
Form: Probable base of a projectile point. Sides are parallel, base is convex.
Dimensions: 34 mm (broken) by 19 mm by 6 mm
Material: Chert
Technique: Percussion

Tubac Unclassified

Two chert projectile-point fragments, one a mid-section and one a tip, were found. Neither is assignable to formal class.

Tool Blanks. Three stone tool blanks, two of chert and one of silicified wood, were found at Tubac. All were roughly shaped by percussion from large primary flakes. Two were bifacially worked while the other has flakes removed from only one side. No evidence of mechanical use is apparent. Average dimensions are 54 mm by 27 mm by 15 mm.

Material Types

With the exception of obsidian, stone of the sort used for tools at Tubac may be found within four kilometers, 2.5 miles, of the site, and occurs abundantly in the adjacent terrace gravels. The obsidian, only 14 examples of which were found, is translucent and brittle and may be black, brown, green, red, or banded. The source area for this material is unknown.

Granite was the most common stone used for grinding tools, with basalt and conglomerates occasionally occurring. For flake tools a tough, red chert was usually employed, along with rhyolite, chalcedony, quartzite, and other minor stone types. The most homogeneous and fine-grained stone types are found in bifacial tools and projectile points.

Flake-Tool Technology

A reconstruction of flaking techniques, applicable to this assemblage, has been inferred. Cores averaging about 60 mm in maximum dimension were reduced by

the direct percussion method. Cores were not shaped, split, or quartered, but rather were selected on the basis of prior suitability of platform angle. Economy of operation is indicated by the relatively small amount, 40 percent, of cortical and primary flakes produced in relation to secondary and biface-thinning flakes. Flake production was not highly systematic. Flakes are largely irregular in form and tend not to follow a consistent striking pattern.

Cores were first struck on a single face until angles were reduced to impracticable limits, then were rotated to form a bifacial core, or were attached on other faces. Most cores were discarded while the potential for further flaking still existed. Such core renewal as occurred consisted only of crushing and grinding along striking-platform edges.

Flake tools were most often made on large primary or cortical flakes, about 35 mm long, by direct percussion. One or more edges were retouched either unifacially or, less commonly, bifacially. The workmanship is irregular and tools are not well differentiated as to function. However, in the craftsman's repertoire were techniques for producing regular, symmetrical, pressure-thinned tools, as evidenced by some of the bifacial knives and projectile points.

A micro-tool technique was practiced at Tubac. Very small cores, about 22 mm in maximum dimension, were struck by percussion to produce small primary flakes about 16 mm long. These flakes were edge-trimmed by pressure, either unifacially or bifacially to form micro-tools. By inference, the small, edge-trimmed projectile points, Tubac Type 1, probably are part of this complex, as was the case at Alder Wash Ruin (Teague 1975).

Regional Comparisons

Comparison of the Tubac stone artifacts with stone artifacts from other sites is difficult. Protohistoric and historic stone tools in the southwestern United States tend to be poorly made and poorly differentiated. However, students of southwestern prehistory have long taken particular note of metate forms and projectile-point forms, this latter being the most diagnostically sensitive among lithic classes (Willey and Phillips 1958).

The Tubac metates, simple, unshaped flat or full-trough forms, are similar to those from other historic, or late prehistoric, contexts in southern Arizona. At Babocomari Village, Quiburi, Santa Cruz de Gaybanipitea, San Salvador Baicatcan, and at San Cayetano, DiPeso (1951: 130-133; 1953: 154-162; 1956:

463-467) found a number of metates which were identical in form to those at Tubac, although different in dimensions, this latter owing perhaps to differences in material type. In addition, Russell (1908: 109) observed flat metates, similar to those found at Tubac, in use among the modern Pima.

The Type 1 projectile points are interesting technologically in that they were made by the bifacial edge-trimming of small primary or secondary flakes, about 20 mm long. Similar projectile points were found in the context of the 18th-century Sobaipuri occupation at Alder Wash Ruin (Hammack 1971: 21). Additionally, similar points from a probable early 19th-century Papago occupation in the Santa Rosa Wash are illustrated by Germeshausen (1972: 139-140). Haury (1950: 272, Fig. 56:o, s) has illustrated points from the historic Papago village of Batki which appear identical to the Tubac Type 1 projectile points.

Examples of elongated, triangular, concave-based projectile points, such as the Tubac Type 2 points, are found throughout southern Arizona in various historic Papago, Pima, and Sobaipuri contexts (DiPeso 1951: 157; 1953: 169; 1956: 95; Germeshausen 1972: 140; Hammack 1971: 17; Haury 1950: Plate 22; Russell 1908: 110). Corner notched forms, such as Tubac Types 4 and 6, are ubiquitous, ranging in time from preceramic to historic periods in the Southwest (DiPeso 1953: 169; Sayles and Antevs 1941). The projectile point base, Tubac Type 7, is similar in form and technique to the bases of Archaic points which are found in sites from the nuclear Southwest to California (Hunt 1960; Irwin-Williams 1973; Renaud 1942; Rogers 1939); however, a sample of one point base obviously precludes generalization.

In summary, the stone artifact assemblage from Tubac is consistent with collections from historic Papago, Pima, and Sobaipuri sites in southern Arizona. There is no evidence to substantiate occupation at the Tubac presidio prior to Spanish settlement.

Distribution in Time

All the metates, metate fragments, manos, and mano fragments at Tubac were found in contexts which date from the Early (1750-1800) and Middle (1800-1850) periods of occupation. It may be that increased availability of commercial milling equipment caused the indigenous techniques to fall into decline.

One of the rubbing stones was found in Late-period context (1850-1900), suggesting continued use from earliest to latest occupations, perhaps in conjunction with pottery manufacture or wall plastering.

The flake tools, cores, and debitage were found to be concentrated in the Early- and Middle-period provenience units. Ten percent of the tools were found in Late-period provenience units of questionable association, such as upper sheet trash, surface, and intrusive trash pits. It would seem that at Tubac stone flaking and stone-tool use enjoyed considerable popularity from the beginning of occupation at Tubac until the mid-19th century, after which time the practice was abandoned, or occurred very infrequently.

Stylistically and technically, no change is observed through time among the Tubac lithics. Particular projectile-point forms are as likely to be found in Early-period as in Middle-period contexts, although they disappear from the assemblage altogether after the mid-19th century.

Distribution in Space

During the Early period (1750-1800), nearly three-quarters of the lithic artifacts were discarded or abandoned in primary refuse locations; that is, such locations as room floors, work-area surfaces, and plaza basal level. After the locations of stone artifacts were plotted on a map of the site, the following conclusions were reached subjectively and by inspection.

During the Early period, grain milling, as indicated by metate and mano fragments, took place in both of the room outliers and in Room 4. Core reduction and tool manufacture also were carried out in the room outliers, as evidenced by the presence of cores, cortical flakes, bifacial thinning flakes, and tool blanks. A few pieces of manufacture debris also were found in the plaza. Stone tools, knives and scrapers, were used in largest part within rooms, especially Rooms 1, 2, and 6, and were also used in room outliers.

Different patterns of spatial use are apparent in the Middle period (1800-1850). About one-quarter of the lithic artifacts were found in primary-refuse proveniences. Most of these artifacts were flakes, but 24 other artifacts were examined in terms of spatial distribution. We found that milling activities had shifted to the northern end of the plaza, and that the plaza was now the center for core reduction and tool manufacture and for flake-tool use. Flake tools were still in use within rooms and, to a lesser degree, in Room Outlier 1. Flake tools were rarely used in the Late period (1850-1900).

Exotic Stone

Introduction

This class of material comprises unworked stone specimens which do not occur naturally in the geologic deposits at Tubac proper and which are presumed to have been transported to the site through human agency. These specimens are: chalcedonic concretions of the kind known colloquially as "desert roses" (Haury 1950: 335), mica, and a banded concretion.

Description

Chalcedonic Concretions

Number: 5
Average dimensions: 25 mm by 18 mm by 12 mm
Description: Translucent, white concretions, amorphous in form with many small nodes.

Mica

Number: 1
Dimensions: 35 mm by 20 mm by 4 mm
Description: Transparent, rectangular in form.

Banded Concretion

Number: 1
Dimensions: 21 mm by 16 mm by 8 mm
Description: Green with yellow bands, pyramidal in form.

Summary

This class of stone is, as DiPeso puts it, "best defined as artifacts having a special socio-religious connotation which is difficult to describe" (DiPeso 1953: 176). The assumption often made is that objects such as these were used in magic and curing ceremonies (DiPeso 1956: Fig. 61).

Analogous assemblages were reported by Russell (1908: 111) who saw, during his study of the modern Pima, "crystals and curiously shaped stones of all kinds . in the outfits of the medicine men."

At Tubac these "curiously shaped stones" are found equally in Early- and Middle-period contexts, with no post-1850 associations. Two of the chalcedony concretions were in plaza-floor association, while the remaining items were found in trash deposits.

Worked Bone

Seventeen worked-bone artifacts were found at Tubac. Details of description and provenience will be found in the section on faunal analysis appended to this report.

In brief summary, both grinding and flaking techniques were used t produce cutting tools, piercing tools, and bone discs. Temporal distribution centers in the Early (1750-1800) and Middle (1800-1850) periods. Tools were discarded or abandoned in both of the room outliers, the plaza, and Rooms 4, 6, and 9. See Figure 53 for examples of bone tools.

Shell Artifacts

Several indigenous beads of polished shell were recovered at Tubac. These beads, showing evidence of wear, were probably strung with others and worn for personal adornment. All specimens came from Early- and Middle-period contexts. A summary of shell bead attributes is given in Table 3.

The Tubac shell beads represent marine shells native to the Gulf of California and Pacific Coast (Morris 1966). Shell was reaching Tubac along native trade routes, and possibly may have been brought in by the Spaniards too. The use of shell beads as personal ornamentation was still popular in Tubac, even after 1800.

Table 3

Shell Beads

Whole Beads	Length	Diameter	Perforation Diameter	Material	Context	Period
	- - - in centimeters					
1. Fig. 54:a	1.3	0.5	0.35	Olivella dama	S/E SW structure debris	Middle
2. Fig. 54:b	0.9	0.7	0.25	Olivella dama	S/E SW use-area floor fill	Middle
3. Fig. 54:c	2.2	1.5	1.00	Conus sp.	S/E SW use-area floor fill	Middle
4. Fig. 54:d	1.2	0.6	0.28	Olivella dama	Plaza use-area floor fill	Middle
5. Fig. 54:e	1.8	0.9	0.20	Olivella dama	Disturbed	
6. Fig. 54:f	1.9	0.8	0.35	Olivella dama	Disturbed	
7. Fig. 54:g	2.1	0.8	0.60	Vermetus sp.	Disturbed	

Discussion: These small whole shells are unworked save for the perforation, and have been rolled in hot sand in order to bleach them white. The spiral base was ground off of the Olivella shells to enable stringing. The spire and conal ends of the Vermetus and Conus were ground to form a perforation.

Cup-shaped Bead	Diameter	Thickness	Perforation Diameter	Material	Context	Period
	= = = = = = = in centimeters = = = = = = =					
1. Fig. 54:h	1.5	0.3	0.3	Conus sp.	Disturbed	

Discussion: The top of the shell was ground off to form a concave-convex round bead. The perforation was made by grinding at the point of the spire apex.

Disc Bead	Diameter	Thickness	Perforation Diameter	Material	Context	Period
	in centimeters					
1. Fig. 54:i	0.75	0.35	0.30	Spondylus sp.	Room Outlier 1 floor contact	Early

Discussion: The bead was worked to shape, and then the perforation was drilled.

Pendant	Length	Diameter	Perforation Diameter	Material	Context	Period
	in centimeters					
1. Fig. 54:j	2.5	1.6	0.2	Haliotus sp.	Room 4 floor fill	Middle

Discussion: A flat section of shell was ground to size and then perforated. This cut-shell pendant is only partially drilled.

Chapter 6

NON-INDIGENOUS ASSEMBLAGES

Ceramics

Historical ceramics recovered from the various occupational strata of Tubac can be divided into four major categories. This division is based on body or paste type, glaze characteristics, and decorative techniques. The categories are: earthenware (relatively soft, porous paste); porcelain (vitreous paste which is hard, non-absorbent, and translucent); whiteware (hard, vitreous, white-bodied paste); stoneware (hard paste, only slightly absorbent). Vessel form could not be relied on for identification as no restorable items were available from Tubac. Ceramic shapes are fairly standard, though, and all four categories of paste were made into storage vessels and fashioned into tableware in the form of plates, cups, and saucers.

The majority of sherds fall into the earthernware category. This was not unexpected as earthenwares represented the cheapest and most easily obtained ceramic type for the frontier population from the time of the presidio's installation in 1752 well into the 19th century. Ceramics from Mexico, the Orient, England, and possibly Holland and the United States are represented in our sample. In order to facilitate further analysis of our data, ceramic descriptions will be discussed under two main temporal divisions, Early to Middle, and Middle to Late. This classification is based on the availability and preponderance of certain wares during the specific periods of occupation, and not necessarily on their manufacturing dates.

Early-period to Middle-period Wares

Between 1750 and approximately 1850 three distinct tablewares were being used by the residents of Tubac: majolicas, Chinese porcelains, and various Mexican glazed earthenwares. Until the establishment of a presidio in this area of the Santa Cruz Valley, the priests and settlers both had to rely on infrequent caravans coming up the Camino Real for goods which they could not

produce themselves. After 1752 caravans began reaching Tubac on a more regular basis with provisions from central Mexico to support the soldiers and their families.

Majolica

Tubac was being settled during the period when Puebla was the primary source of tin-enameled ceramics in the New World, and the styles described in this section originated in that city. Earthenwares produced in the potteries of Puebla have been discussed a number of times by the following authors: Barber (1908, 1911, 1915); Barnes (1971); Barnes and May (1972); Caywood (1950); DiPeso (1953); Goggin (1968); Snow (1965); and many others. For this reason, only a brief background of its history will be given here.

Mexican production of majolica began in La Puebla de los Angeles which was founded in 1532. The manufacture of this ware was not of great importance in Puebla until about 1550-1570 when the art of glazing was first introduced into New Spain by Dominican friars from Talavera, Spain (Barber 1911: 10). Edwin Barber notes:

> In the early days of Puebla's history, the Dominican friars, struck by the aptitude of their Aztec parishioners at making crude native pottery, and desirous of obtaining tiles for the monastery and church which they were building, sent word to the Dominican establishment at Talavera de la Reina, in the province of Toledo, Spain, that they could make good use of five or six of the brotherhood who were acquainted with the Spanish process of pottery-making, if such could be sent them. Accordingly, a number of Dominican friars familiar with the clay working process in use at Talavera were assigned to the Puebla house of their order, and under them were trained a generation of workmen who for the first few succeeding years produced some excellent results (1911: 4-5).

By the last half of the 1600s the Pueblan potters, besides creating their own styles, expanded business greatly and founded a guild with laws for regulating manufacturing techniques. By the 1700s outside influences had loosened the hold of the guild (Barnes and May 1972: 4). Goggin states that the reason for this change was "associated with a certain amount of prosperity" (1968: 223). That is, the people who purchased majolica were the ones who could afford to accommodate current fashion trends. Hence, the first half of the 18th century saw Mexican copies of Chinese porcelains, while during the second half "artistic developments . . . from Europe exerted a strong influence on Puebla potters, as is

reflected in their work" (Goggin 1968: 191). The Pueblan potters attempted to make good copies. However, "during the last years of the eighteenth century several million pesos worth of contraband entered Mexico through the ports of Vera Cruz and Campeche. . . ." (Gerald 1968: 54). The competition offered by the cheap European wares was so severe that the number of earthenware manufacturers in Puebla decreased from 46 in 1793 to 16 in 1802 (Humboldt 1941: Vol. 4, 17).

The following majolica styles of Puebla were recovered from Tubac:

Puebla Blue-on-white. The most popular majolica style, Puebla Blue-on-white, accounts for 152 sherds of our sample. Occurring in both plate and bowl form, this ware was found throughout the site and was the most common in Early to Middle-period floor-fill and contact stratigraphic levels.

The plates are white glazed with dark blue decoration (Fig. 55:a, b). On the interior rim are two wide dark blue bands, from which are suspended small blue dots, interspaced with dark blue blossoms (Barnes and May 1972: 7). Bowls may have light and dark blue-on-white decoration. Goggin dates this blue-lines-with-blue-dots style from 1750 to 1850 (1968: 191).

San Elizario Polychrome. While Goggin (1968: 10) does recognize two distinct plate designs in Puebla Blue-on-white, he does not give this style a separate type status. Gerald (1968: 54) and Snow (1965: 26) believe the distinction is necessary. Smith classifies his San Elizario sherds from Florida as Playa Polychrome, noting that the decorative schemes are uniformly blue, white, and black (1965: 86).

A total of 26 sherds of this ware were discovered, for the most part in Middle-period contexts. The dating for San Elizario is variously cited as 1750-1830 to 1850 (Goggin 1968: 191; Smith 1965: 85). While most abundant in trash levels, several sherds were found in the floor fill of Rooms 3, 4, and 7.

The decoration of San Elizario Polychrome is the same as the Puebla Blue-on-white of the 1750-1850 period, except for its use of two thin black lines to outline the one wide, blue interior rim band (Fig. 55:c, d). Other accenting in black may also occur on the plates. Thus far, no bowls of this style have been found in the Santa Cruz Valley (Barnes and May 1972: 10).

Huejotzingo. Barnes and May (1972: 10) state that only plate forms of this style are found in the Santa Cruz Valley. Decoration consists of either a blue, a green, or a yellow rim band on a white plate (Fig. 55:e). This color

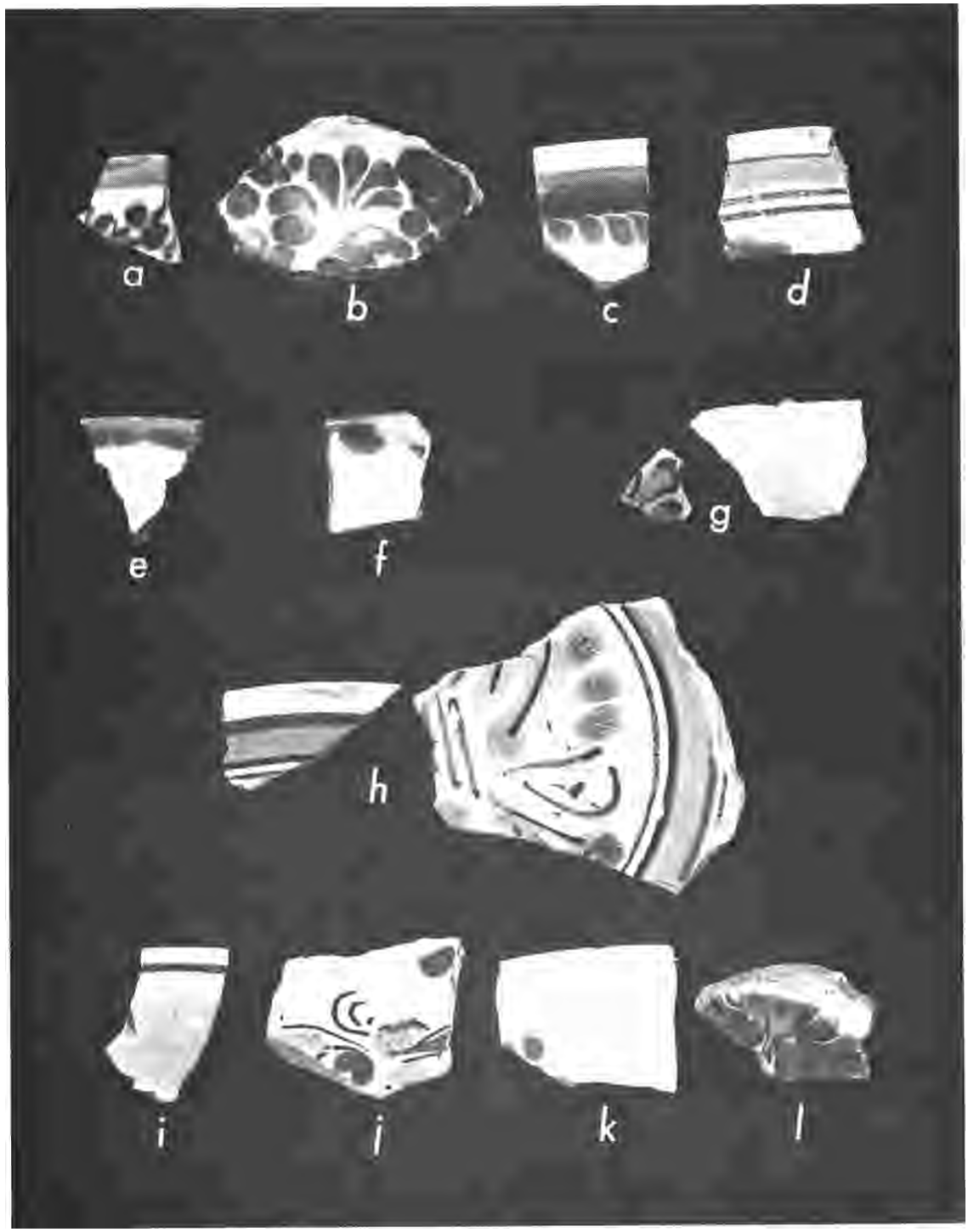


Figure 55. Majolica. Maximum dimension of a, 23 mm.

band is applied to both the interior and exterior surfaces of the plate's rim. Most Spanish sites have Huejotzingo with blue pigments (Barnes and May 1972: 10); however, at Tubac, the green variety was also present.

Twenty-six sherds of Huejotzingo Blue-on-white and one of green-on-white were recovered, again from various occupational strata and areas of the site. Dating for this style is evidently very uncertain, extending all the way from 1700 to the 19th century (Goggin 1968: 195). Smith (1965: 85) indicates a 1750-1830 period for this ware, while Snow (1965: 26) dates Huejotzingo from 1780-1850.

One sherd of Huejotzingo contains a wavy, green rim band rather than the typical straight rim decoration on the interior (Fig. 55:f). It was recovered from a Middle-period trash pit. Barnes and May (1972: 11) place the introduction of this style between 1770 and 1780.

Tumacacori Polychrome. This ware is represented by plates with undulating rims, bowls with ring feet, and cups with handles. Decoration on these blue-glazed plates has three pattern varieties which show definite vertical or temporal relationships to one another (Barnes and May 1972: 11).

All 12 sherds recovered of this ware were small, and only one contained any decoration (Fig. 55:g). It can be placed hypothetically under Barnes' Type III classification, having black-accented, green flower dots around the interior rim, indicating an 1830-1840 to 1850-1860 temporal zone in the Santa Cruz Valley. Other Tumacacori types date from 1780-1790 to 1830-1840. The typed sherd was found in an Early-period trash pit located in Room Outlier 1.

Aranama Polychrome. The main characteristic for Aranama is an orange-yellow band near the interior rim and one circling the interior base, both accented with thin black lines (Barnes and May 1972: 12). Plate decoration consists of yellow ovals with black diagonal slashes, tight orange-brown spirals, and green floral sprays. Barnes and May (1972: 12) believe that this plate and bowl decoration from the Santa Cruz Valley probably ranges from 1790 to 1830. Goggin states that while this is a very definite type in form and temporal position, it may be used carelessly as a catchall for a variety of late polychrome wares (1968: 198). Tubac contained 25 sherds of Aranama Polychrome (Fig. 55:h). They were recovered from various levels mostly situated in a Middle-period context.

Unclassified Mexican Polychromes. By the 19th century, the variety of majolica forms being manufactured in Mexican kilns had greatly increased. Polychrome and duochrome styles began to appear in a vast array of colors. Eleven sherds of unclassified Mexican polychromes were recovered from Tubac. These sherds dating from 1821 to 1900 represent seven different motif styles. Green, yellow, and blue pigments illuminate the designs which are bounded by brown bands (Fig. 55:i, j, k, 1). As yet, no studies have been conducted regarding these various forms of majolica (Barnes and May 1972:)40). By the middle and late 19th century, the markets had been completely dominated by the cheaper European tablewares. Therefore, only the least expensive quality of majolica could have been transported from Mexico and still have undersold the foreign competition.

Unclassified White. White sherds constitute a considerable part of any majolica sample, and Tubac proved to be no exception. One hundred plain white sherds were recovered. Many of these probably represent undecorated portions of stylized plates and bowls described above; many, however, are from plain, white vessels. These were evidently being produced in the same potteries as the decorated forms. Goggin tentatively calls them Puebla Plain, but indicates that since we cannot distinguish the origin of any given sherd, it is less confusing simply to list this type as unclassified white (1968: 202).

Chinese Porcelain

It is unknown just to what extent porcelains were coming into Mexico, but there must have been considerable amounts. Remnants appear in almost all the earlier sites in the Southwest and Sonora, along with majolica. Caywood discusses the production of this ware:

> Chinese porcelains from the Ch'ing Chen kilns had reached a high degree of perfection by 1600. Cobalt blue, a color which endures the heat of the porcelain kiln, was used on the body of the piece and covered with transparent glaze. The body of the ware was usually extremely thin and translucent. This extremely hard, thin paste with intricate pictorial designs in blue can easily be identified by anyone finding it. Some later types of porcelain with rose, green, yellow and other colors of glaze decorations are sometimes found (1950: 8)4-85).

Blue-on-white. A total of 39 sherds of this porcelain style appeared at Tubac. The decoration motifs are typically Chinese, as described by Caywood above (Fig. 56:a, b). This ware was uncovered in a number of strata mainly

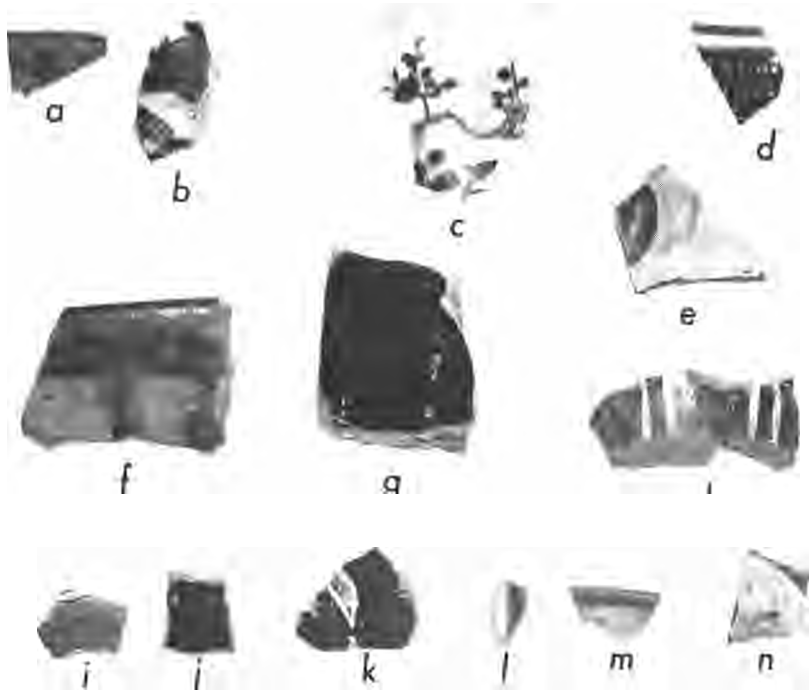


Figure 56. Porcelain and glazed earthenwares. Maximum dimension of a, 29 mm.

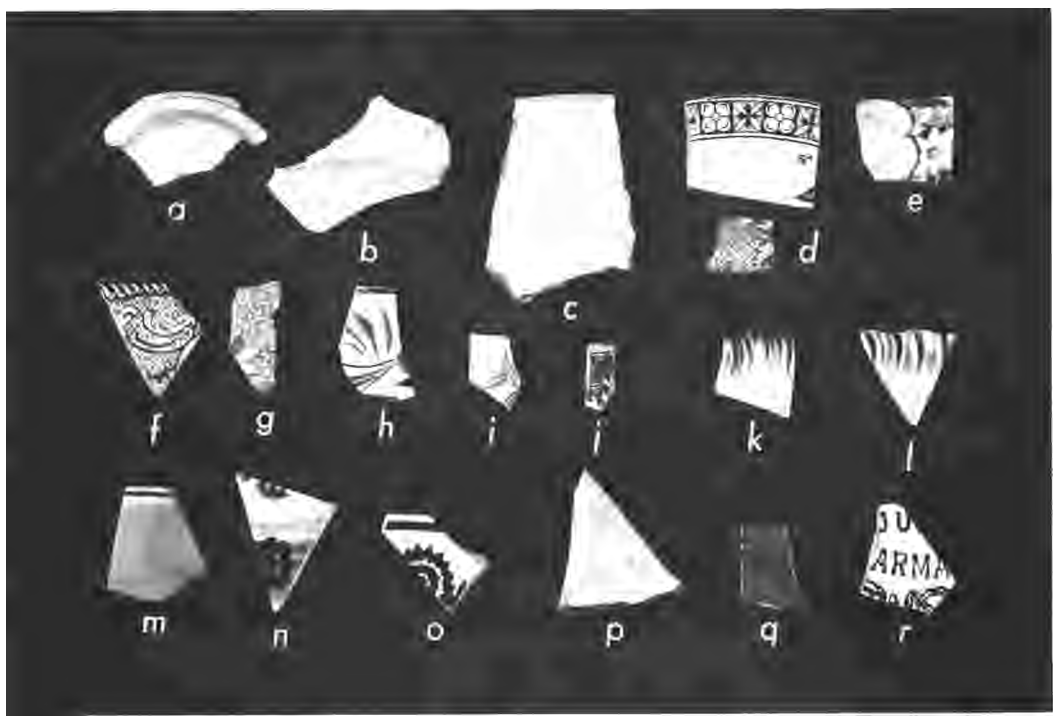


Figure 57. English ceramics. Maximum dimension of a, 43 mm.

connected with Early- to Middle-period trash pits and use-area floor-fill zones.

Chinese Polychrome. The colors of this porcelain are blue and red, with occasional touches of gold and green. Delicately hand-painted floral scenes are the major decorative styles (Fig. 56:c). Forty-two sherds were recovered, with a number of these coming from Early-period occupational levels.

Red-on-white. For the most part, this style employs a lined or cross-hatched effect (Fig. 56:d) which was sloppily applied. Only nine sherds were recovered, mostly from the plaza area.

Unclassified White. Again a large percentage of our ceramic sample was plain. The 85 undecorated porcelain sherds found at Tubac were placed under this classification. They were recovered from various strata and temporal contexts.

Glazes

Sometime around 1780, a different variety of glazed earthenware, in addition to Puebla majolica, began to make an appearance in northern Sonora and Pimerfa Alta (Caywood 1950: 85). This class of pottery was probably the cheapest glazed ware available, being for the most part wheel thrown. Such imported glazes as these provided the frontier settlers with an inexpensive heavy-duty utilitarian ware, capable of being used for both tableware and storage vessels.

Green Glaze. This ware, believed to have been manufactured at Guanajuato, was also found at the mission of Tumacacori, to the south of Tubac. It is presumed to have made its appearance in this area around 1780. Sherds of these undecorated green-glazed plates have been described by Caywood:

> The paste of these pieces is of a much better quality and harder than even Maiolica. The green glaze is overall and appears identical with that used on the "olive jars." Some of the plates were very finely wheel-turned with thin walls and a beautiful transparent glaze. Sometimes the green glaze was not applied to all of the exterior but only as a band about one inch below the rim (1950: 86).

Guanajuato green-glazed wares were found in considerable numbers at Tubac, with 382 sherds collected (Fig. 56:f). It was definitely the majority ceramic type at Tubac. Seventeen percent of this sample appear to belong in a storage-vessel class, while the remainder seem to be heavy tableware. Sherds appeared

in numerous levels throughout the site, but were most common in Early- and Middle-period contexts.

"Olive-jar" Green Glaze. Seventy-seven sherds of green-glazed ware, found mostly in trash and room-fill layers, were assigned to this classification (Fig. 56:g). Caywood provides us with the following description of Spanish "olive-jars":

> These jars often show horizontal ribbed effects from being wheel-turned. The paste is usually tile-colored and varies from three-sixteenths to half an inch in thickness. These vessels were constructed with very heavy walls, constricted necks and small orifices because of their use for transportation and storage purposes (1950: 86).

Most of the examples of this ware from Tubac contain only an interior glaze. According to Caywood, "olive-jars" are the most common type of green glaze found in the Southwest, Florida, and California (1950: 86). However, at Tubac, and as DiPeso (1953: 223) reports for Quiburi, this green-glazed ware ranked second to the higher quality Guanajuato pottery.

Tonala Polychrome. This ceramic ware has a cream-colored glaze on which rather crudely applied designs in green and brown are executed. Caywood notes the occurrence of this style at Tumacacori and at other Pimería Alta mission sites (1950: 85). Forty-six sherds were recovered from Tubac (Fig. 56:e, h) and were a common find in Early- to Middle-period room-floor and use-area fill depositions.

This type of green glaze was first introduced into this area in the 1780s, having its origin in the small town of Tonala, Jalisco. Examples from Tubac appear to have been plates and cups, verifying Caywood's statement that this ware was apparently made only for table use (1950: 85). Our sample represents four different plate patterns and one cup style. Gerald gives an 1830 cut-off date for the manufacture of Tonala Polychrome (1968: 5)4).

Awatovi Green. Twenty-four sherds of this thin, glazed earthenware were recovered; all are very small. This type contains a soft paste, very similar to majolica, which is whitish in color. Sherds exhibit an overall translucent, emerald green glaze (Fig. 56:i). Caywood believes this green glaze was probably produced in either Spain or Puebla (1950: 87).

It seems likely that only one vessel of Awatovi Green is represented in the Tubac sample. Almost 80 percent of the sherds analyzed were recovered from

a small area of plaza floor fill. Sherds of this ware found in the excavation of Awatovi are believed to be from a vessel shaped much like a modern terra cotta flower pot. Awatovi Green glaze has been dated from 1780 to 1850 (Gerald 1968: 53).

Brown Glaze. Thirty sherds recovered from Tubac feature a dark brown glaze on the interior surfaces. Another set exhibit a reddish brown glaze covering the interior and extending one inch below the rim on the exterior with a dark brown rim band (Fig. 56:j). Both of these styles have been placed under this classification. Production of this ware probably started around the beginning of the 19th century, and eventually it began to replace the green glazes in popularity. This change did not occur until much later, however. Examples from Tubac were recovered mainly from Middle-period fill.

Galera Polychrome. This classification forms a catchall for a variety of glazed redwares still available in the markets today. The decoration includes a number of plant and animal forms which are painted in white, brown, black, green, and blue. Galera Polychrome is said to have been produced in Tlaquepaque, a small town near Guadalajara, Jalisco, from 1780 to the present (Gerald 1968: 53-54).

A total of 21 sherds have been included under this heading. Colors used include white, green, blue, and red (Fig. 56:k, 1, m, n). This ware was found in Middle- and Late-period trash and fill contexts.

Middle-period to Late-period Wares

Prior to the 1820s potteries of foreign manufacture could not be imported into Mexico legally. As noted previously, contraband had been entering the country since the end of the 19th century. Finally, three years after Mexican independence, in 1824, an Anglo-Mexican trade treaty allowed English ceramics to be imported directly to Mexico from England, nearly dealing a death blow to the majolica industry (Barnes and May 1972: 5). Mexico was then flooded with English wares. Between 1800 and 1900 a steady increase can be seen in the popularity and importance of these inexpensive, well-made tablewares in the household inventory of frontier residents.

White Earthenware

The criteria used in establishing this category of English ceramics include its white body and decoration. Names assigned to types and varieties reflect paste differences and decorative styles. White earthenware, being vitreous, is a thin, very hard pottery with a body ranging from cream-colored to pure white. Decorating techniques include transfer printing, shell edging, banding, hand painting, and sponge-root stamping. The majority of English wares recovered from Tubac fall under this classification.

Creamware. An important development of the 18th century was the gradual perfection of a thin, hard-firing, pale yellow earthenware (Noel Hume 1972: 123). Ground flints were mixed into the clay, yielding a cream-colored body when fired at low temperatures. Josiah Wedgewood had perfected creamware by 1762, and it remained in production until approximately 1820. All 11 sherds were recovered from Middle- and Late-period trash contexts (Fig. 57:a).

Pearlware. In 1779 Wedgewood developed a ware whiter than creamware, which he termed "Pearl White." The body had an increased flint content, and the glaze contained a small quantity of cobalt which produced a slightly bluish surface color. By the 19th century, a number of English pottery firms were manufacturing this tableware. The nine sherds found at Tubac came from Early- to Late-period trash zones (Fig. 57:b).

White Wares and Ironstone. "By 1820, pearlware was on its way out, being superceded by various forms of hard white wares and semiporcelain that are extremely difficult to date with accuracy and which ran parallel to. . .Mason's celebrated 'Ironstone China' of 1813" (Noel Hume 1972: 130-131). At Tubac 106 sherds of undecorated white ware were recovered. These sherds came from either the decorated vessels to be discussed later, or from plain items. The majority occurred in Late-period contexts.

Ironstone, which is a slightly heavier and thicker ware, began to be exported by England in large quantities sometime around the middle of the 19th century. Ironstone is basically a utilitarian product, and was used extensively by the United States military throughout the West. It was inexpensive and very durable. Ironstone is by far the most abundant ceramic type found in 19th-century sites of the American Southwest (Berge 1968: 203). Plain ironstone

sherds, 181 in number, were recovered at Tubac in both Middle and Late contexts (Fig. 57:c).

Although American potters began to make ironstone wares in the 1870s, it would appear from the Tubac collection and others made thus far in this area (Fontana and Greenleaf 1962: 92), that in the western portion of the United States, English ceramics continued to be the most popular tableware available. Hallmarks of five English firms were recovered at Tubac. Two other marks could not be definitely classified, but were very likely also English in origin, from Burslem, Staffordshire, establishments. The following ceramic firms were represented at Tubac.

Two fragmentary marks, printed underglaze, have been tentatively identified as belonging to the Staffordshire pottery of H. Alcock & Company. One of these sherds incorporated the description, "PORCELAIN," which would tie in with the firm's use of the term semi-porcelain on their wares. The other exhibited "DIEU ET" in a fashion similar to the Alcock hallmarks. The company began producing ironstone china in 1861 (Godden 196)4: 27; Ormsbee 1959: 22-23) and continued operating under this name until 1910.

J. & G. Meakin (Ltd.) has operated in Hanley, Staffordshire, from 1851 to the present. Meakin produced a range of ironstone tablewares which were largely exported to North America (Godden 1971: 77). The mark "ENGLAND" printed underglaze appears beneath the company name on one sherd of this ware. Ormsbee states that in 1891, the United States began to require that all imports be marked with their country of origin (1959: 16). Prior to 1891, only two English potters, A. J. Wilkinson and Grainger & Company, included "ENGLAND" in their ceramic hallmarks. It is therefore likely that this mark, complying with the McKinley Tariff Act, can be placed in a post-1891 temporal period.

One hallmark, J. W. & Son, has proven to be unidentifiable so far. Although common to historic sites in Arizona, no record of this company has been uncovered. The mark itself does supply us with some information, however. Printed underglaze in black, the center motif consists of a double shield, one side representing the United States, the other England. Above the shield are the words "Trade Mark." The addition of these words to ceramic hallmarks dates the ware to after the Trade Mark Act of 1862 (Berge 1968: 251). Below the shield are the company name and the description "Stone China." If, indeed, this ware is British, as seems

likely, it would have been produced between 1862 and 1891, since the country of origin is not included in the hallmark.

A hallmark printed underglaze in brown distinguished the Burslem, Staffordshire, pottery of A. J. Wilkinson, Ltd. This firm produced good quality "Royal Patent Ironstone" for home and American markets from 1885 to the present (Godden 1971: 99). While the mark names the country of origin, England, the pottery identified is not necessarily a post-1891 product. As noted previously, A. J. Wilkinson was one of two potters to use "ENGLAND" in conjunction with their hallmark prior to the McKinley Tariff Act.

A white earthenware sherd was recovered with a partially visible hallmark printed underglaze in brown. The Staffordshire Company of William Emberton produced earthenwares from 1851-1869 and was formerly W. Emberton & Co. Distinguishing initials were generally used by the firm on several marks of differing design. The name of the individual pattern was also often included from 1851-1869. Several garter-shaped marks were used (Godden 1964: 237). This hallmark was garter shaped containing the initials WE & C, followed by the pattern name " VY" and the city of origin, Hanley. Godden indicates that the Emberton firm was operating in Brownhills, Tunstall, during this period, however (1964: 237). Yet no Hanley pottery could be found utilizing this particular hallmark.

Marks found on two sherds of ironstone, both probably English, remain unidentified. The first of these contains the ceramic description "GRANITE" printed underglaze in black. Godden lists several English companies which used this word in their hallmarks (1971: 109). The most promising of these was Thomas Hughes of Burslem, Staffordshire, in operation from 1860 to 1894. Hughes produced "Granite" and "Ironstone China" largely for the North American market (Godden 1971: 73). The other unidentifiable mark was printed underglaze in brown. It was fragmentary and badly smeared, belonging possibly to a Burslem, Staffordshire, firm.

Transferwares. Underglaze transfer printing was first perfected by John Sadler and Guy Green of Liverpool in about 1756. The demand for this type was great, as for the first time artistically decorated ceramics were available to the common classes (Berge 1968: 155). Six pattern colors were represented at Tubac, brown being the most prevalent with 73 sherds, followed by 34 blue, four

black, two red, two gold, and one polychrome blue-and-red transfer print. Underglaze multi-color printing was first invented in 1848 (Berge 1968: 16)4). A sample of the Tubac collection can be seen in Figure 57:d, e, f, g, i, j. This ware can be regarded here as a 19th-century speciality.

Shell-edged Pearlware. Pearlware is most commonly found in the form of shell-edged plates with rims painted in either blue or green. This design type called for brushwork drawn inward to create a feathery edge along the rim. Early examples were well painted and date from 1780. Later, as the market swamped the craftsman, individual brush strokes were lost, and a single stripe was painted laterally around the rim of the plate (Noel Hume 1972: 131). This change in technique occurred around 1800 and the design style continued until 1830. The Tubac examples show individual brush strokes on three sherds of blue shell-edged, and the single-line style on one sherd of green (Fig. 57:k, 1).

Peasant Ware. By the turn of the 19th century, competitive potters became aware of the working-class market. The potential was tremendous if only dinner services could be produced at a low price (Berge 1968: 170). As Bemrose states:

> Even the larger factories did not disdain the ever-growing working-class market and from 1810 onwards a class of boldly painted earthenwares, invariably in bright enamel colours was produced in North Staffordshire, Wales, Yorkshire and Scotland (no date: 9).

Simplicity was the key to this type of pottery, which was produced inexpensively in order to appeal to the lower-income family.

Twenty sherds from deep bowls contain hand-painted decoration in bold brush strokes. Floral motifs were executed in colors of green, brown, and dark blue (Fig. 57:h). These sherds were recovered from Late-provenience trash levels.

Fifteen sherds of banded ware were recovered which also came from bowls. This ware contained a narrow brown rim band above a wide blue band in the center of the body (Fig. 57:m). All interiors were undecorated. Banded wares came mostly from Middle-period fill and structural-debris and trash layers.

Sponge-root earthenware is represented by only four sherds at this site. This type is decorated by dipping pieces of sponge root in various colors of paint and applying it against the vessel. A clear glaze is then used over the decoration (Roebacker 1971: 245). This technique was initiated in the mid-1800s and continued until approximately 1900. The typical design element is an abstract flower motif (Fig. 57:n, o).

Stoneware

With the advent of glass containers, the need for ceramic bottles rapidly declined. By the 18th century, the only common pottery bottles were of brown stoneware. Six sherds of this ware were recovered. The bodies are gray and covered on the exteriors with an iron-oxide slip which has turned to a rich brown stipple in the firing (Fig. 57:q). These bottles were used for ink, beer, and other liquids from 1820 until after 1900 (South 1972).

Also recovered were two sherds of salt-glazed stoneware. Salt glaze is an alkaline glaze which is produced by the presence of salt in the kiln, creating an orange-peel texture (Berge 1968: 202). The samples from Tubac have a clear glaze over a gray body, and are wheel turned (Fig. 57:p). No vessel shape could be determined.

All stoneware was collected from Late-period trash depositions. One sherd of a hard-paste earthenware contains a partial mark, stenciled in black. This coarse stone pottery has been identified as belonging to a marmalade jar of English manufacture. The full mark is as follows: "GRAND MEDAL OF MERIT VIENNA 1873 / JAMES KEILLER & SONS / DUNDEE / MARMALADE / ONLY PRIZE MEDAL FOR MARMALADE / LONDON, 1862 / CONTENTS. 1 lb. NET" (Fig. 57:r). A complete photograph of a similar jar can be seen in Berge (1968: Fig. 27).

Modern Ceramics

Several dozen sherds of 20th-century manufacture were also recovered from Tubac. Most of these fall under the category of terra cotta, as used for flower pots. The majority of modern wares came from plaza sheet trash.

Summary

> We were able to find more pieces of tin-glazed earthenware on the ground at the Terrenate presidio in a single day than we have been able to find at any northern Sonoran or southern Arizona, Spanish mission site ever excavated. The reason is now becoming apparent. These particular types of majolica were Mexican-made Spanish ceramics. The people who had them brought such great distances and who preferred them to Indian wares were Spaniards and other Europeans. Presidios were not merely Spanish frontier institutions, they were inhabited by Spaniards and their families. . . . (Fontana 1972: 12)

Ceramics are more than just a plate, bowl, and cup inventory. They can also supply us with data on the cultural level of the inhabitants of any household. For example, all the ceramic sherds recovered at Tubac came from utilitarian tablewares and storage vessels. Yet, even the presence of Mexican wares in the Early-period levels indicates a certain level of prosperity, as supply lines were infrequent and shipping costs high during this period.

Mexican products and porcelain occurring in Middle-period contexts signify isolation from European and American goods. Trade items were still coming up the Santa Cruz, even though after the Mexican Revolution military coverage and protection were poor. By 1850 a large portion of the valley had been deserted.

Prior to 1850 a few wares of English origin were being imported from Mexican sources, first as contraband, and then as legal trade. It was not until after the Gadsden Purchase of 1854, however, that the Southwest was really opened up to European and American trade routes. With availability, the better-made and more popular English tablewares began to supplant wares of Mexican manufacture, and eventually became the mainstay of the frontier household.

Glass

Glass fragments are one of the most abundant artifactual materials found in historical sites of the Southwest. Over 17,900 gm of bottle glass alone were retrieved from Tubac. Other glass products include household items such as tablewares and vases, window glass, glass beads, eyeglass lenses, and marbles, which will be discussed later. The vast majority of glass artifacts from Tubac were in a fragmentary condition.

Bottles

By the beginning of the 19th century, all the major techniques used to produce glass containers and tableware were in existence. What occurred during this period were improvements and innovations in glass working and production. Bottles of the 17th and 18th centuries were free blown without the use of molds. These bottles are usually globular and asymmetrical with smooth, shiny surfaces. The bases of hand-blown pieces contain a spot of rough glass, the pontil scar, in the center. A rod, called a pontil, was attached to the base with a glob of molten glass to hold the object while the finish was applied (Lorrain 1968: 36).

Finishes were completed by laying a narrow band of glass around the top of the neck. This type of bottle was still very common early in the 19th century.

Shortly after 1800, mold-blown or blown-in-mold bottles were being made in full-size contact molds and dip molds of various sizes. A dip mold was composed of one piece, open at the top. The bottle shoulders were then free blown, causing them to bulge slightly. No mold seams are present on bottles manufactured in this manner. Dip molds were used primarily in the production of wine bottles.

Bottles blown in full-contact molds sometimes exhibit mold lines which resulted from molten glass seeping into hinge seams where the mold sections joined. These bottles are often called "blown-in-mold" wares (Switzer 1974: 6). Hinged molds did not make their first appearance in this country until after 1810 when the three-piece mold was introduced. Newman indicates a 1900 cut-off date for the manufacture of this mold type (1970: 72). It was most popularly used between 1870 and 1910 for utility wares, such as wine bottles (Toulouse 1969b: 578). Three-piece molds leave seams around the shoulders, and lines from the shoulder to the neck, disappearing below the finish.

The hinged-bottom mold was also in use by 1810. Only on bottles produced in this mold does the seam line cross the bottom of the base. In some bottles of this period the seam is partly obliterated by a pontil scar (Toulouse 1969a: 535). The cross-bottom mold seam was common until about 1880.

The two-piece hinged mold began to replace the three-part mold between 1840 and 1850. These molds left a seam which ran from the base up to the neck before fading out. The disappearance of the mold lines on the upper neck is due to the reheating of the neck when additional glass was added to the finish. Sometime prior to 1850 an applied glob of glass formed by a lipping tool had almost entirely replaced the simple laid-on ring of molten glass (Lorrain 1968: 40). The rotation of the tool obliterated the seam lines and the glass was left with a swirled appearance. Newman dates two-piece molds from 1845 to 1913 (1970: 72).

By 1857 a tool most important to the bottle-making industry had been invented, the snap case. This simple device completely replaced the pontil for holding a bottle while the lip finish was being applied, and left no rod scars. About this same time, the first bottles with raised lettering were making their appearance. A large number of lettered bitters bottles were recovered from

the steamship Bertrand, dating their manufacture before 1865 (Switzer 1974: 6).

Mason, on November 23, 1858, was the first to patent the post-bottom mold for use in his wide-mouthed jars. This construction was popular because it allowed automatic alignment of mold parts when the mold was closed (Toulouse 1969b: 582). The name "post-bottom mold" comes from the design of the bottom plate which has a raised platform in the center. The seams on these bottles circle the center of the base, with two side seams extending from this ring to the neck.

Sometime around 1870, an improvement in bottle-manufacturing techniques made it possible to produce a smooth, shiny exterior surface on the bottle. Prior to the chilled-iron mold, bottles produced in contact molds had a pebbly surface resembling hammered metal (Lorrain 1968: 41).

The first semi-automatic bottle machine was developed in 1881. Mold lines on these bottles run up to the lip. Few bottles were produced as the machine was not widely distributed (Lorrain 1968: 43). In 1903 Michael Owens patented a fully automatic bottle machine. On these bottles mold seams continue onto the top of the lid. Cut-off and valve scars are also characteristic of machine-made bottles (Toulouse 1969b: 582-583). The most common mold type used is the cup bottom. The changeover to automation by the commercial glass industry was completed by 1920, and large-scale production was begun.

The above section is only a brief summary of dateable changes in 19th-century manufacturing techniques. More detailed data, along with illustrations, are available in the following references: Lorrain (1968), Meigh (1960), Newman (1970), Switzer (1974), and Toulouse (1969). Classification systems such as that seen in Lorrain's article require complete or nearly complete specimens. Since only five whole bottles were recovered at Tubac, analysis will have to remain primarily descriptive. More concrete information on production methods and possible vessel usage will be given where practicable. While it is traditional for certain general shapes of bottles to be associated with their contents, in many cases one bottle type may have been in several categories.

Dark Olive Green (1844 gm). This glass is opaque and black in appearance until viewed against a strong light. All fragments have innumerable gas bubbles resulting in pebbly, patinated surfaces. These sherds apparently represent heavy bottles with thick-walled bodies and bases. Sherd thickness ranges from 5 mm to 12 mm.

All basal fragments have an indented concave bottom, a kickup, which strengthens the bottle and serves as a settling basin for sediments in the liquid. The majority lack pontil scars, indicating a post-1857 date for their manufacture. One base and possibly some of the body and neck sherds are earlier. No mold seams are present. Seven basal fragments were recovered:

1. One free-blown wine-bottle base; high basal kickup with pontil scar; base shows excessive wear (Fig. 59:a). Diameter of base: 130 mm. Probable date of manufacture: late 18th century. Locus: Room 4 floor (Early period).

2. Two contact-mold-blown liquor-bottle bases, snap case, pebble finish. Diameter of bases: 78 mm, 83 mm. Probable date of manufacture: 1857 to 1870. Loci: plaza trash pit (Late period); Room 8 structural debris and trash.

3. One case-gin bottle base, flat sided with beveled edges; base is flat with a shallow, dish depression in center. Diameter of base: unknown. Probable date of manufacture: mid-19th century. Locus: plaza use-area floor fill (Middle period).

The remainder of the basal fragments are too small to be diagnostic. One body sherd contains two partial, raised letters, and is probably from a square bitters' bottle. As the glass has a pebbly surface finish, the bottle was probably manufactured between 1865 and 1870. It was recovered from Late-period plaza sheet trash.

Seven necks were found with finishes, all of which represent applied lips. These include one wine finish, two brandy finishes, one slanting collar-and-ring finish (Fig. 59:b), and three slanting-collar oil finishes. The necks, recovered from Middle- and Late-period trash contexts, were probably produced between 1840 and 1870.

A minimum number of 16 liquor bottles were represented by the dark olive green glass sample at Tubac.

Light Olive Green (2280 gm). Glass fragments from 18 liquor vessels were placed in this category. Bottles present include wine, champagne, and sherry containers. The glass differs from the dark olive in that it is lighter colored and thinner. Otherwise both specimens of bottles are virtually identical. Pebble- and smooth-surface finishes are present. All bottles contain basal kickups. Sherd thickness ranges from 4 mm to 7 mm. Basal fragments represent:

1. Three cylindrical wine bottles, contact mold, pebble finish, basal wear. Diameter of bases: 69 mm, 79 mm, 90 mm. Probable date of

a

Figure 58. Glass bottles. Length of a, 210 mm.

Figure 59. Glass bottle fragments. Length of h, 126 mm.

Figure 60. Glass beads. Diameter of d, 14 mm.

manufacture: 1800 to 1870. Loci: plaza use-area floor fill (Middle period); Room 5 structural debris (Middle period).

2. One square-case bottle, contact mold, used for gin or bitters, pebble finish. Diameter of base: unknown. Probable date of manufacture: 1800 to 1870. Locus: Room 4 floor fill (Middle period).

3. Six cylindrical wine bottles, chilled-iron mold, smooth, shiny finish. Diameter of bases: 68 mm to 90 mm. Probable date of manufacture: 1870 or later. Loci: plaza sheet trash (Late period), trash pit (Late period), Room Outlier 1 sheet trash (Late period), structure exterior, southwest, trash pit (Late period).

A total of five necks with finishes were recovered. Three necks contained single-ring, wine finishes (Fig. 59:c), while two had simple wine lips. All finishes present were applied lips. Two partial necks were from bottles produced between 1870 and 1910. Both vessels had been turned in the mold, obliterating all seams. One contained an appliqued wine seal on its shoulder. The seal was oval with the printed word "XF " (sherry). The fragments were located in Room 1 and 4 trash pits (Late period).

The broken edges of two sherds were beveled and showed evidence of usage. The edges had been shaped by percussion techniques. Evidently these glass fragments had been used as scrapers. They were recovered from Middle-period structural-debris and trash zones located in exterior activity areas.

Aquamarine (273 gm). This glass is blue-green in color, transparent, and contains numerous gas bubbles. Most of our sample has a pebbly finish and relatively flat bases. Sherd thickness ranges from 2 mm to 6 mm. Bottles represented include culinary and prescription-extract varieties. Relishes were evidently very popular during the 19th century. At least 12 such vessels are present at Tubac.

One whole 16-ounce horseradish bottle was recovered (Fig. 58:a). Blown in a two-piece mold, the bottle has a cylindrical body and a short cylindrical neck with an asymmetrical rolled-collar finish, requiring a cork stopper. Dimensions: height, 21 cm; diameter of base, 7.8 cm; diameter of neck (outside), 4.5 cm, (inside), 4.1 cm. Probable date of manufacture: 1840 to 1870. Locus: structure exterior, southwest (disturbed). Discussion: A bottle of this type was recovered from the steamship Bertrand, although of a smaller, 7-ounce capacity (Switzer 197)4: 61). Putnam's (1965: 193) bottle identification guide does show this bottle available in the 16-ounce size, however.

Basal fragments represent:

1. One square-sided pickle bottle, contact mold, shallow-dished base. Diameter of base: unknown. Probable date of manufacture: about 1865. Locus: plaza sheet trash (Late period).

2. Two rectangular prescription or extract bottles, two-piece mold, pebble finish, recessed side panels with angular corners, and flat bases. Diameter of bases: unknown. Probable date of manufacture: 1840 to 1870. Loci: plaza sheet trash (Late period) and use-area floor fill (Middle period). Discussion: a similar bottle recovered from the steamship Bertrand can be seen in Switzer (1974: 70).

3. One cylindrical bottle, chilled-iron mold, basal-ring groove with shallow, dish depression in center. Diameter of base: unknown. Probable date of manufacture: 1870 or later. Locus: Room 11 trash pit (Late period).

All lip treatments are applied and tooled. Two ring-neck finishes are present flush with the lip, probably from pickle jars (Fig. 59:f). One neck has a bead finish, and one neck has a prescription lip and partial body from a liniment bottle. Printed down the side of the vessel in raised lettering are "LINIM. . . ." The probable date of manufacture is 1865 to 1870, as the bottle also has a pebbly surface finish (Fig. 59:h).

Aqua (2892 gm). This glass is transparent and pale bluish-green in color. Most fragments show heavy patinization. Vessels are thin walled with slightly recessed bases. Sherd thickness ranges from 2 mm to 7 mm. Bottles, including three whole ones, represent the following container categories: ink, castor oil, patent medicine, soda, and possibly perfume. A minimum of 14 vessels are present in our sample.

Two ink wells were recovered intact. The first is a small octagonal, fluted pyramid-shaped bottle (Fig. 58:d). This 2-ounce well is mold blown and exhibits a flat base with a pontil scar. The neck is short and cylindrical with a thin, rolled-collar finish. Dimensions: height, 6.5 cm; diameter of base, 6.5 cm; diameter of neck (outside), 1.9 cm, (inside), 1.3 cm. Probable date of manufacture: 1840 to 1870. Discussion: Van Rensselaer states that ink wells of this type were first made in 1840, and that this same size and shape persist to this day (1926: 34). According to Newman, rough pontils were in use between 1810 and 1870 (1970: 73). The second well is identical to the first except that it is a product of an automatic bottle machine. Both wells were found in a Late-period trash pit in Room 1.

A whole 3-ounce castor oil bottle was blown in a two-piece mold. The bottle is oval with a long, cylindrical neck and has a ring or oil finish. The base is flat and smooth. There is a front panel indentation, which is square. Dimensions: height, 16.0 cm; diameter of base, 5.8 cm; diameter of neck, (outside), 1.6 cm, (inside), 1.0 cm. Probable date of manufacture: 1857 to 1913. Locus: structure exterior, southwest (disturbed) (Fig. 58:b).

Basal fragments represent:

1. One small, circular bottle blown in a hinged-bottom mold, slightly recessed base forming a kickup with a pontil scar. Diameter of base: 3.5 cm. Locus: structure exterior, southwest (disturbed). Discussion: This bottle was probably in a patent medicine or perfume class. On the side near the base is the raised letter "C."

2. Two cylindrical bottles, post-bottom mold, basal dish depression. Diameter of base: unknown. Probable date of manufacture: 1860 or later. Locus: Room 12 trash pit (Late period).

Three laid-on ring-neck finishes were identified: one wine bottle, one bead finish (Fig. 59:e), and one prescription lip. All finishes were applied and tooled. Also recovered were a number of necks with crown-cap finishes from an automatic bottle machine dating to after 1903.

Amber (1072 gm). Most of this glass represents beer bottles, dark brown in color and transparent. Vessel walls are thin with sherd thickness ranging from 4 mm to 7 mm. A minimum number of 12 bottles are represented by our sherd sample. Only two basal fragments are diagnostic however:

1. One beer bottle, post-bottom mold, slightly dished base. Diameter of base: unknown. Probable date of manufacture: 1860 or later. Locus: Room 12 sheet trash (Late period).

2. One beer bottle, with partial mark on base. Diameter of base: unknown. Probable date of manufacture: 1890s. Locus: plaza sheet trash (Late period). Discussion: Raised letters "B G" belong to the Streator Bottle and Glass Company of Streator, Illinois (Fontana and Greenleaf 1962: 52).

Nine necks with hand-finished lips were recovered. Bead, brandy, and double-ring neck finishes dated to the late 19th century. A minimum number of three vessels are represented by 113 gm of light amber glass. Glass fragments are transparent and contain a few bubbles. Only body sherds were found, none of which are diagnostic.

Clear (121)4 gm). The majority of dateable clear glass recovered came from surface levels and was modern. At least six bottles predate 1900, however. One whole bottle is a ball-neck panel type (Fig. 58:c). It has a rectangular body and flat base. The neck is cylindrical with a thin collar ring just above the shoulder, and is finished with a flat-lipped prescription collar. This 1.5-ounce bottle was made by a semi-automatic bottle machine, dating its manufacture between 1810 and 1913. Dimensions: height, 11.7 cm; diameter of base, 4.4 cm; diameter of neck (outside), 2.2 cm, (inside), 1.1 cm. Locus: Room 12 trash pit (disturbed). Discussion: Bottles similar to this one, probably medicinal, appear in the Whitall, Tatum & Co. 1880 catalog (1971: 9) and in Wilson's 19th Century Medicine in Glass (1971: 72). Only one basal fragment predates 1900 and represents the following bottle:

1. One cylindrical bottle, post-bottom mold, recessed dish depression in base. Dimensions: unknown. Probable date of manufacture: 1860s or later. Locus: plaza trash pit (Late period).

A neck and shoulder came from a bottle produced in a three-part mold, dating its manufacture from between 1810 and 1890. It was found in a Late-period plaza trash pit and contains an applied and tooled lip, as do the two other finishes analyzed. Both of these are probably from medicine bottles dating before 1870. One still has a broken glass stopper in place (Fig. 59:g). The remaining neck is from a ball-neck panel bottle produced in a semi-automatic bottle machine approximately 1880 to 1913. A minimum of six vessels are represented by the pre-1900 clear-glass sample at Tubac.

Household Glass

Various forms of household glass were also recovered and analyzed. A basal fragment from a clear drinking glass was found in plaza use-area floor fill. It is possibly machine made with a diameter of 55 mm. Another similar base came from structure-exterior, southwest, sheet trash from the Late period. Two rim fragments from this same area are probably also machine made. A minimum of four drinking vessels are represented, along with two cups, both cup fragments coming from Room 2 floor fill: a red cup handle and an opaque milk-glass rim sherd.

Tableware glass can be separated into nine items, consisting of pressed- and fluted-glass fragments. The invention of the pressing machine allowed the production of large quantities of attractive and inexpensive tablewares. By 1840,

pressed glass was common in American households (Lorrain 1968: 39). Examples were recovered from the following proveniences: plaza sheet trash and trash pit; Room 4 trash pit; Room 8 sheet trash and structural debris; Room 12 trash pit. Clear fluted glass came from both Middle and Late proveniences: Room 1 trash pit; Room Outlier 1 structural debris and trash; Room Outlier 2 sheet trash; and structure exterior, southwest, structural debris and trash.

A minimum of two clear-glass storage jars are present, both being machine made and dating to after 1880. One rim fragment was recovered from a Room 12 trash pit from the Late period. Three lamp globes are represented by five scallop-edged fragments. All date to after 1890 and were recovered from upper levels.

Also included in this section are miscellaneous items such as mirror and eyeglass pieces. Four small sherds of mirror glass were recovered from structure-exterior, southwest, trash from the Late period. Flat and convex spectacle glass was found with both round and oval lenses present. Eyeglass lenses are nearly impossible to date in a fragmentary state. Carson (1967: 122) reports that early in the 19th century "lenses were large and round, then small and round, and later octagonal, rectangular, or oval." Lense fragments were recovered from the following levels: Room 4 floor fill (Middle period); Room 7 floor fill (Early period); Room Outlier 1 trash (Middle period); structure exterior, north, trash pit (Middle period).

Window Glass

The usual small fragments of window glass recovered from archaeological sites are seldom identifiable. Approximately 2,700 gm of shattered flat glass have been included in this category. The vast majority of the sample came from Late-period and disturbed proveniences, with only 15 percent of the total count coming from earlier periods. Flat glass was recovered mostly from trash depositions; 15 gm were present in Middle-period floor fill and 5 gm in Early-period floor fill. Window glass was definitely a rare commodity on the frontier.

Modern Glass

A number of sherds of modern glass were recovered at Tubac. These fragments of clear, aqua, green, blue, and amber glass represent machine-made

bottles and jars (Fig. 59:d). Most were produced in a cup-bottom mold, and they display continuous thread necks. This site has been open to disturbance for most of the 20th century.

Glass Beads

The vast majority of glass beads are extremely difficult to date, as they possess few distinguishing features. All are roughly globular in shape with hole diameters and colors varying. Only four glass beads were found in the Tubac excavation (Table 14). One possible reason for such a small sample is that beads may have passed through the screens without being seen; other explanations are not known.

Two spherical specimens have been included in a broad class of beads termed "fancy beads." These beads are described by Noel Hume (1972: 55) as tubular, lozenge, and globular forms inlaid with glass of a different color in random patterns of swirls and dots. "Fancy beads" date from 1775 to the early 19th century (DeJarnette and Hansen 1960: 57; Noël Hume 1972: 55).

Table 4

Glass Beads

Type	"Fancy"	"Fancy"	"Russian"	Costume
		in centimeters - - - -		
Figure	60:a	60:b	60:c	60:d
Color	Red/white	White/red	Translucent clear	Translucent clear
Diameter	1.10	1.10	0.95	1.40
Length	0.90	0.90	0.75	1.40
Hole Diameter	0.20	0.23	0.28	0.20
Locus	Room 12 trash pit	Room 2 p.o.* room fill	Room/O 2 p.o.* room fill	Plaza sheet trash
Period	Late	Middle	Middle	Late

*post occupational

The most common bead type of the first half of the 19th century was carefully faceted and made from pieces of glass tube, generally shorter than its diameter. The specimen from Tubac contains eight facets cut around each end, leaving the central sections untouched. These faceted beads are known in the Northwest as "Russian" beads because they were found on Russian sites in Alaska (Noel Hume 1972: 54).

The remaining bead is large and spherical. As this bead possesses no distinguishing features, it is impossible to classify at this time. The bead probably represents fairly recent costume jewelry.

For more detailed information on glass beads as they occur in archaeological contexts, refer to the following reports: De Jarnette and Hansen (1960); Gregory and Webb (1965); Smith (1965).

Summary

The scant amount of Early-period glass recovered at Tubac was predictable. This was especially true for bottle glass. Very few dateable fragments could be placed before 1850. Tubac's remote position on the northern frontier precluded the availability of glass containers. Glass is not suited to long trips by mule or wagon train, and its procurement by local residents would likely have been an expensive matter. For this reason, liquids were shipped in sturdier vessels such as the Spanish "olive jars" and Mexican green-glazed wares. Ceramic storage-jar sherds are much more common in the earlier levels than fragile glass. As noted by Fontana (1968: 53), even mission inventories of Pimerfa Alta for the 18th and early 19th centuries are noticeably lacking in many glass items, especially bottles.

The archaeological evidence at Tubac further verifies this fact. Glass was a very rare item in settlements on the frontier of New Spain. Samples dated to this period show much evidence of basal wear, indicating their reuse over time and final discard when broken. It was not until after 1850, when American interests began to penetrate the area, that glass containers became more readily available from the north. The introduction of the railroad during the late 19th century would also have facilitated access to more fragile trade goods.

M[illegible]

In the past, descriptive sections on metal have usually been based on the material involved, with artifacts discussed under the headings of iron, copper, brass, and so forth. As we are interested in broader artifactual assemblages, rather than the individual items, it was decided to categorize metal objects into functional groupings based on use and not composition. This method of discussion will better facilitate the analysis and understanding of the specific research problems posed at Tubac.

Food Containers and Utensils

A large number of tin-can remnants were recovered at Tubac. The majority of this sample is fragmentary and unidentifiable. Three partial cans and over 100 fragments are recognizable as the open-top can variety. These cans have hermetic double-seam closures and were introduced around 1900. Represented at Tubac are round and sardine-can base types. Only two base diameters are available: 6.5 cm and 12 cm. Approximately 53 sherds and three partial bodies once belonged to hole-in-top containers. Cans of this type have seams which are soldered, as are the separate pieces for top and bottom. A smaller cap is soldered in place on the top with solder drops covering the final pin hole. These cans were on the market from 1811 to about 1900. Included in the Tubac sample are round-and square-base cans, with diameters of 6 cm and 7 cm. One can is 6.5 cm high. Other container fragments, not assignable to a can type, represented paint and tobacco cans. More detailed information on the tin-can industry can be found in Fontana and Greenleaf (1962: 67-77). Tin cans were evidently present in Tubac prior to 1850, as 20 hole-in-top can remnants were found in Middle-period contexts.

Both can openers and bottle closures were recovered from Late-period trash levels. Six key-strip can openers date to after 1895 when this method was first developed in Chicago (Fontana and Greenleaf 1962: 71). With the introduction of bottled beer and ginger ale in the 1880s, tighter bottle closures were necessary. Tin disc caps were held over the cork [illegible] a securing wire (Lief 1965: 15). Only three such caps were found at Tubac (Fig. 61:a). Later, about 1892, bottles used metal crown seals, and still do today. These beverage-bottle caps have a corrugated flange which can be crimped into a locking position (Lief 1965: 17). Thirty-three of these universal bottle seals were recovered from the site.

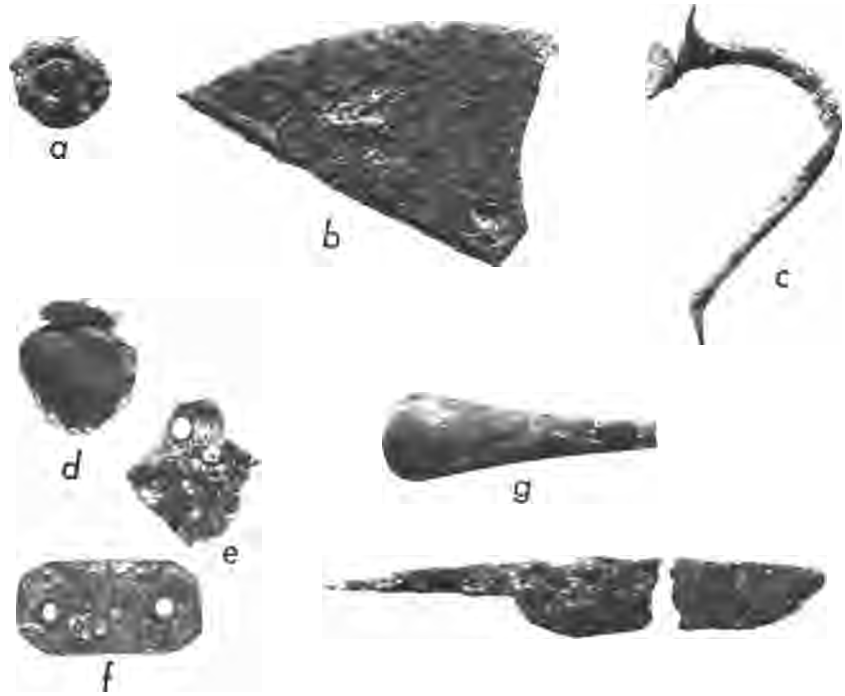


Figure 61. Metal: food containers and utensils. Diameter of a, 24 mm.

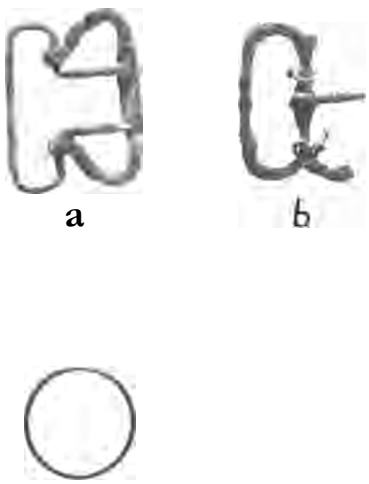


Figure 62. Metal: personal accessories. Length of e, 35 mm.

Figure 63. Metal: domestic. Length of a, 24 mm.

Metal cooking vessels were represented by pot fragments, handles, and repair patches. Four iron pot fragments and one handle were found in Middle- and Late-period trash. Sherd thickness ranged from 2 mm to 5 mm. It was not possible to determine vessel size because the fragments were too small (Fig. 61:b).

Also recovered, from Room 7 Early-period floor fill, was a copper handle for a Spanish jarro choclatero, or chocolate pot. DiPeso (1953: 185) reports that these pots were "one of the most common objects used by the early Spanish expeditions. . . " and that they are characterized by straight cylindrical necks and bulbous bases. The handle is riveted to the body in only one place (Fig. 61:c). A picture of a whole vessel can be seen in DiPeso (1953: 18)4). Chocolate pots were used during the 17th, 18th, and early 19th centuries.

Because of the scarcity of metal on the frontier, copper scrap was often reused many times before being discarded. One use for such scrap was in the repair of copper pots and pans. These patches are irregularly cut sheet copper with rough edges. One specimen has been cut with a cold chisel to a rectangular shape. A few of the patches contain punched rivet holes. Dimensions of the nine fragments recovered range from length, 27 mm to 45 mm; width, 18 mm to 35 mm; thickness, 1 mm to 2 mm (Fig. 61:d, e, f). Similar patches were seen in the Terrenate presidio (DiPeso 1953: 215) and Presidio San Agustin de Ahumada (Tunnell and Ambler 1967: 67-68). Loci at Tubac include Late-period trash, Middle-period fill, and Early-period Room Outlier 1 floor fill.

A bronze spoon handle was found in an early Room Outlier 1 trash pit. The incomplete handle is 7 mm wide at its narrowest point fanning out, away from the spoon, to a shoe-horn shape at the upper end, 21 mm wide. Thickness is 1 mm (Fig. 61:g). Metal utensils were rare on the frontier, and the only reason this one was discarded was probably because it could not be repaired. It is possible that the lower end remained in use, however, since it was not found. Two fragments of an iron table knife were recovered from Room 4 Middle-period trash. The blade curves up to the point with the backside extending straight to the tip of the haft tang (Fig. 61:h). The midsection of the blade is missing.

Domestic Items

Included under this heading are sewing equipment and home-furnishing paraphernalia. A brass thimble was recovered from Early-period Room 7 floor fill. Its sides are covered with closely-spaced circular depressions, exhibiting a

grid pattern on the tip. This thimble is very small and contains the following dimensions: outside diameter, 1.35 cm at base, 0.9 cm at tip; and length, 1.6 cm (Fig. 63:c). Similar thimbles are reported at Quiburi (DiPeso 1953: 212) and San Agustin de Ahumada (Tunnell and Ambler 1967: 68-69).

An incomplete brass straight-pin (Fig. 63:d) was found in contact with a Middle-period floor in Room 12. The pin has a spherical head, and the shaft, which is broken, is made of brass wire. Its dimensions are: length, 2.7 cm; shaft diameter, 1 mm; and head diameter, 3 mm.

Two partial scissors handles were recovered from Late-period trash in Room Outlier 1 and the plaza. The handles are plain and constructed of stamped steel (Fig. 63:e, f).

Home-furnishing artifacts include six fragments of a brass burner tube for a lamp, along with other brass ornamental paraphernalia. A piece of decorative stamped plate (Fig. 63:b) was probably used as a keyhole escutcheon for a cabinet or chest. Similar items are illustrated in the Sears hardware catalog (1905: 123). The escutcheon, recovered from plaza Late-period trash is oval, measuring approximately 2.5 cm by 2.0 cm. Another piece of molded-brass rickrack is fragmentary, and measures 2.3 cm by 0.4 cm by 0.4 cm (Fig. 63:a). It was recovered from Middle-period structural debris in Room 7.

Personal Accessories

Clothing fasteners, excluding buttons which will be discussed later, include buckles, clothing rivets, and clothing snaps and eyelets. Two iron buckles were recovered at Tubac. The first specimen, located in plaza sheet trash belonging to the Late-period is of a type commonly used on men's suspenders or vest straps (Fig. 62:a). The other buckle was found in Middle-period plaza floor fill. It is fragmentary and small, measuring approximately 28 mm by 23 mm. The buckle is plain and shaped like a figure "8" with an iron prong (Fig. 62:b). Twisted around the center bar are two small pieces of brass wire, serving an unknown purpose.

Five clothing rivets were recovered from Late-period plaza trash. Two specimens are brass with a burr diameter of 1.0 cm. Printed on the outside faces of both burrs is "L. S. & CO - S.F.," representing the Levi Strauss Company of San Francisco. These rivets therefore date to after 1873, and an example of one can be seen in Figure 62:c. The remaining three rivets are

constructed of steel. Two have diameters of 1.5 cm, and one has a diameter of 2.5 cm.

One clothing snap along with two eyelets were also found in Late-period contexts. Two other eyelets came from Room Outlier 1 structural debris and trash from the Middle period. These specimens are brass with diameters of 0.7 cm and 1.0 cm respectively.

Only three items could be classified as jewelry. Included here is a pocket-watch fragment recovered from Late-period plaza sheet trash. A part of the body along with the top ring attachment are of chromed brass. Watch diameter is 5.5 cm; thickness is 1.5 cm.

A gold wedding band was also found in Late-period trash. It is a simple style with a diameter of 2.0 cm. The ring contains embossed designs on the exterior; engraved on the interior are the letters "CHECO" (Fig. 62:d).

A brooch is an ornamental pin which is usually worn on a woman's dress. Such an item was recovered from a Middle-period trash pit in Room 2. This brass brooch has a pin of thin wire which is attached to a small decorative fist. The wrist then splays out to the left and right leaving four small arms. Between these arms is situated a piece of decorative glass, held in place by a brass screw securing the top and bottom arms (Fig. 62:e). This type of jewelry dates fairly early, and can probably be placed in the 18th century.

Hardware

A number of items could be categorized under the heading of building fasteners. This includes nails, tacks, spikes, and wood screws; bolts, nuts and washers, and brackets. Fencing staples will also be discussed here.

Thirteen iron nails are hand-wrought. These specimens are badly corroded and fragmentary for the most part (Fig. 64:a, b, c, d). Shaft length ranges from 3.3 cm to 6.0 cm. These nails are characterized by their irregularity. Shanks are roughly rectangular and tapered; most exhibit large rose heads, which are common to nails forged by hand. Early-period loci include structural debris and floor fill. Middle-period specimens came from trash, structural debris, and floor-fill levels.

The majority of nails recovered at Tubac are square cut, numbering 211 whole specimens and numerous fragments. In 1790, nails were first cut by machine, thus featuring even, rectangular shafts. Until 1825, however, such nails were still

Figure 64. Metal: hardware. Length of a, 60 mm.

being headed by hand (Fontana and Greenleaf 1962: 54). Three nails located in Early-period plaza use-area contact and Middle-period Room Outlier 2 floor fill fall into this interim period. After 1830, nail production was fully automated, with cut types available until about 1890. Nail sizes at Tubac range from 1d to 16d, with 45 percent of the sample being the practical 8d measure. Varieties of nails comprise common-cut, the most abundant type, and brad, fencing, finishing, flooring, furniture, and roofing nails (Fig. 64:e, f, g, h, i, j). Six 2 inch, 5.1 cm, and two 2.25 inch, 5.8 cm, horseshoe nails were also recovered, from Late-period plaza trash (Fig. 64:k, l). While square-cut nails occurred in Early, Middle, and Late proveniences, over 93 percent of our specimens are in association with post-1850 strata.

Whereas wire nails were invented in France around the middle of the 19th century, it was not until about 1890 that they became popular in the United States (Fontana and Greenleaf 1962: 55). A total of 139 wire nails were located at Tubac, in sizes ranging from 2d to 20d. Pennyweight, length parallels are available in Fontana and Greenleaf (1962: 56). Box, common-cut, finishing, roofing, and scaffold nails are present (Fig. 64:m, n, o, p). All specimens are from Late-period trash contexts.

Numbers and sizes of square-cut and wire nails at Tubac are itemized below:

	20d	16d	10d	9d	8d	7d	6d	5d	4d	3d	2d	1d
Square-cut		2	9	2	96	5	35	19	21	12	2	1
Wire	4	4	6	5	44	5	18	4	31	16	2	

Ten tacks were recovered with large circular flat heads and relatively short shanks. The following hand-wrought varieties were found: one 1.8 cm brass, one 2.5 cm iron roofing. Square-cut samples include: one 1.4 cm flooring, two 2.5 cm roofing. Wire varieties are: three 2.5 cm roofing, one 3.2 cm roofing, one 4.4 cm galvanized roofing. The hand-forged specimens are from Early plaza contact levels, while the remaining sample came from Late plaza and Room 12 sheet trash. Tacks are illustrated in Figure 64:q, r.

There were also five spikes found: a fragmentary hand-forged example from Middle-period plaza structural debris; one 6.0 cm badly corroded square spike from Middle-period plaza floor fill; and two 8.9 cm and 11.5 cm specimens from Late-period plaza trash. Nine counter-sunk flat-head wood screws have lengths of from 2.0 cm to 4.0 cm. These screws were recovered mostly from Late-period

proveniences. One 2.0 cm screw is hand-forged and was found in contact with the Early plaza surface.

Bolts include a broken carriage type, 4.4 cm by 0.7 cm; two common machine bolts with square heads, 6.5 cm by 1.0 cm and 7.0 cm by 0.6 cm; and a thumb-turn bolt, 7.8 cm by 1.4 cm (Fig. 64:s, t). Eight square nuts and two hexagonal specimens were recovered. Diameters range from 1.0 cm to 2.5 cm, while bores are from 0.5 cm to 1.2 cm wide. It can be generalized that square nuts were commonly used on farm implements and wagons, and hexagonal nuts on machines. Iron washers range from 1.4 cm to 2.8 cm in diameter. Two lead specimens, 1.2 cm and 1.3 cm, were punched from a sheet and are concave-convex in cross section. Two other washers are roughly hand-cut brass and are not uniformly shaped (Fig. 64:u). Diameters are 1.5 cm and 2.2 cm; loci are Early-period Room Outlier 1 trash pit and Middle-period plaza floor fill. The remaining washers, along with the nuts and bolts, were recovered, for the most part, from Late-period trash. Illustrations of such hardware are available in the Sears (1905) and C. Sidney Shepard & Co. (1895) catalogs.

Four small corner brackets were recovered from Late plaza trash. The brackets are 2.8 cm long and probably from a small box, such as were used for cigars.

Fifty-three iron fencing staples range in length from 1.3 cm to 4.5 cm. A number of the staples are wire; others are thicker, with some possibly converted from nails (Fig. 64:v, y). All but three specimens are from Late-period contexts. Those remaining were found in Early structural-debris and floor-fill levels. These earlier staples were probably used for other purposes than fencing, for construction, for example.

Other hardware items recovered include three iron snatch hooks, 6.0 cm, 5.0 cm, and 2.5 cm long; one 4.2 cm screw eye; two brass ferrules; an iron pin, 4.0 cm long and 0.7 cm in diameter; a hand-wrought brass cabinet fitting, 8.0 cm long; one circular grommet with a beveled edge, 1.1 cm in diameter; one 10.2 cm hinge pin; part of a door-locking mechanism, 9.0 cm by 5.5 cm, and a lock latch. 8.0 cm by 1.2 cm, about 1860s or later; an eye-bolt grasp for a heavy padlock key; and an iron door-key handle, in the style used for skeleton keys. Loci for the above artifacts are Late-period structural debris and trash.

Machine parts at Tubac were few in number. A broken, bullet-shaped piece of machine rod was found in Room 7 Middle-period trash. Other items include a

brass gear, 1.5 cm in diameter; a gear and shaft assembly; an axle nut; and a 1.5 cm piece of wire spring, all from Late trash contexts. Four machine parts could not be specifically identified and were recovered from Middle-period plaza sheet trash and use-area floor fill.

Several items could be classified as tools. A knife-blade fragment and pieces of a broken pocket knife, brass housing with iron blade, were recovered from Late-period trash. Middle-period plaza structural debris produced a tang fragment, 10.5 cm by 0.5 cm, from a draw knife. A fragment of hammered cast iron once belonged to a pair of blacksmith's pincers (Fig. 6)-:w). A 9.5 cm section of a pincer arm at the bolt connection has been cut out, with an edge beveled on one end. The specimen was more than likely reused as a chisel. The recovery locus is Late-period plaza trash. Examples of blacksmith pincers are illustrated in the Sears hardware catalog (1905: 20-21). A hand-wrought iron awl was unfortunately found in a disturbed provenience. Dimensions are as follows: length, 6.6 cm; maximum width, 1.8 cm; thickness, 0.5 cm (Fig. 64:x). This small tool was probably used for punching leather. Two file fragments, a triangular tip and a cross-cut portion, were also recovered, again from Late-period trash.

Horsegear and Wagon Parts

Two buckles could be classified as harness fittings. The first is a ring made of 4 mm brass rod, which has been bent and brazed (Fig. 65:a). The ring may be a strap buckle from a mule saddle or pack cinch (Specifications . . . 1882: Plates 3, 8). The other buckle is a complicated iron variety. The harness strap is interwoven between the various bars of the buckle (Fig. 65:b). Its dimensions are 41 mm by 35 mm by 8 mm. Both specimens were found in Late-period trash.

Copper harness rivets recovered at Tubac number only six. The rivets contain shaft lengths of 0.4 cm to 1.1 cm and burr diameters of 0.9 cm to 1.2 cm (Fig. 65:c, d, e). These specimens were recovered from Late-period trash and Middle-period plaza floor fill.

Other horse paraphernalia include three ornamental copper brads. The decorative heads are thin and slightly domed, presenting a concave-convex profile (Fig. 65:g, h, i). The diameter is 1.2 cm. A shank extends from the center of the back for subsequent attachment to leather. All specimens have been roughly hand-forged. Brads such as these were commonly used as saddle decoration,

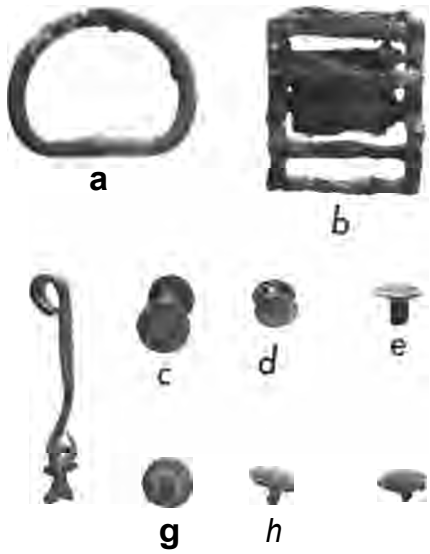


Figure 65. Metal: horsegear. Length of f, 52 mm.

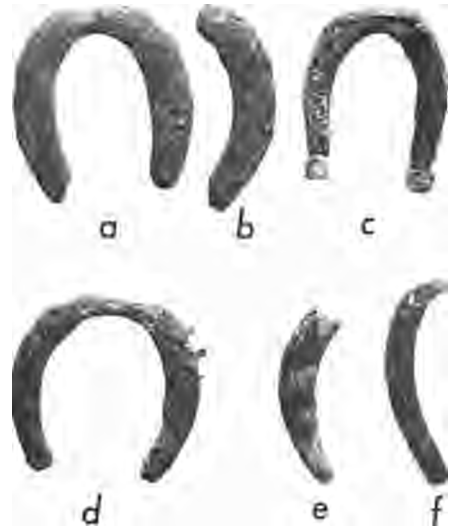


Figure 66. Metal: horseshoes. Length of a, 122 mm.

Figure 67. Metal: military insignia and musical instrument. Length of b, 50 mm.

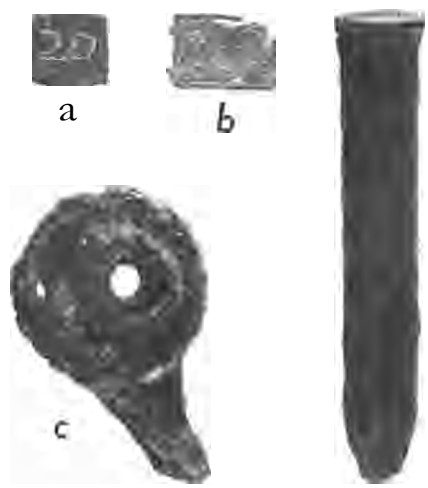


Figure 68. Metal: miscellaneous. Length of d, 102 mm.

especially during the colonial period. Loci include a basal level pit, a Middle-period trash pit, and Late sheet trash.

Another Spanish colonial item is a brass higo or jingler. An higo is a metal ornament which was attached to a horse's gear to either the anguera or the bridle bit. This particular example consists of an engraved metal strip looped over at both ends. The top was attached to the fitting. Hanging from the lower loop is a small, thin, brass human figure, perforated through the head, which jangled as the horse moved. Dimensions are length, 5.0 cm; width, 0.5 cm. DiPeso (1953: 19)4-195) illustrates a number of higos from Quiburi. The Tubac specimen (Fig. 65:f) was recovered from Middle-period plaza floor fill.

Three whole horseshoes and four fragments were recovered at the site (Table 5). Number 1 is a thick, heavy shoe, which curves in at the heel. It contains eight nail holes in a shallow fullering groove and probably dates to the late 18th century. Number 2 is broken, but also has its nail holes in a channel or fullering. The heel is beveled on the inner side of the branch. It probably dates to the mid-19th century. The third specimen is a mule shoe with calkins on both heels. Nail holes are again in a fullering. The shoe is whole and U-shaped, and can be placed in the late 19th century. Number 4 has been termed by Fontana and Greenleaf (1962: 86) a "prairie-shape" horseshoe. It is larger than usual and was probably used on a work horse. The remaining specimens are all broken. Number 5 has nail holes in a fullering and dates to the last half of the 19th century, as does Number 6. This latter fragment is narrow and squared at the heel. The last fragment is too small to be identified. A very general evolutionary progression of 17th- to 19th-century horseshoes can be found in No61 Hume (1972: 238).

Only two items could be classified as wagon parts. These include a possible tie rod, 39 cm by 8.5 cm by 1.5 cm, and a broken, iron, wagon-box strap bolt. The bolt section is missing on this last specimen. It is 3 mm thick, and the ends have been trimmed with a hot chisel. Both parts are from Late-period trash from the plaza and structure exterior, southwest.

Table 5

Horseshoes

Horseshoes	Length	Width	Thickness	Weight	Loci	Context
	- - - in centimeters - - - -					
1. Figure 66:a	12.2	11.7	0.8	300 gm	Room 12 floor contact	Middle
2. Figure 66:b	Broken		1.5		Room 12 floor contact	Middle
3. Figure 66:c	11.7	10.0	1.5	293 gm	Room 12 floor contact	Middle
4. Figure 66:d	13.0	12.5	0.7	250 gm	Room 1 trash pit	Late
5. Figure 66:e	Broken		0.8		Plaza floor fill	Middle
6. Figure 66:f	Broken		0.6		Plaza sheet trash	Late
7.	Broken				Plaza contact	Early

Military Insignia

In the 1870s, hat insignia for the infantry and the cavalry were issued with a small brass number, worn above, and a letter, below, denoting the regiment and company affiliations (Brinckerhoff 1965: 9). A U.S. Army regimental number was recovered from Late plaza trash. The number, a brass "7," is hollow backed and 1.9 cm high (Fig. 67:a).

Musical Instrument

The frame of a Jew's harp, minus the vibrating tongue, was recovered from a disturbed provenience (Fig. 67:b). Webster's New World Dictionary defines the harp as "a small musical instrument made of metal, held between the teeth and played by plucking a projecting bent piece with the finger; it produces twanging tones." The dimensions of the Tubac specimen are as follows: maximum length, 5.0 cm; maximum width, 2.6 cm; frame thickness, 0.6 cm. The harp is iron, with a roundish frame head, and fits into Stone's (1970: 98) classification system for harps, as a Series B type. Jew's harps are an 18th-century phenomenon (Stone 1970: 90-102).

Miscellaneous Metal

Also recovered were a large number of wire strands. These include common wire from Middle and Late contexts with maximum strand length of 28 cm, and a diameter of 2 mm to 3 mm, and fencing wire. Sixty pieces of common single-strand barbed, double-strand barbed, and multi-strand barbed wire came from Late-period trash: maximum length, 20 cm; strand diameter, 3 mm. Other wire fragments include handles for buckets and cans. Fourteen specimens were in Late trash.

'Several metal objects have been tentatively identified. A small square of brass or bronze, 1.7 cm by 1.6 cm by 0.2 cm, has the number "20" engraved into one facing (Fig. 68:a). It is believed that this item was used as a counter-weight. Unfortunately, no measure of weight could be found in which this object registered as 20. Its gram weight is about eight. Another specimen (Fig. 68:c) is probably a knob backing from a stove or heater. It is constructed

of iron with a swivel grip. A lead item, 2.4 cm by 1.6 cm, has an indented back with scroll designs in relief on the front (Fig. 68:b). It is either a facing for a small buckle, or a locket cover of some sort. The last item is a drift pin with a lathe centering hole in one end. It is bullet shaped, 10.2 cm long, and 1.8 cm in diameter (Fig. 68:d). All of the above artifacts were found in Late-period contexts.

Other unidentified iron objects include an iron ring, 14 mm in diameter, iron pipe, iron rod, bar iron, strap iron, and iron sheeting. Pieces of copper rod and tubing were also recovered along with a fragment of a lead bar, sheet lead, strip and sheet tin, and a lead-foil cap, probably for a patent medicine bottle, from Middle-period Room 12 floor fill.

Modern Metal

A number of fragments of modern metal were recovered at Tubac, including tin cans, continuous thread closures, and razor blades. These are the result of 20th-century disturbances at the site.

Summary

As with glass products, the scarcity of metal on the northern frontier was a serious problem for its population. This was especially true during the Spanish and Mexican occupations at Tubac. Very few objects of metal were recovered from Early- and Middle-period proveniences. For example, only a paltry number of horse-related items were found at a site, whose very livelihood for over 100 years depended on the horse. Most of these artifacts were situated in the plaza courtyard, as one would expect. The animals, themselves, were kept in stock corrals close to the center of town in order to protect this valuable commodity from Apache raids. Still, one would normally expect more horsegear to have been present in the area of the commandant's quarters and general headquarters.

One explanation for the absence of metal artifacts during these periods is that 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. Pack trains were not able to transport so heavy a material

as iron in any large quantity. Dobyns (1959: 626) notes that a handicap of the new 1851 Mexican military colony was its lack of a blacksmith. The blacksmith was evidently an integral part of frontier existence.

Buttons

A total of 34 buttons was recovered from the excavations at Tubac. These buttons are constructed of a variety of materials including metal, bone, milk glass, mother-of-pearl, plastic, and wood. Both military and civilian types are included.

Metal

Three flat, cast-brass buttons are of the spun-back type with shank and disc cast in one piece (Fig. 69:a). A hole is drilled in the shank for the eye. Button diameter is 16 mm. These are Type 31 buttons according to South's (1964: 124) classification system, placing them in a 1837-to-1865 context. Olsen (1963: 553), on the other hand, dates these sleeve-link buttons between 1700 and 1765. All three specimens came from Middle-period units, with two being recovered from Room 12 floor fill.

Another brass button is a United States Army issue, commonly used on officers' coats between 1855 and 1865. Known as the Line Eagle Device, this readily identifiable button was generally worn by enlisted men from 1833 to the Civil War, and continuing to 1902 for officers (Brinckeroff 1965: 3). In the center of the convex front is a recessed shield in which the raised letter of the service is stamped, "C" for Cavalry in this case, first used for officers after 1855 (Fig. 69:b). Stamped on the back is "SCOVILL MFG CO/WATERBURY," a mark characteristic of an 1850 to 1865 time period (Albert 1973: 6). This button was found in a Late Room 1 trash pit.

Two trouser buttons recovered are of stamped-steel construction. The first disc is the backing of a two-piece button, stamped, and badly preserved. The diameter of the four-hole button is 17 mm. Olsen (1963: 55)4) indicates a post-1870 date for this type. The other button is a concave disc with the four fastening holes formed by criss-crossing metal strips in the center (Fig. 69:c). The diameter is also 17 mm. Olsen (1975, personal communication) believes this to be an Army trouser button, in use after 1875. Pewter had formerly been used for such buttons. Both examples are from Late-period trash contexts.

Also included in this section are metal clothing rivets which were utilized as buttons. Seven specimens were analyzed, all of which had been used as trouser or workpants buttons (Fig. 69:d, e, f). These fasteners are flat, stamped-steel

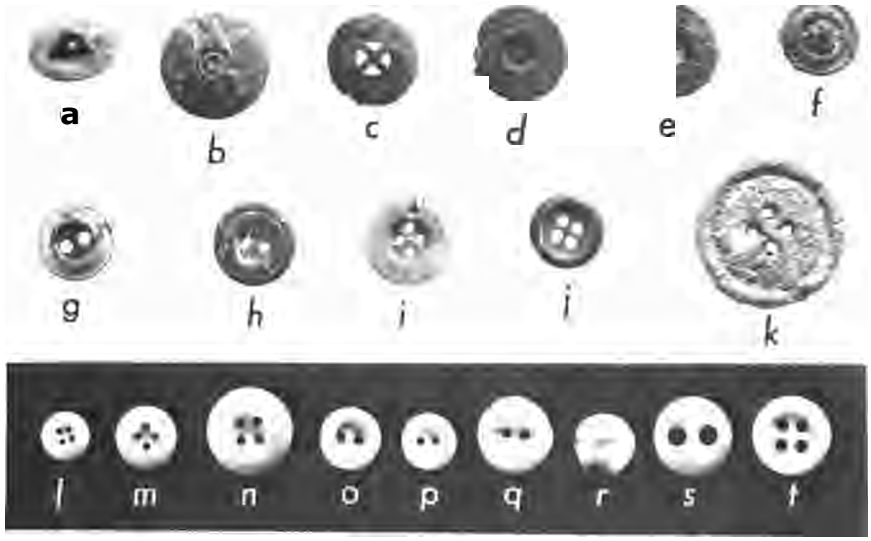


Figure 69. Buttons. Diameter of k, 27 mm.

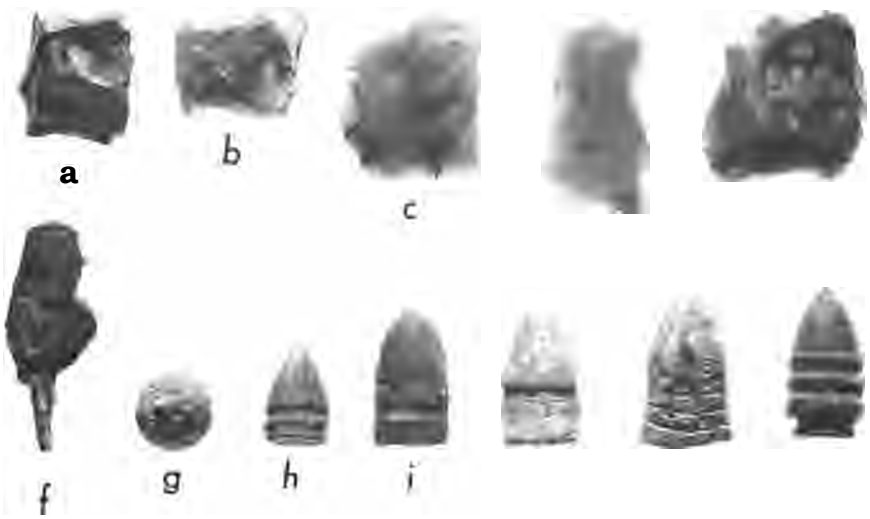


Figure 70. Gun part, bullets, and gunflints. Length of 1, 27 mm.

types. The shank and disc were cast in one piece, and the rivet is still in place. Diameters average about 17 mm. Three are definitely from blue jeans; printed in relief around the outer disc is "LEVI STRATTSS & CO/S.F. CAL" (Fig. 69:d). These would then have to date after 1873, when that company first went into operation. All specimens were recovered from plaza and Room 12 trash depositions from the Late period.

White metal buttons of pewter or lead were first produced during the 1890s. These buttons were machine stamped and decorated by hand painting, or other method (Albert 19)49: 8). Two such buttons were recovered at Tubac, from disturbed proveniences. Both are two-hole, size 10, shirt buttons, one painted in blue (Fig. 69:g), the other in green (Fig. 69:h). It is likely that the latter specimen is from a World War I to II context (Olsen 1975, personal communication).

Bone

Three bone buttons were recovered. These are four-hole, sunken-panel types with diameters ranging from 1.3 cm to 1.7 cm (Fig. 69:i). The backs are slightly domed showing evidence of smoothing by a cutting tool. The holes have been drilled in the center depression, and taper both front and back. These buttons correspond with South's (196)4: 121) Type 20, placing them in an 1800-to-1865 context. All were found in Middle-period trash units from the plaza and structure exterior, north.

Wood

An undecorated wooden button was recovered from Early-period Room 5 floor fill. This button is dark brown in color with four holes drilled through a cup center. The diameter is 13 mm (Fig. 69:j). A fine hardwood was used, with polishing bringing out the natural grain.

Another wooden button was covered with fabric (Fig. 69:k). This button contains four holes and was probably used on an overcoat. Diameter of the disc is 27 mm. Albert (19)49: 47) states that by 1850, the inexpensive cloth-covered button had replaced the metal one in general popularity in most fields of use. Wooden or metal molds could be purchRsed and then covered in any material. The Tubac specimen was recovered from a Middle- to Late-period trash pit.

Milk Glass

Three common four-hole shirt buttons of milk glass came from Late-period trash contexts. The addition of oxide of tin to the glass mixture makes it opaque white. Milk-glass buttons were being produced in England from the mid-18th century (Albert 19)49: 50). The following types were found at Tubac: one size 14, one size 16, and one size 24 (Fig. 69:1, m, n).

Mother-of-Pearl

Two specimens recovered are probably hand-made, thereby pre-dating 1850. The buttons are a white, polished staple type (Butler Brothers catalog 1915: 486-487), with two and four holes respectively, which have been drilled individually. The back of the size 16 button appears to be in its natural shell state (Fig. 69:o), and was found in Middle-period Room 1 floor fill. The other button is a size 22.

Six other pearl shirt buttons are machine made and date to after 1850. Two white, polished staple types have chipped faces and are of irregular thickness: a two-hole size 14 and size 20. Three more two-hole buttons were of the fisheye type in sizes 16, 18, and 20. The size 18 is a gray, ocean pearl color. The remaining specimen is a white, polished self-shank type in size 16. The shank and disc are cast in one piece with a drilled hole in the shank for the eye (Fig. 69:p, q, r). All are from Late-period trash contexts.

Plastic

Celluloid became a popular button material during the late 19th and early 20th centuries (Albert 19)49: 69). Three white-ivory plastic buttons were recovered in the following sizes: one four-hole size 16, one two-hole size 20, and one four-hole size 20 (Fig. 69:s, t). These buttons are of a type generally seen on underclothes. All are from Late-period trash.

Modern Buttons

A number of buttons, mostly plastic, could be dated to after 1900, and, therefore, will not be described here. These buttons came in a variety of shapes and colors. One specimen of interest had printed on the back, "P.B. CO./PATENTED DEC. 9, 1924." According to Albert's list of American button makers (19)49: 407),

the Patent Button Company of Waterbury, Connecticut, has operated from 1870 to the present.

Summary

Only one button could be placed in an Early-period context, and that was the plain wooden button found in Room 5 floor fill. By the time the 19th century had begun, a variety of materials were appearing in button form, including brass, bone, fabric covering, and mother-of-pearl. Still, only nine specimens were recovered from Middle-period levels: four from trash, three from Room 12 floor fill, and two from Room 1 floor fill.

As with other artifactual categories already discussed, after the Gadsden Purchase we see a tremendous increase in available trade goods. Twenty-four buttons in a variety of materials were recovered from Late-period contexts. New trade routes from the north, along with more economical means of transport, enabled frontier residents for the first time to be able to order almost anything they desired from manufactured goods' catalogs. The presence of the U.S. Army can also be seen now by the cavalry officer's coat button and two stamped-steel trouser buttons recovered.

All buttons analyzed were of a simple utilitarian nature; no fancy types were seen. Over the years, local residents were evidently purchasing inexpensive buttons as they became available.

Coins and Seals

Spanish Colonial Coins

One Spanish colonial coin, a silver one-real piece, was found. The coin is in very poor condition, and the date is unreadable. However, coins of this sort, also called Pillar Dollars or Spanish Milled Dollars, were made at various mints of New Spain from 1732 to 1772 (Utberg 1963: 16).

Republic of Mexico Coins

Three copper one-quarter-real coins were found. Dates are unreadable, but coins of this type were minted in Hermosillo, Sonora, from 1832 to 1836 (Utberg 66). One of the coins has an atypically stamped reverse and a small punch mark on the obverse. All are in very poor condition.

United States of America Coins

One copper-nickle "Flying Eagle Cent" was found. The date is unreadable, but coins of this type were minted in the United States from 1856 to 1858 (French 1973: 91).

In addition, two modern coins were found, a U.S. cent dated 1944 and a Mexican ten-centavo piece dated 1959.

Seals

Three round lead seals were found. Two are identical, having embossed on one side a "cross patee" and the words "JOSEPHO VIALE DE. . . ." In both cases, the bottoms of the seals were clipped or torn off. The seals have diameters of 38 mm and thicknesses of 2 mm. The reverses are blank. Another seal, also 2 mm in thickness, has been trimmed to a diameter of 28 mm and has, in addition, been drilled orpunched through the center. This modification has cut away part of the embossed lettering leaving only the numbers "72" and the letters "ITO." Illustrations of the lead seals appear in Figure 71.

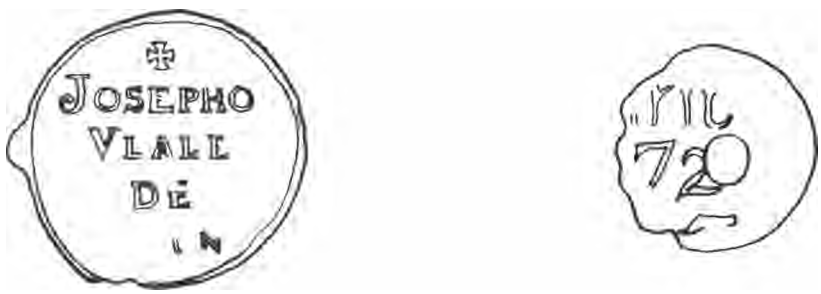


Figure 71. Lead seals. Object on left is 38 mm in diameter.

Similar, though not identical, seals have been found in Spanish colonial context at Quiburi (DiPeso 1953: Fig. 26), Santa Rosa Pensacola (Smith 1965: 70), and Presidio San Agustin de Ahumada (Tunnell and Ambler 1967: 74). These seals are usually called bale seals and are presumed to have been used to secure textiles during shipment (Noel Hume 1972: 269-271).

At Tubac, two of the seals were found on the Early-period floor of Room 4, while the other was found in an Early-period context on the floor of Room Outlier 1.

Firearms and Related Items

At Tubac were found 29 lead bullets, one piece of lead waste, 16 cartridge cases, seven gunflints, and one gun part. Descriptions of these objects follow.

Lead Bullets

Spherical Bullets:

Calibre 54
Number: 11
Description: Hand-molded. Average diameter, 0.544 in; diameter range, 0.534 in to 0.550 in. See Figure 70:g.

Conical Bullets:

Calibre 38
Number: 1
Description: Fired and deformed from impact.

Calibre 44
Number: 1
Description: Diameter, 0.445 in; length, 0.671 in. Single-grooved. Form is consistent with that of a number of combustible cartridge bullets patented about 1861 for use in Colt pistols (Logan 1959: 25-26). See Figure 70:h.

Calibre 52
Number: 1
Description: Diameter, 0.530 in; length, 0.930 in. The bullet is double-grooved and a small concavity, 0.180-in diameter, has been machined into the base. This bullet is similar to those made for use in the calibre 52 Sharps rifle (Lewis 1956: Plate 37). See Figure 70:1.

Calibre 54
Number: 14
Description: Average diameter, 0.558 in; average length, 0.936 in. Single-grooved. Bullets are similar to those made to be used in the calibre 54 Burnside rifle (Lewis 1956: Plate 39). See Figure 70:j.

Calibre 58
Number: 1
Description: Diameter, 0.580 in; length, 1.054 in. Triple-grooved, concave base. Made for use with paper cartridges in the 1855 Springfield musket (Logan 1959: 16). See Figure 70:k.

Calibre 58
Number: 1
Description: Diameter, 0.576 in; length, 1.018 in. Double-grooved with a basal flange. Similar in form, though not in diameter, to the 32 Bore 52 calibre Sharps paper cartridge used in the Model 1859 Sharps military rifles and carbines (Logan 1959: 14). See Figure 70:1.

Lead Waste

One piece of melted lead weighing 10 gm was found. This material may have been used in bullet manufacture.

Cartridge Cases

Rimfire Cases:

Calibre 22 (22 Short)
Number: 1
Headstamp:
Manufacturer: Winchester Repeating Arms Co.
Date of manufacture: from about 1860 to present (Logan 1959: 63).

Calibre 22 (22 Long)
Number: 1
Headstamp: "H"
Manufacturer: Winchester Repeating Arms Co.
Date of manufacture: from about 1860 to present (Logan 1959: 63).

Calibre 44 (44 Henry Flat?)
Number: 1
Headstamp: none
Manufacturer: unknown
Date of manufacture: after 1860 (Fontana and Greenleaf 1962: 81; Logan 1959: 68).

Center-Fire Cases:

Calibre 30 (30-30 Winchester)
Number: 1
Headstamp: "W.R.A. Co. 30 WCF"
Manufacturer: Winchester Repeating Arms Co.
Date of manufacture: after 1894 (Bearse 1966: 105).

Calibre 30 (303 Savage)
Number: 1
Headstamp: "W.R.A. Co. 303 Sav."
Manufacturer: Winchester Repeating Arms Co.
Date of manufacture: after about 1896 (Bearse 1966: 118).

Calibre 38
Number: 1
Headstamp: none
Manufacturer: unknown
Date of manufacture: probably late 19th century.

Calibre 38 (38-55 Peters)
Number: 1
Headstamp: "PETERS .38-55"
Manufacturer: Peters Cartridge Co.
Date of manufacture: after 1884 (Bearse 1966: 142).

Calibre 38 (38 Smith & Wesson)
Number: 1
Headstamp: "WRA Co. 38 S & W"
Manufacturer: Winchester Repeating Arms Co.
Date of manufacture: unknown.

Calibre 41
Number: 1
Headstamp: "UMC 41 L C"
Manufacturer: Union Metallic Cartridge Co.
Date of manufacture: after 1877, before 1902 (Logan 1959: 10, 134).

Calibre 44 (44-40 W.C.F.)
Number: 1
Headstamp: "U.M.C. .44 C.F.W."
Manufacturer: Union Metallic Cartridge Co.
Date of manufacture: after 1873, before 1902 (Bearse 1966: 154; Logan 1959: 10).

Calibre 44 (44-40 W.C.F.)
Number: 1
Headstamp: "WRA Co. 44 WCF"
Manufacturer: Winchester Repeating Arms Co.
Date of manufacture: after 1873 (Logan 1959: 137).

Calibre 44 (44 Smith & Wesson)
Number: 1
Headstamp: "WRA Co. 44 S & W"
Manufacturer: Winchester Repeating Arms Co.
Date of manufacture: after 1871 (Logan 1959: 136).

Calibre 50 (50-70 Musket; .50 Govt.)
Number: 1
Headstamp: none
Manufacturer: unknown
Date of manufacture: after 1869 (Logan 1959: 148).

In addition, three modern cartridge cases were found. These are:

Calibre 38 (38 Special)
Number: 1
Manufacturer: Remington-UMC Co.

Calibre 45 (45 Automatic Colt Pistol)
Number: 1
Manufacturer: Remington-UMC Co.

Gauge 12 (12 Ga. Peters Target)
Number: 1
Manufacturer: Peters Cartridge Co.

Gunflints

European Manufacture
Number: 2
Description: Both are made of a translucent yellow-amber flint and are percussion trimmed. Edges are heavily battered on both specimens. One specimen is made on a blade, the other on an amorphous flake. Dimensions: 36 mm by 17 mm by 10 mm, and 38 mm by 32 mm by 8 mm. See Figure 70:d, e.

Local Manufacture
Number: 5
Description: Average dimensions: 22 mm by 19 mm by 6 mm. All are squared by a unifacial percussion technique. Two are heavily battered, while the other three show slight evidence of use. Materials are locally-available cherts and chalcedonies. See Figure 70:a, b, c.

Gun Parts

Trigger
Number: 1
Description: Maximum length, 41 mm; maximum width, 8 mm. Probable iron trigger. See Figure 70:f.

Chronological Implications

The spherical lead bullets cannot be assigned to specific time period, but the calibre is compatible with that of various rifles and muskets of the mid-19th century and earlier. The conical lead bullets are types which were introduced just prior to the Civil War and which continued in use into the late 19th century. The cartridge cases were introduced at various times ranging from about 1860 to 1896. With the exception of gunflints and trigger, firearms paraphernalia was found mainly in post-1850 contexts at Tubac.

Two gunflints were provisionally assigned to a "European manufacturer" category. These flints are consistent in material and form with those described as "French gunflints" by Witthoft (1966: 28-32) and Woodward (1960). According to frequency distributions elsewhere in North America (Hanson 1970: 55), manufacture and import of these flints centered in the last quarter of the 18th century.

Identification of the one gun part found, a trigger, is tenuous at best. It is similar, however, to triggers from Mexican cavalry carbines which are short, English-made flintlocks of large calibre, dating from the first half of the 19th century (Serven 1965: 5).

Spatial Implications

By observation the following spatial clusters were noted. In the earlier periods firearm-related activity was centered in Room Outliers 1 and 2 and in the plaza. In later periods this activity was most intense around Room 1 and adjacent parts of the plaza and structure exterior. The storage of munitions in Room 1 is suggested.

Conclusions

Over time at least 15 different types of firearms were in use in the Tubac area, as indicated by the variety in type and calibre of bullets and cartridge cases. The majority of these bullets and cartridge cases were designed for military weapons.

Despite the presence of gun salesmen in the territory during the Late period, firearms and related items seem to have been in short supply. Imported gunflints were rare and local chert and chalcedony were pressed into service as substitutes. Bullets were cast on the spot in some cases, as evidenced by the presence of melted lead waste. Even cartridges appear to have been in short supply. Two of the cartridge cases have been cut down in length, presumably to fit firearms with smaller chamber sizes.

The lack of broken and discarded gun parts, with the exception of one trigger, suggests that facilities for gun repair were limited at Tubac, although, according to Dobyns, at least three gunsmiths operated at different times at the presidio (1959: 209, 445).

Amulets

An amulet made of carved ebony (Fig. 73) was found in a Late-period trash level at Tubac. The fica represents a clasped hand, or closed fist, with the thumb projecting between the index and middle fingers. This symbol has its

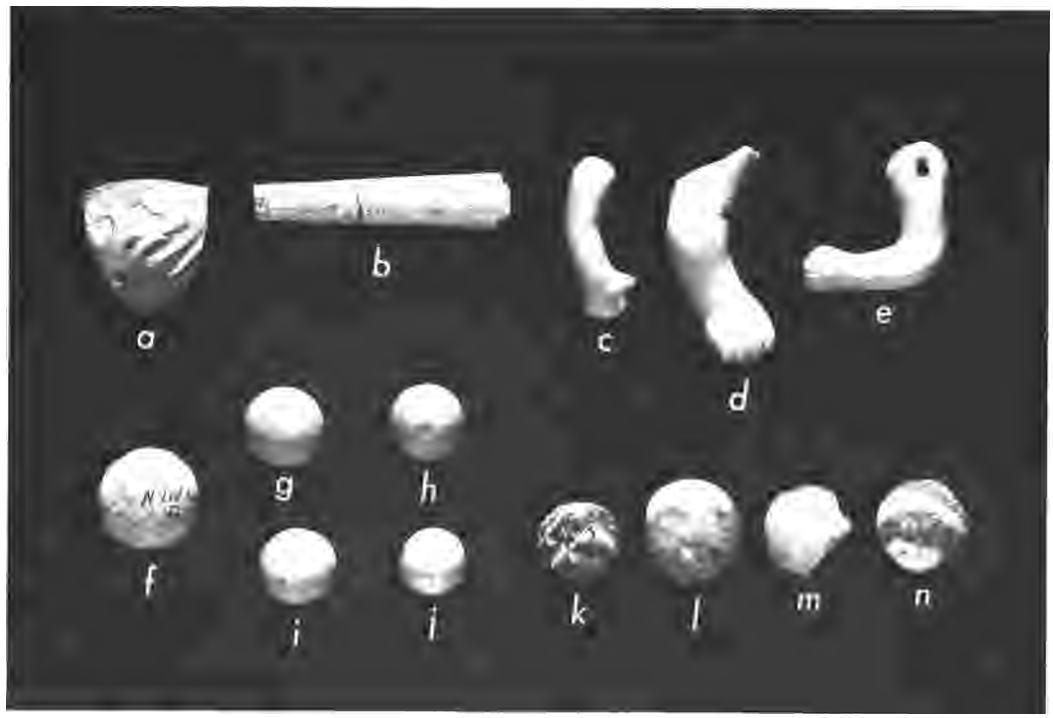


Figure 72. Tobacco pipes and toys. Length of b, 47 mm.

Figure 73. Ebony fica charm.
Length, 24 mm.

origins in the Old World, and is now widespread in Latin America. The amulets are not of a religious nature, but were popularly used to ward off the "evil eye" from the wearer. DiPeso (1953: 211) states that according to Dr. Wolfgang Born:

> Another magic means of protection against the "evil eye" consists of an amulet in the form of the sexual organs. . . . The spread of Christian morality made the representation of the genitals an offense, so the naturalistic phallic amulets in Christian times were replaced by symbolic forms. The most widespread of these is the fig or fica, namely a hand with the thumb placed between the index and the third finger; a very old sign for cohabitation.

While ficas are then anti-religious, they are commonly found in mission sites which date from the Spanish colonial period in Mexico and Arizona (Ayres 1965: 7). A specimen almost identical to that recovered at Tubac was found by DiPeso at Quiburi (1953: 210-211). Charms such as this were also used in large numbers by the Spaniards as jinglers on their horsetrappings. Two fica jinglers from the Presidio San Agustin de Ahumada have been described by Tunnell and Ambler (1967: 63-64, 69-70), one brass, and the other iron. So, both the rider and his horse were protected from evil.

The Tubac example, a right hand, has a raised ridge around the wrist, produced by carving away the surrounding surface. An incised line across the back of the hand is used to represent knuckles. The talisman measures 2.4 cm in length, 1.1 cm in width, and 0.7 cm in thickness. It has a hole for stringing which runs through the long axis of the wrist just above the raised edge. The diameter of the hole is 1.5 mm. The piece was found associated with the structure exterior, southwest.

Tobacco Pipes

Only two clay-pipe fragments were recovered at Tubac. This is strange since clay pipes were both inexpensive and fragile. These fragments represent pipes manufactured by English firms (Fig. 72:a, b).

The first specimen is a red clay-bowl fragment. It is a pillar-molded or fluted type which became common in England and the United States in the late 18th century and continued in favor into the 19th century (Noel Hume 1972: 307). The bowl sherd may correspond with Hume's Type 21 (1972: 303), placing it in a 1780 to 1820 context. It was found in Room 2 floor fill from the Early period.

The second item is a stem fragment of white kaolin recovered from plaza use-area floor fill from the Middle period. While many ways of dating pipe stems have been postulated (Binford 1961, Eaton 1962, Irwin 1959), applying these techniques to a sample of one cannot be fruitful. It is very likely that the Tubac stem dates to around 1800, based on Harrington's (1954) chart for hole diameters.

As such pipes were generally "manufactured, imported, smoked, and thrown away, all within a year or two. . ." (Noel Hume 1972: 296), it is unfortunate that a larger sample was not recovered for analysis.

Toys

Included in this section are items which can be interpreted to be children's playthings. The majority of 18th- and 19th-century toys were miniature versions of well-known objects, whose dating criteria can generally be applied to the small replicas (Noel Hume 1972: 313). At Tubac, however, this was not the case, and only more general classes of toys were recovered: parts of China dolls and marbles.

China-doll fragments are fairly common childhood relics encountered in historical sites. Three doll arms, each representing separate toys, have been analyzed. The first (Fig. 72:c) is of white solid bisque, fairly straight, and 24 mm long. It had been anchored to the doll body at one time by threads sewn around an applied loop, situated on the inner shoulder. The thumb is clearly defined, indicating it is an early example, mid-19th century. It was recovered from Middle-period Room 8 floor fill. Two other bisque arms are bent, one solid, and the other hollow-cast and tinted a flesh color (Fig. 72:d, e). Doll limbs became bent and "naturalistically infant" (Noel Hume 1972: 318) starting near the end of the 19th century. These two specimens were recovered from Late-period trash pits.

A total of 18 marbles were recovered at Tubac. Nine of these were of the spherical clay type. In the last part of the 19th and early 20th centuries the practice of baking clay-sphere marbles was begun in Europe and the United States. Clay marbles were commercially produced in the United States from 1884 until the end of World War I (Randall 1971: 103). These marbles ranged in size from 1.3 cm to 2.5 cm, and generally occurred in the following opaque colors: blue, green, purple, pink, or white. Examples from Tubac (Fig. 72:f, g, h, i, j) are white, pink, and blue in color, with diameters of 1.3 cm to 1.8 cm. All occur in Late-

period trash contexts of structure exterior, southwest, Room Outlier 1, and the plaza.

Glass marbles were made by hand for many years before being first produced commercially in the United States in 1880 (Randall 1971: 104). The nine specimens from Tubac are mostly fragmentary, and in a battered condition. It will have to be assumed, therefore, from the opaque appearance of the glass, that most, if not all, are machine made (Fig. 72:k, 1, m, n). Criteria used in distinguishing hand- and machine-made marbles can be found in Randall (1971: 10)4-105). Marble-making machines were not in operation until 1901, in Ohio, and a vast array of designs were soon being produced. Color types at Tubac include red, brown, opaque white, blue, and green, yellow, blue, and brown swirl patterns. Diameters of whole specimens range from 1.6 cm to 2.2 cm. Glass marbles were recovered from Late-period trash and structural-debris levels. Areas include Room Outlier 1, plaza, structure exterior, southwest, and Rooms 2, 5, and 7.

Miscellaneous Items

A number of miscellaneous artifactual materials were also recovered at the site. Included here are leather, cloth, graphite, chalk, and slate. The leather recovered at Tubac came from Middle- and Late-period proveniences, mostly in Room 12 and the plaza. Eighty-one of the collected pieces are quite small and cannot be identified. The remaining fragments consist of shoe leather. This sample can be classified as follows: 27 pieces of shoe leather; 7 pieces of sole; and 1 heel. Two soles contain wire nails which had been driven into the sole and upper leather, and then headed. This technique of shoe-nailing by machine occurred between 1800 and 1880. Another artifact is from a ladies' shoe with a square, high heel. The sole is fastened to the upper leather with small iron nails, dating its manufacture after 1812 (Fontana and Greenleaf 1962: 105). The heel appears to have metal nails, and is probably made of vulcanized rubber. Absolutely no leather was recovered from early contexts. A small bit of cloth was found in a late trash pit.

Items which could be included in a writing assemblage were also recovered: graphite, chalk, and slate. Of eight small pieces of graphite found, six were from Late-period trash contexts; one was from Middle-period plaza floor fill; and one piece was found in Early-period Room 11 floor fill. Chalk fragments

include white and gray limestone varieties: seven from Late-period trash and one from Early-period use-area contact. Ninety-eight sherds of slate were recovered, with the vast majority occurring in Late-period Room 12 trash.

Chapter 6

NON-ARTIFACTUAL MATERIALS

Sea Shells

A total of 35 shell fragments were collected at the site. Shell occurred in various levels, and was most abundant in Middle- and Late-period contexts. Room 4 was a consistent recovery area. Represented in the Tubac sample are salt-water clam and oyster. Only one species of clam could be identified, Laevicardium elatum, a cockle shell which ranges from San Pedro, California, to Panama. While these bivalves are regularly eaten in Europe, they have not been used for food to any extent in this country (Morris 1966: 23, 25), at least not in modern times.

Peach Pits

Excavations at Tubac uncovered 21 peach pits, again mostly from Middle- and Late-period proveniences. After the Mexican takeover in 1821, several types of fruits were introduced at Tubac. Peaches were the major orchard crop grown, and evidently produced quite well (Dobyns 1959: 577). This orchard continued to provide fresh fruit in later years to occasional parties traveling through the area.

Corncobs

Only four partial corncobs were found at Tubac. Three of these came from an Early-period trash pit in Room Outlier 1; the remaining cob was found in Room Outlier 2 Middle-period, post-occupational fill. During the Spanish colonial period, the basic diet of the frontier residents consisted of cereal products made from staple grains of maize and wheat (Dobyns 1959: 361). The cultivation of cereal grains continued during the Mexican occupation. Racial identification of the cob fragments was not possible because of their small size.

Smelting Refuse

At Tubac were found 958 pieces of coal slag, 83 pieces of copper oxide, malachite or chrysacola, and 13 pieces of slag and copper oxide which had been fused together. These objects are taken to indicate smelting in the vicinity of the Tubac presidio.

The slag and copper oxide are found distributed throughout nearly all provenience units at the site, although only seven percent were found in Early-period contexts. About half the specimens were found in Middle-period associations, and the remainder were found in Late-period or disturbed contexts. No spatial clustering is apparent.

Interpretation of this phenomenon is difficult. Sporadic mining is reported in the area near Tubac from the middle of the 18th century until the 1830s (Dobyns 1959: 318, 490, 579), after which the works were abandoned (Dobyns 1959: 617). The Sonora Exploring and Mining Company opened new operations, based at Tubac, in the 1850s, but there is no indication of ore-processing or smelting operations at the headquarters proper, either in historical documentation or in the archaeological record.

It may be that a small-scale smelting facility operated nearby during the early 19th century and used the occasionally abandoned presidio as a dump for smelting refuse.

Chapter 7

DATA INTEGRATION

Spatial Organization

Within an archaeological site, the structural features and the pattern of artifact distribution indicate the functional divisions and the uses of spatial units. Even isolated artifacts, when functionally defined, are useful as activity indicators, but for greatest utility this concept must be elaborated. This introduction will advance some of the concepts and procedures used in interpreting the use of space at Tubac.

Consider first the term function. Linton (1936: 404) developed a ramified way of viewing the function of cultural elements and chose to distinguish between functions and uses. We make no such distinction, and prefer the more rudimentary definition offered by Pye (196)t: 10), who describes function as "what someone has provisionally decided that a device may reasonably be expected to do at present." For us, a "device" becomes an artifact, and the emphasis is on provisional decisions.

Once artifacts have been assigned to functional classes, those classes with similar functions can be grouped into hypothetical activity sets. This term is used by Struever (1968: 287) to indicate the spatial clustering of artifact and feature types. An example of an activity set at Tubac is the food-processing activity set, which is composed of milling stones, utility cutting and scraping tools, and storage containers. This activity set can be combined with associated sets such as the food-preparation and consumption-activity sets, comprised of cooking vessels, plates, and eating utensils to form a larger category of activity which we might call domestic activity or household-maintenance activity sets.

Finally, given sets of activity indicators, the pattern of artifact distribution within the site is inspected for associations and clustering. However, to insure that these associations are in fact indicative of activities carried on at particular locations, we must resort to another set of concepts.

Following Schiffer (1972), with some modification, we take it that primary-refuse locations are those places where objects were abandoned or discarded at the locus of use; in this case, plaza and use-area floors and floor fill, and room floors and floor fill.

There are obvious difficulties in dealing with the above concepts. Problems include establishing occupational contemporaneity, confirming refuse-location types, and comparing excavation units of different sizes.

In addition, at Tubac we found that there were few primary-refuse locations remaining from the Late period (1850-1900). The Late-period manifestations, being stratigraphically highest, were consequently the most disturbed. The upper levels in Rooms 9 and 10, for example, were removed in their entirety, presumably during barro-pit operations. In addition, the plaza contexts were often confused by surface disturbance, and many artifacts were excluded from the sample for this reason.

We also found that our sample size was very small. Only 461 functionally distinct artifacts, some two percent of the total number of artifacts, were found in primary-refuse contexts. The small size of the samples, when distributed through 150 years of occupation, precludes tests of statistical significance. In any case, it would have been difficult to devise a test which would quantify the difference between, for example, two metates in one location as opposed to several bullets in another. What has been done instead is to rely on the often maligned subjective element for interpretations. A record of the data used for these interpretations follows. Details of the locational contexts can be found in other sections of this report.

The Data

Criteria used for assigning functional classes will be found in the section on artifact description. For this section only those artifacts which are functionally distinct have been recorded, and scrap metal, scrap glass, ceramic-vessel body sherds, and unidentified artifacts have been excluded from the sample. Distributions are given in Table 6.

Table 6

Artifacts in Primary Refuse Contexts

	Early Period (1750-1800)	Middle Period (1800-1850)	Late Period (1850-1900)
Room 1:	1 knife, 5 cooking/ eating-vessel rim sherds	1 storage-vessel rim sherd, 1 button, 1 nail, 1 iron bar	4 storage-vessel rim sherds, 2 cooking/ eating-vessel rim sherds, 2 bullets
Room 2:	1 knife, 2 storage-vessel rim sherds, 10 cooking/eating-vessel rim sherds, 1 smoking-pipe fragment		3 storage-vessel rim sherds, 1 cooking/ eating-vessel rim sherd, 1 bottle base
Room 3:	1 storage-vessel rim sherd, 7 cooking/ eating-vessel rim sherds, 1 gunflint	1 knife	
Room 4:	2 metate fragments, 1 cooking/eating vessel, 1 bottle base, 2 iron bars, 2 lead seals	1 scraper, 5 storage-vessel rim sherds, 1 bottle base, 4 cooking/ eating-vessel rim sherds, 1 shell pendant, 1 gunflint	
Room 5:	1 storage-vessel rim sherd, 4 cooking/ eating-vessel rim sherds, 1 button, 1 gunflint		2 cooking/eating-vessel rim sherds
Room 6:	1 knife, 1 scraper, 1 storage-vessel rim sherd, 7 storage/ eating-vessel rim sherds, 1 chocolate-jar handle		
Room 7:	4 storage-vessel rim sherds, 7 cooking/ eating-vessel rim sherds, 1 thimble	1 storage-vessel rim sherd, 1 eyeglass fragment	1 storage-vessel rim sherd

Room 8:	6 storage-vessel rim sherds, 9 cooking/ eating-vessel rim sherds, 2 nails		1 bottle base
Room 9:	1 bone tool	1 projectile point	
Room 10:	1 storage-vessel rim sherd		
Room 11:	8 storage-vessel rim sherds, 1 cooking/eating-vessel rim sherd, 1 iron staple, 1 piece of iron wire		
Room 12:	1 scraper, 1 cooking/ eating-vessel rim sherd	2 storage-vessel rim sherds, 1 metal can, 1 metal cap, 2 cooking/ eating-vessel rim sherds, 1 straight pin, 2 buttons, 8 nails, 2 horseshoes	2 cooking/eating-vessel rim sherds, 1 bullet
Room Outlier 1	1 mano, 1 knife, 11 storage-vessel rim sherds, 15 cooking/ eating-vessel rim sherds, 1 spoon handle, 1 shell bead, 1 nail, 1 projectile point, 1 lead seal	1 mano, 1 knife, 1 storage-vessel rim sherd, 1 nail	
Room Outlier 2	1 metate, 1 knife, 12 storage-vessel rim sherds, 23 cooking/eating-vessel rim sherds, 1 nail	7 storage-vessel rim sherds, 8 cooking/ eating-vessel rim sherds, 3 nails	
Structure exterior northwest		2 storage-vessel rim sherds	

Structure exterior southwest	3 storage-vessel rim sherds, 4 cooking/eating-vessel rim sherds, 1 projectile point	1 shell bead	3 bullets
Plaza:	1 knife, 2 metate fragments, 7 storage-vessel rim sherds, 23 cooking/eating-vessel rim sherds, 3 nails, 1 screw, 1 projectile point, 1 bead, 1 horseshoe, 1 piece sheet lead, 1 piece exotic stone	1 mano, 1 metate, 1 knife, 1 scraper, 47 storage-vessel rim sherds, 6 metal cans, 3 bottle necks, 3 bottle bases, 42 cooking/eating-vessel rim sherds, 1 buckle, 1 shell bead, 1 smoking-pipe fragment, 19 nails, 1 screw, 1 washer, 2 projectile points, 1 bullet, 1 rivet, 1 higo (jingler), 1 horseshoe, 1 piece exotic stone	8 storage-vessel rim sherds, 2 cooking/eating-vessel rim sherds, 1 bottle base, 1 bullet

The Use of Space

Early Period (1750-1800). Storage and preparation of food was centered in the southwest and northwest corners of the structure, specifically in Rooms 1 and 2 and Rooms 7 and 8. Room 6 may have served as a kitchen. In addition, a great deal of storage and food preparation occurred in extramural areas, especially in Room Outliers 1 and 2 and to a much lesser extent, in the plaza. The function of other rooms is unclear, but Room 11 may have served as a generalized storage room, and the remaining rooms may have been used as sleeping quarters. Artifacts reflecting other aspects of spatial use are few in primary contexts, but it is inferred that most work such as maintenance of buildings and equipment occurred in extramural areas.

Middle Period (1800-1850). Storage and food preparation took place in Rooms 4 and 12 and to some extent in Room Outliers 1 and 2, but the bulk of storage and food preparation centered in the plaza, especially toward the northern and east-central areas. As in the Early period, maintenance and military-related artifacts are found mostly in extramural areas. It is likely that Rooms 5, 6, 10, and 11 either remained unoccupied after the initial abandonment, or

were the first areas abandoned during the Middle period. In evidence, all of these rooms have Middle-period trash-fill levels superimposed on their floors.

Late Period (1850-1900). Artifacts in primary context are scarce for this period, but we suggest that once again the southwest and northwest corners, Rooms 1 and 2, and Rooms 7 and 8 of the structure were used for storage and food preparation, along with the plaza. A number of bullets for military weapons were found in and around Room 1, suggesting that this room was used at some time during the later occupations as a storeroom for munitions. It is likely that the remaining rooms and the room outliers were not reused during the Late period, except as areas for dumping trash.

Interpretation

At Tubac space was used differently at different times. There was a shift in emphasis from room outlier or extramural-centered domestic activities to plaza-centered activities, and eventually no extramural areas were in use. Interpretation of this trend is difficult. We would have expected quite the opposite since both the Spanish intruders and the indigenous populations in the area at the time of historic contact were familiar with interior-focused structures. Plaza-directed walled compounds or enclosed multi-unit dwellings were architectural styles common to both groups (DiPeso 1953: 136-1)41, Fig. 34; DiPeso 1956: Figs. 17, 19). Interpretation involving differential activity types is unsatisfactory, since the assemblages both in the extramural areas and in the plaza are functionally diverse and similar to one another in composition.

An equally unsatisfactory interpretation would have it that, whatever the reason for extramural activity in the Early period, increased raiding by Apaches in the Middle period, after about 1800, caused the residents of Tubac to conduct more of their affairs within the confines of the military post. However, this notion is unattractive on two counts. First, there is no reason to believe that the mere amplification of an existing threat would cause any such disruption in behavior patterns. Second, the presidio complex, at least as we understand it, seems not to have been particularly well suited for defense.

An alternate interpretation deals with social differentiation. It may be that the original occupants of the presidio were more concerned with the dichotomy between administrators and servants than were later occupants, and required that domestic activities take place outside the administrative precinct.

Another similar interpretation would hold that during the first occupation, the functional quality of spatial units was more riddidly defined by the occupants. The plaza may have been used solely for military or administrative purposes, while the exterior of the structure was relegated to domestic activities.

Another change through time is in the preference for using certain rooms rather than others. We believe this reflects the steady decline in the integrity of the structure at Tubac. Rooms were progressively abandoned until only the southwestern and northwestern rooms were in use. We presume that during the various periods of abandonment rooms, one after another, fell into such disrepair that restoration was too costly to contemplate. The rooms were instead used as trash receptacles. The continued use of corner rooms may be accounted for by the greater structural stability inherent in intersecting corner walls. Simply put, the corner rooms were occupied until the end because they were less effected by neglect than other rooms and were consequently easier to maintain.

Subsistence Economy

By the time of the founding of the Tubac Presidio in 1752, substantial alterations had occurred in subsistence economy along the Sonoran frontier. Contemporary accounts have it that, by the mid-18th century, stock herding had become a dominant part of the subsistence strategy among both indigenous populations and Spanish intruders alike (Bolton 1948; Treutlein 1949). In addition, such crops as wheat, barley, sugar cane, and melons were added to the existing native crops of corn, beans, and squash (Treutlein 1949).

At Tubac, there was ample irrigated farm land, but farming is thought to have been carried on in a desultory fasion, even though agricultural settlement was encouraged (Dobyns 1959: 316, 416). Whatever the source of supply, troopers of the Spanish garrison were supplied with quantities of corn, wheat, chile, beef, mutton, and salted meat. Garrison rations were supposedly standardized after Rub's inspection tour in 1766 (Dobyns 1959: 362; Kessell 1970: 178).

Sporadic ranching and farming continued with varying degrees of success throughout the remaining periods of the site's history. Tubac was surrounded by natural grass pasture on the uplands for livestock; the irrigable river bottom lands provided a large area for cultivation (Dobyns 1959: 577-578). During the Mexican Garrison's occupation orchards were established. Wild game obtained through trade is thought to have been of importance (Dobyns 1959: 577-580).

The scarcity of non-faunal food remains in excavated collections hampered the reconstruction of subsistence activities. Only 21 peach pits and four corncobs were recovered. All of these specimens were found in Middle (1800-1850) or Late (1850-1900) period contexts, with the exception of three of the corncobs which came from an Early-period (1750-1800) trash dump.

However, animal remains were in good supply and have been subsequently analyzed. While not doing full justice to the faunal analysis, some generalizations about subsistence at Tubac are presented. A detailed report on faunal materials is available in the Appendix.

From the Early-period depositions over 95 percent of the specimens are of domestic animals, especially bovids, pigs, and fowl. One trash concentration of the 13 found for this period yielded bones of a diverse assemblage of exotic fauna including goose, crane, cormorant, and fish, in addition to the standard domestic animal remains. No shellfish were recovered from Early-period contexts, and wild-game remains were limited to wild fowl and small animals.

From the Middle period the majority of bone specimens are of domestic bovids, especially sheep, and pigs, a smaller proportion of domestic fowl being evident at the site. Some marine bivalves were present, and remains of wild game, both large and small, constitute a minor proportion of the total number of faunal specimens.

Domestic bovids and pigs are more prevalent during the Late, post-1850 period. Similarly wild-game remains form less than five percent of the total sample. Some marine bivalve shells are present in contexts dating from this period.

To summarize, while animal remains are abundant at Tubac, botanical food products are almost nonexistent in the archaeological record. Only a few specimens of corn were found, in Early- and Middle-period levels. The peach pits were associated with Middle and Late contexts, as were the marine shells. There is definitely an increasing trend from early to late for consumption of bovids and pigs. A similar increase holds true for diminished popularity or availability of domestic fowl. Wild game was never consumed in large amounts at the Tubac presidio and bones of these animals account for less than five percent of the total number of faunal specimens.

In comparison, at a Spanish presidio in Texas (Tunnell and Ambler 1967: 98-101), similar faunal distributions are reported. The majority of the collection

comprised bones of large mammals of the size of cattle or bison. Wild animal bones are lacking with the exception of some possible deer and turtle remains.

A similar situation is described for the village of Quiburi. DiPeso (1953: 237) notes, "The bone material from Quiburi consisted for the most part of remains of domesticated animals, which would indicate that the eating of domesticated animal flesh took precedence over the eating of wild animal flesh after the coming of the Spanish."

In conclusion, we posit that the subsistence economy at Tubac was one devoted to ranching, and, to a lesser extent, to farming. Domestic animal production became more important through time, although the hunting of wild game was never of paramount importance. The reasons for the sudden changeover from wild to domestic animals by native populations has been discussed by both DiPeso (1953: 275) and Deetz (1963). They have suggested that the lack of undomesticated animal remains in European contact sites is a sign of early acculturation. The introduction of Spanish culture resulted in a subsequent decline in indigenous hunting practices, as the new and easier food procurement methods were accepted.

At Tubac, this hypothesis is supported. Although according to Dobyns (1959: 580), there was a "great abundance of wild game in the Santa Cruz Valley near Tubac. . .," this natural resource was not exploited by the residents of Tubac to any extent. The scarcity of wild-game remains also suggests that friendly Papago and Apache who settled near the fort had also adopted a domestic food supply. The mechanisms involved in this early acculturative change are to be discussed later.

Communication and Transportation

Communication and transportation reflected the direction that acculturation and adaptation took at Tubac. These systems served to restrict the adoption of non-indigenous materials by the native peoples. The Spanish were not able to supply provisions to remote areas at economical costs. The scarcity of goods and equipment on the northern frontier was a serious problem for its entire population, especially the Spanish and Mexican settlers accustomed to having these necessities.

Historical records indicate that a number of presidial supply systems were tested by the Spanish, usually resulting in mismanagement and fraud. Initially,

enlisted men received an annual stipend of three hundred pesos each, paid either in cash or treasury warrants (Warner 1966: 12). With these funds, the troopers could purchase necessary provisions wherever cheapest. Unfortunately, this method left the soldiers at the mercy of local merchants who were, for the most part, free of price controls (Moorhead 1961: 53).

During the 17th century, another method of presidial supply was formulated. Centralized paymasters now "collected the salaries of presidio soldiers in Mexico City, purchased goods there, and conducted supply caravans to frontier garrisons. . ." (Warner 1966: 12). Troops were then paid half in cash and half in provisions, and at times received only material goods as their wages. Even this system of distribution proved to be fraudulent as officials constantly marked up prices. Finally, in 1729, uniform price lists were established under a set of Reglamentos, but these were merely ignored (Moorhead 1961: 32).

The 18th century plan made presidial commandants the principal suppliers of manufactured goods for garrison soldiers and local citizens. The captains worked through merchant-suppliers in Mexico City who purchased needed supplies for the outposts with annual salaries. These provisions would then be distributed to the troops at the garrison forts. Soldiers were now paid only in goods, for which presidial commanders were able to charge excessive prices (Warner 1966: 13). Individual troopers were soon in debt because of overspending, and were financially obligated to their captain.

It was under this system that the Royal Fort of Saint Ignatius was placed after its conception in 1752. The trooper entered this closed commercial network the day that he enlisted. Upon entering the Tubac Company, the soldier was supplied with "a complete outfit of arms, body armor, saddle, bridle and other horse gear, six good horses, and a uniform" (Dobyns 1959: 198). However, he was expected to pay off his debt for this gear within his first year of service if possible. The trooper's pay went not only to his own arming and outfitting, but also to the clothing and maintenance of his family.

The garrison soldier was forced to augment his meager payroll salary by other agencies. Spoils of war were another source of income. Booty such as foodstuffs, weapons, and clothing was distributed after each successful campaign (Dobyns 1959: 203). This additional compensation proved to be a considerable motivation for service in presidial companies.

When desperate for supplies, the soldiers resorted to illegal trade with the Indians, at times with hostiles. This traffic flourished even though penalties were often severe. As a consequence, the indigenous population was able to receive imported goods such as guns, ammunition, and other hardware (Warren 1966: 11). The trade of arms for such provisions as food and clothing exhibits the deficiencies in the methods of presidial supply.

The Marqués de Rubí reported after his 1766 to 1768 inspection tours that the chief source of discontent among the garrison soldiers was the practice of receiving provisions instead of cash as payment (Moorhead 1961: 33). Later, the Reglamento of 1772 forced presidial commanders to withdraw completely from purchasing supplies for their companies. The job was placed in the hands of an elected paymaster. Mismanagement at the hands of elected officials resulted in a number of bankruptcies, often leaving the troops short of food, clothing, and ammunition (Moorhead 1961: 3)4).

Since this method of supply also proved to be faulty, it was replaced in the 1780s by a private contract system. At the first of each year a merchant, under contract stipulations, would collect a list of goods needed by the families of the presidio. This list was then sent to agents located in Mexico City, Puebla, and Vera Cruz, who purchased and shipped the goods up the Camino Real to the fort (Barnes and May 1972: 20).

All of the numerous changes in the presidio supply system brought about little improvement on the frontier. Freighting was still a very profitable enterprise, with rates often tripling before goods reached their final destination. Presidial soldiers just could not obtain imported goods at economical prices.

After Tubac was established in 1752 yearly caravans of provisions from central Mexico reached the area to support the troops and local residents. The main supply route for Sonora at this time was by way of Guadalajara and up the west coast of Mexico (Caywood 1950: 92). Since much of the terrain was too difficult for wagon wheels to handle, supplies and goods were transported by mule train.

A number of factors therefore limited the adaptation to non-indigenous materials and design by the native population. These restrictions, which also hampered the lifestyle of the intrusive groups, resulted from the failure to develop reliable communication and transportation networks. First, mismanagement

and fraud in the various methods of supplying the frontier resulted in exorbitant prices and frequent shortages of goods. Even when goods were available, caravans only reached Sonora once a year with provisions. This was a long wait for needed items. Next, these goods had to be transported by mule packs, which created many shipping difficulties. The size and weight of any item ordered had to be limited.

And these problems did not only affect the Spanish occupational periods. During Mexican sovereignty, supplies still had to be packed long distances since many items could not be produced on the frontier. Even as late as 1852, the Tubac garrison had to rely heavily on imported supplies shipped up from the south.

The question is how did the site occupants react to this limited access to goods and materials. Their response to the adverse situation gives an indication of the interactive processes at work in Tubac. We know that between 1752 and at least 1774, the site household was inhabited by the two post commandants, Belderrain and later Anza. These were wealthy men of noble Spanish heritage, and it is unlikely that the factor of cost could have affected them to any extent. Cost again became an influencing factor after 1787 with Pima Company and Mexican occupancies. Overall the availability of imported products affected everyone.

In general, it can be said that frontier residents did not accumulate much in the way of material belongings. This has been verified by the archaeological record at Tubac, especially for the periods prior to 1850. There is a significant correlation between the development of reliable routes of communication and transportation and the quantity of non-indigenous goods present at the site.

During the 1750 to 1800 period of occupation, supply trains were supposed to reach the frontier once a year with manufactured goods. Yet mismanagement and fraud often resulted in shortages of needed provisions. Even when available, a number of products were made inaccessible to the common settler by prohibitive shipping costs and transportation difficulties.

The presence of imported goods in the Early-period levels indicates a certain level of prosperity. As already noted, cost would likely not have been a major concern of Commandants Belderrain and Anza. But receiving desired items was still no easy task.

Trade conditions changed only slightly for the better during the Middle period (1800-1850). Private enterprise handled the problems of frontier supply, but the same restricting factors were still present. Provisions still had to be shipped long distances. While the cost of shipping was lower because of better

management, the residents of the presidio were no longer members of the affluent nobility. The Mexican government also had trouble with its payment system during this period. So, fewer assets were available for imported purchases. Another impediment was Apache harrassment. Supply trains bringing goods to the remote outposts were a prime target of the Indians.

But Mexican products were reaching the frontier in increasing numbers, since, overall, new lines of transportation were opening up in all directions. Trade goods were still, for the most part, coming up the Santa Cruz River, even though military support was poor after the Mexican Revolution. The existence of this material signifies that the area was still isolated from European and American markets. A small influx of English wares, such as ceramics, however, first as contraband, and then as legal trade, began to appear.

The Late period (1850-1900) saw a development boom of reliable routes of communication and transportation, resulting in a tremendous increase in available trade goods. After the Gadsden Purchase in 1854, the Southwest was finally completely opened up to the European and American trade network. With availability, the better-made and more inexpensive English and American manufactured products began to supplant the Mexican market. American interests started to penetrate the area almost immediately after the treaty was ratified. As Poston reported for Tubac in 1855, "and traders from Sonora, New Mexico, and California came to supply all our wants. . ." (Browne 1974: 254).

Not only were new and better trade routes present, but more economical means of transport were also available for use. For instance, wagons could now be used to transport goods to Tubac, thus bringing into the household inventory a larger array of materials which were not available by pack mule. The introduction of the railroad was probably the most important factor influencing southwestern buying habits at this time. Freight could be shipped along numerous supply routes to Arizona from cities such as San Francisco, New York, Denver, Austin, and Salt Lake City (Hinton 195)4: 372-373). Connections with Tubac could always be made by freight wagon and stage lines. Costs to the consumer were greatly reduced, and deliveries quicker and more reliable, because of this transportation advance.

Progress was also being made with reference to mail communication. Hinton (195)4: 374) indicates that the principal mail routes had been tri-weekly, but "from July 1st, 1878, they will be daily. . . ." Therefore goods could also be

ordered now from a number of American catalogs of manufactured goods. This also greatly increased the range of products available to frontier residents. And since these goods were generally mass-produced, cost was not a restricting factor.

Examples from the archaeological record at Tubac will be used to verify this correlation between development of reliable communication and transportation routes and the quantity of non-indigenous goods present at the site. As stated previously, the small size of the meaningful artifact sample in relation to Tubac's 150-year occupation span precludes tests of statistical significance. However, an attempt will be made to utilize ratios to demonstrate the progression of the imported artifact inventory at the site in response to advances made in the trade network.

Ceramics

While the poorer settlers at Tubac purchased or traded for northern Piman ceramic wares, the captain's residence displayed imported earthenwares and porcelain as well. The quantity of this material is small, however. The proportion of indigenous to non-indigenous ceramics was ten to one during the Early period (1750-1800). The local wares were cheaper and more accessible during these years.

The Middle-period (1800-1850) ratio is still rather large, being twelve to one. However, after 1800 an influx of English wares into the household inventory is evident. Between 1800 and 1900, there was a steady increase in the importance of these inexpensive and well-made tablewares to frontier residents. Supply restrictions still curtailed the presence of imported wares in any numbers, but the network was beginning to establish itself. While only a small percentage of the non-indigenous ceramic assemblage occurred in Early levels, this figure more than doubled in Middle-period contexts.

By the Late period (1850-1900), the competition offered by the popular English wares outclassed both the products of Mexico and of the local Pimas. The southwestern market was flooded with English ceramics at this time. The ratio of indigenous to non-indigenous ceramics dropped to five to one and over half of the total sample occurred in Late proveniences.

Glass

Objects of glass were rarely available on the northern frontier. Glass was not suited to long trips by mule train, and its procurement would likely have been an expensive matter. During the Early and Middle periods, sturdier earthenware vessels were used in lieu of glass containers. After 1850, because of advances in the transportation system, railroad and wagon routes, glass products are more evident in the artifact assemblage. For example, when bottles or bases from undisturbed contexts were tabulated, the following proportions were discovered: Early, 1 item; Middle, 7 items; Late, 17 items.

Metal

The same results hold true for this category. Very few objects of metal were found, relatively speaking, in Early- and Middle-period proveniences (Table 7). If calculated as percentages, 4 percent of the assemblage occurred in Early, 11 percent in Middle, and 85 percent in Late contexts.

Table 7

Relative Numbers of Functionally Distinct Metal Artifacts

	Early	Middle	Late
		items - - -	
Food containers, utensils	4	27	185
Domestic	1	2	9
Personal accessories	0	4	9
Hardware	22	37	417
Horsegear	2	8	8

Two other implications tested for in the artifact sample have also proven to be true as far as Tubac is concerned. In the first place, indigenous goods were used chiefly for those commodities which were excessively fragile, bulky, or otherwise difficult to transport easily. This situation was regulated by the status of the supply system during the different occupational periods.

For example, the assemblage of artifacts recovered from Early- and Middle-period contexts indicate that the residents were utilizing lithic and worked-bone tools. Flake tools are concentrated in these proveniences, and were evidently rarely used after 1850. Before 1850 pack trains were not able to transport so heavy and bulky an item as metal in any quantity, so needed implements were manufactured from the available indigenous materials. By the Late period, better quality tools of iron replaced stone and bone types in frequency.

Fragile glass products were also a difficult item to transport easily. No household glass like tablewares or jars were recovered from Early-period levels; and only five items could be identified from Middle contexts. The scarcity of bottle glass in these proveniences has already been noted. In general, objects produced of indigenous materials were used as replacements. The household residents usually used native ceramic tablewares and storage vessels. These were durable, inexpensive, and could be replaced easily if broken.

Since metal was difficult to transport, the food preparation and consumption artifactual component is also basically indigenous. Cooking pots were almost exclusively comprised of locally made plain and red ceramic wares, as utensils probably were. The Early-period metal-tableware inventory consisted of one pot handle, two patches, and one spoon handle. The situation improved only slightly in Middle-period levels.

The second test implication is related to the first and involves the use of non-indigenous goods for all commodities which were easily transportable, given the state of the communication networks at any one time. A number of small imported goods were present at the site during the periods of supply turmoil from 1752 until after 1850. This inventory includes personal accessories such as buttons and pipes, domestic paraphernalia such as thimbles, straight pins, and ornamental rickrack; and metal for several hand-forged building-maintenance supplies such as nails. In the case of these easily transported items, shipping costs were evidently a restricting factor. For instance, only 10 imported buttons were recovered from Early- and Middle-period contexts, while more than twice that number came from the post-1850 levels.

Native jars remained in the majority as household food and water storage containers. As already noted, provisions could not be shipped in glass containers. And even jars of indigenous ceramic manufacture had trouble withstanding the rigors of mule-train travel. Liquids and other goods were therefore shipped in

sturdier, non-indigenous earthenware vessels, such as the Spanish olive jar and Mexican glazed wares. However, the ratio of non-indigenous to indigenous storage-jar sherds was only three to one from the Early to Middle occupational zones. As trade lines to the south decreased after 1850, this ratio jumped to eight to one. The imported Mexican storage jars were easily transported, and evidently were favored by the local population when available.

The residents of Tubac made maximum reuse of the non-indigenous materials that were present. A number of bottle bases recovered from Early- and Middle-period contexts show excessive basal wear. Bottles, which were very scarce on the frontier, were utilized many times before finally being discarded when broken.

Metal especially was consistently recycled into new products as needed by the local occupants. Quite a few iron artifacts were hand-forged of metal obtained from this general pool, such as nails, tacks, and screws. Copper cooking pots lasted many years, since small pieces of metal patching covered any holes that developed. Even after 1850 tools were still produced from recycled materials; the chisel from the blacksmith pincer handle, for instance.

Summary

In summary, the following test implications were found to be valid for Tubac:

1. There is a significant correlation between the development of reliable routes of communication and transportation and the quantity of non-indigenous goods present at the site.

2. Local residents used indigenous goods chiefly for those commodities which were excessively fragile, bulky, or otherwise difficult to transport easily; and non-indigenous goods for all commodities which were easily transportable, given the state of the communication networks at any one time.

3. Occupants made maximum reuse of non-indigenous materials that were at hand.

These implications tend to support the original hypothesis concerning communication and transportation. The process of acculturation at Tubac was dominated by a trend towards adoption of non-indigenous characteristics by the Indian population and retention of those same characteristics by the intrusive group. The principal restriction on adaptation of non-indigenous materials and

artifact design was then availability, which was dependent on the development of communication and transportation networks.

The artifact assemblage recovered at Tubac indicates that from at least 1752 until the 1850s, frontier residents of the Southwest were purchasing inexpensive trade goods as they became available. Both the nature of the supply system and the cost of such items restricted adaptation of non-indigenous materials during these periods. Settlers were often forced to use cheaper and more accessible indigenous wares, in lieu of more popular and socially prestigious imported ones.

After the Gadsden Purchase opened up the area to American interests, the buying power of these isolated frontier inhabitants was greatly increased. More efficient supply networks and transportation methods after 1854 facilitated the increased availability of a greater range of goods at lower prices. Non-indigenous goods then began to supplant indigenous products in importance in the household inventory at Tubac.

It should be noted here that economics may not have been the only element influencing the general absence of distinct Spanish artifacts from Early- and Middle-period contexts. Another explanation involves a report uncovered by Dobyns (1959: 18). According to him, in 1849 the abandoned structure of the presidio at Tubac provided emigrants not only with a place to rest, but also with "souvenirs." As no physical disturbances could be directly related to this early scavenging, it seems likely that only surface materials were removed. Just to what extent this occurrence may have affected our sample is not known.

Sociocultural Interaction: Acculturation at Tubac

Acculturation has been defined as "culture change that is initiated by the conjunction of two or more autonomous cultural systems" (Social Science Research Council 1954: 974). It has been said that the aspect of culture which changes most readily is that of technology (Social Science Research Council 1954: 990), and that technological change is likely to have wide-reaching effects (Watson 1952: 96-97). If this is the case, the archaeologist as a specialist in material-culture correlates may reconstruct the processes which lead to acculturative change.

The Problem

Spicer (1962: 5-6) has noted that during the first 200 years of contact between the Spanish and the Indians of the Southwest, missionaries, administrators, and soldiers actively sought to replace various features of Indian cultures with elements of Spanish culture, yet by the end of the 17th century the Spaniards had done little more than lay the foundations for European ways among the Indians.

However, by the end of the first 250 years of contact, a number of Indian cultures, including those of the Opata, Yaqui, and Pima, had been fundamentally transformed, and had accepted domestic animals, metal, and certain concepts of religion and local government, among other things (Spicer 1962: 572).

Then it can be expected that, given the interactions between Spaniards and Indians at Tubac, acculturative change would have been significant by the end of the 18th century. The problem was to determine the dominant mechanism which operated in effecting these changes.

Two archaeological studies have dealt with processes of acculturation on the Spanish frontier, one concerning the mission system in California (Deetz 1963), and the other the presidial system in Florida (Deagan 1973). These studies have presented useful models for interpreting acculturative processes, and will be reviewed here. In addition, we will present a model which has specific reference to Tubac.

The Deetz Model

Deetz excavated the Mission La Purisima at Lompoc, California. This mission was built in 1812 following the destruction of an earlier structure and housed Chumash Indian neophytes. Deetz apparently assumes the mission system to be the dominant mechanism of acculturation, saying that "the decline of the Chumash under missionization was rapid, spectacular, and complete. . ." (Deetz 1963: 186). Deetz, not unreasonably in this case, equates decline with acculturation.

He then discusses differential cultural loss, as reflected in the archaeological remains. This difference he feels is due to a greater rate of loss among items which relate to male activities, such as stone tools, while female-related items, such as milling equipment and comales, remain in good supply.

Striking differences are noted between the material culture of La Purfsima and a nearby historic Chumash village which was occupied just prior to establishment of the Purisima complex. In comparison, at Purfsima there is the nearly total loss of chipped-stone and bone-tool inventories, the introduction of glass and metal artifacts, the introduction of European ceramics, and a marked change in the composition of decorative items, with shell beads becoming less frequent and glass beads becoming more frequent.

In summary one might expect, as a result of missionization, the loss of male-related items of indigenous technology such as chipped-stone tools, the retention of female-related items such as food preparation equipment, and the replacement of many artifacts such as beads with artifacts of European technology.

The Deagan Model

In distinction to Deetz, Deagan has proposed a model of acculturative process which rejects the importance of the missionary system among the Florida Indians. According to Deagan (1973: 57), "While the missionaries attempted to change certain social and religious aspects of Florida's native cultures, the technology and subsistence systems were virtually unaffected. . . ." She believes instead that it was through the process of mestizaje, the marriage or concubinage of Indian women with Spanish garrison soldiers, "that the most viable channel of exchange of cultural elements was provided" (Deagan 1973: 57). This sort of intensive extra-missionary contact between Indians and Spaniards first occurred in Florida after 1700 when Indians were relocated near the St. Augustine presidio in the face of increased enemy Indian harrassment.

In order to determine the archaeological correlates of mestizaje as an acculturative mechanism, Deagan (1973: 63) has proposed a hypothesis as follows:

"Given the interaction structure of eighteenth century Florida, acculturation was largely manifested by Indian women in Spanish or mestizo household units within a predominantly male-oriented cultural milieu." Testable implications for this hypothesis were devised, as follows: acculturation is demonstrated primarily in women's activities such as food preparation and household activities; women's crafts such as ceramics would be primarily Indian; male-related activities such as dwelling construction, military affairs, and hunting would reveal less evidence of Indian infusion; socio-technic items (see Binford 1962: 95) would

be largely Spanish; Indian elements would be increasingly absorbed into Spanish forms and functions through time.

In summary, one might expect as a result of mestizaje the loss of male-related aspects of indigenous material culture, notably items related to hunting, building, and warfare, and their replacement with artifacts and techniques of European origin. One would also expect the retention of indigenous female-related crafts and techniques, and the increasing acceptance of European technology through time.

Evaluation of Deetz's and Deagan's Models

The above models were appealed to in an attempt to discover the acculturative mechanisms which operated at Tubac. The models, taken out of context to be sure, nonetheless proved to be unsatisfactory for our purposes. Upon examination, the material-culture correlate sets which serve as hypothesis expectations are distressingly similar in both cases. Apparently, given either missionary or mestizaje mechanisms, much the same results obtain. In both cases, male-related indigenous artifacts disappear, female-related indigenous objects are retained, and items of European technology gradually supplant those of indigenous tradition.

In addition, by giving greater weight to some details, one could make a case for either missionary or mestizaje influence or, too, one could argue that nonconformity in detail indicates that acculturation did not even in fact take place.

For Tubac we proposed an alternative model. Postulates for this model are Deetz's and Deagan's assumptions that food-processing is female-related and that acculturation is revealed most readily through female-related artifacts.

The Tubac Model

Data drawn from excavations at the captain's quarters and military headquarters will be considered in discussing the acculturative process at Tubac. The occupations of interest are those of the Spanish Garrison, which was initiated in 1752, the Pima Company, and the Mexican Garrison, which ended in 1849. These occupations correspond with our arbitrarily-devised time periods Early (1750-1800) and Middle (1800-1850).

The ethnic composition at Tubac varied with time. The original settlers of the Royal Fort at Tubac were 30 officers and troops, mostly Spaniards, 19 of whom were accompanied by wives. By the terminal stage of the Spanish Garrison occupation, 22 of the 56 soldiers were Spaniards, and the remainder were mestizo, mulatto, morisco, or Indian (Dobyns 1959: 313, 347-349). In addition, many Indians, notably Pima, Opata, and Yaqui, were employed, and in some cases enslaved, at the fort (Dobyns 1959: 249-250, 258, 272).

The subsequent Pima Company group was composed largely of Pima, Yuma, and Opata, led by Spanish officers (Dobyns 1959: 440-441). Spaniards were especially encouraged to join the Pima Company at Tubac (Dobyns 1959: 478). After Mexican independence, the ethnic composition of the military post remained largely the same, although many of the officers and their families left the frontier for duty in the national or state capitals (Dobyns 1959: 597).

During the period 1752 to 1849, the intrusive culture of the Spanish was brought into conjunction with the closely allied indigenous cultures of the Pima, Opata, Yuma, and Yaqui. During the Early period there is record of much intensive interaction between these groups through marriage and concubinage (Dobyns 1959: 592), and during the Middle period it is even probable that the intensity of contact between troopers and Indians increased following the expulsion of Spanish priests in the 1820s (Dobyns 1959: 592).

In counterpoint, contact with the Spanish was hardly a new experience for the Indians at Tubac. The Northern Pima had met the Spaniard Guzman under unfortunate circumstances as early as 1530 (Bancroft 1883: 363). In addition, the Spanish missionary movement became active among the Northern Pima in the mid-17th century, and missionization of the upper Santa Cruz River Valley had begun at the end of the century (Bolton 1948: 119). By 1701 direct attempts to missionize the Indians in the vicinity of Tubac had begun, and Tubac became a visita in 1732 (Hammond 1929: 229-231). The Tubac mission farm was established in the late 1730s (Dobyns 1959: 71), but it would seem that intermarriage was not common.

To summarize, two powerful mechanisms for acculturative change operated on the Sonoran frontier. On the one hand, the indigenous occupants of Tubac had been subjected to at least 50 years of active missionization prior to the establishment of the Tubac presidio. On the other hand, intensive interaction in the form of mestizaje, marriage and concubinage between Spaniard, mestizo, and Indian, took place for the first hundred years after the presidio was established.

In an effort to establish which of these processes, missionization or mestizaje, was the dominant mechanism for acculturation at Tubac, the following proposition was formed:

> Given the historical record of intercultural relationships at Tubac, we expect that by 1750 fundamental acculturative change will have taken place among the indigenous inhabitants as a result of missionization. If this is the case, the character of the material culture assemblages will have stabilized and little change will be seen between the material culture of the presidio Early period (1750-1800) and the presidio Middle period (1800-1850). If, on the other hand, acculturative change has been minimal prior to the establishment of the garrison in 1752, significant change will be seen in the artifact assemblages between the Early and Middle periods. If this latter obtains, we posit mestizaje as the dominant acculturative mechanism at Tubac.

This proposition was examined by comparing artifact distributions through time. Artifact categories were selected which were considered most likely to reflect female-related activities and male-related activities. Food-processing equipment, including ceramics, would represent female-related activity. Flaked-stone tools, bone tools, horsegear, and building fasteners would represent male-related activities (Table 8).

Table 8

Distribution of Selected Artifacts through Time

	Number of Artifacts	
Artifact Categories	Early Period	Middle Period
Indigenous ceramic sherds	2357	6931
Ground-stone tools (milling equipment)	4	10
Flaked-stone tools	18	54
Bone tools	2	7
Non-indigenous ceramic sherds	241	552
Metal food containers and utensils	5	7
Metal horsegear	2	8
Metal building fasteners	22	31

There are obvious problems in deriving implications from this body of artifacts. With the exception of ceramics, sample size is miniscule for most artifact categories. In addition, sample-domain sizes are not directly comparable since more of the Middle-period occupation deposits were excavated than were Early-period deposits. This fact accounts at least in part for the greater number of artifacts in Middle-period associations. In spite of this, some inferences may be drawn.

It is of note that the ratio of indigenous ceramic sherds to ceramic sherds of non-indigenous manufacture remains roughly the same through time. The ratio in the Early period is about ten to one and in the Middle period about twelve to one, indicating that indigenous, female-related, domestic and craft practices were relatively stable through time and not much affected by the intrusion of European techniques and artifacts. Other female-related activities like grain milling continued from 1750 to 1850 with identical tool kits. The introduction of metal utensils had little impact until after 1850. Some of the indigenous male-related activities which involved the manufacture and use of flaked-stone and bone tools survived Spanish contact and continued unabated throughout the Early and Middle periods. Metal horsegear and building fasteners were used in the Early period, but these items gained no greater popularity through time during the first hundred years of occupation at Tubac.

In addition, while data is scanty it would seem that artifact populations unrelated to subsistence changed little through time. Shell beads occur with both Early- and Middle-period associations, while only two glass beads were found, both in Middle-period deposits. Further, exotic stone artifacts, thought to have socio-religious connotations among the indigenes, were found in both Early- and Middle-period contexts.

In summary, by the time of the Tubac garrison, established in 1752, the material culture of the indigenous Tubac residents had been altered significantly, but had also become stable in composition and relatively resistant to change. This stability is revealed in the nature of the artifact assemblages, especially those that relate to female activities.

Conclusion

We conclude that fundamental change through acculturation had occurred among the indigenous cultures of the Tubac area by the time of the establishment

of the Tubac garrison in 1752. We believe that the missionary movement was the dominant mechanism for this acculturative change, and that the mestizaje process was of relatively little importance as a mechanism for acculturation during the first hundred years of occupation at the Tubac presidio.

Caste and Class at Tubac

Significant caste and class distinctions were recognized on the Sonoran frontier during the Spanish colonial period. Castes were divided along ethnic lines, with Europeans forming a high caste, Indians a subordinate caste, and mestizos an amorphous middle group. Each of the castes was further subdivided into classes, such as upper-class Spaniards born in Spain, provincially elite criollos or Spaniards born in the New World and more closely allied with the mestizo population, middle-class tradesmen, mission Indians, slaves, and so forth (Dobyns 1959: 329-356).

Following Mexican independence this regime is thought to have changed. According to Dobyns (1959: 5)46), "one of the differences between republican and colonial Tubac was a significant diminution in caste and class differences." Among the reasons given for this caste-class leveling are the removal of the Sonoran provincial elite and the prohibition of slavery following Mexican independence (Dobyns 1959: 597-598). Also of note were the consciously egalitarian policies of the new Mexican government and the political enfranchisement of Indians in the 1920s (Spicer 1962: 396).

Whatever the reasons for the leveling process, correlates for change in the structure of caste and class were sought for the archaeological record.

The use of space at Tubac was considered first. At the risk of redundancy, it will be necessary to reiterate here interpretations made in the section on spatial organization. Briefly, during the first hundred years of occupation at the Tubac presidio (1750-1850), there was a shift from extramural-centered domestic activity to plaza-centered domestic activity, although extramural areas and rooms continued to be used to some extent for the storage and preparation of food. The original colonial occupants seem to have defined the functional quality of spatial units more rigorously than did later Mexican occupants, and may have restricted the structure interior to military and administrative purposes and required that domestic activities take place outside the

administrative precinct. This trend was interpreted to mean that the first occupants of the presidio were more concerned with the dichotomy between servants, soldiers, and administrators than were later occupants.

In addition to a consideration of the use of space, the contents of the 30 formal trash concentrations were examined. These trash pits and trash dumps were associated with the periods of Spanish colonial and Mexican occupation. Rathje (1974: 240-241) has noted that in modern Tucson high-income families waste very little in the way of food or tools; to the contrary, it is the middle-income families which are associated with the discard of useful and edible things. Unfortunately, this proposition is not amendable to examination at Tubac. Given the conditions of transportation on the Sonoran frontier, exotic and status-related items were always scarce and were dear to people of all stations. Consequently, we found no potentially useful items in formal trash deposits of either colonial or Mexican provenience.

It is conventional wisdom among archaeologists that social stratification is accompanied by differential access to goods and food. From the Tubac trash pits and trash dumps something of this difference may be seen. Thirteen formal trash concentrations of the colonial period were examined for evidence of exotic goods. Six of these trash units contained indigenous pottery as the sole ceramic element, while the other seven contained both indigenous ceramics and more expensive European-derived ceramics like majolica.

In contrast, the 17 trash concentrations from the period of Mexican occupation demonstrated different relationships. Of these trash units, only three contained indigenous pottery fragments as the sole ceramic element. Lest an overall increase in the availability of imported goods be taken into account, consider that the ratio of non-indigenous to indigenous ceramic sherds remains about the same throughout the periods in question; one to ten in the earlier period, one to twelve in the later. We prefer the interpretation that following Mexican independence, access to exotic, status-related goods increased along a broader base of the population.

Differential access to food is harder to demonstrate. The following patterns have been abstracted from Hewitt's faunal analysis (Appendix). Within the formal trash concentrations is a consistent triad of domestic bovid, pig, and chicken remains, along with some minor elements of wild game. In only one of the trash units is there a difference. A trash pit from the colonial period

contains, along with the more familiar animal remains, bones of cranes, cormorants, domestic turkeys, fish, and domestic geese. These remains indicate that only a small number of tables were graced with uncommon and expensive food, and that differential access was most pronounced in the colonial period.

The artifactual information substantiates Dobyns' argument that there was a significant diminution of caste and class differences following Mexican independence. A proposition follows, which will allow future tests of caste and class differences:

> Given strong caste and class differences, there will be status and economic differentiation, and this differentiation will be reflected by rigidly defined spatial units, differential patterns of waste disposal, and differential access to goods and food.

Implications of this proposition are:

1. Evidence of domestic activities, such as food preparation, will be confined to locations removed from administrative areas.
2. Trash deposits will differ in quality, with potentially useful items or objects able to be recycled being found in some deposits but not in others.
3. Trash deposits will differ in content, with exotic goods and food remains appearing in some deposits but not in others.

In conclusion, speculations about the use of space and the patterns of waste discard at Tubac have led to development of a proposition regarding the structure of caste and class on the Sonoran frontier. Inferences drawn from this proposition will allow comparisons to be made regarding changes in caste and class structure through time.

Chapter 8

SUMMARY

Investigations at the Tubac presidio have given us some insight into the cultural and economic base of the southwestern frontier from 1752 until after 1860. To reiterate, excavations at the site had two objectives. First it was hoped that Tubac would provide a body of data which would aid in the reconstruction of culture history and past lifeways, and, in addition, in the interpretation of human adaptation and interaction. Several hypotheses regarding communication and transportation, and acculturation were tested. A hypothesis devised on community function could not be tested because of data limitations. A hypothesis concerned with class and caste differentiation was devised by inference from the Tubac data. It was also necessary to direct excavations in such a way that the basis for an interpretive exhibit could be developed at the site.

For this reason, excavations at Tubac were concentrated within the area occupied by the headquarters building of the Spanish presidio. This U-shaped structure was built during the 1750s and housed the commandant's residence and the military headquarters for the fort. While this area constitutes only one part of an extensive site, the range of information obtainable was broad, and the problems to which this data pertains are by no means exclusively military. The Spanish royal fort, in all phases of its existence, has to be described as a domestic site, both in its activity types and architectural design.

The archaeological history of the site can be best summarized by dividing the occupational span into three arbitrarily devised temporal periods. In this way all of our accumulated data can be pulled together to form a more concise chronicle of Tubac's past. The following divisions have been utilized throughout the text: Early period, 1750 to 1800; Middle period, 1800 to 1850; and Late period, 1850 to 1900. Depositional strata were originally assigned to these periods on the basis of stratigraphic superposition and diagnostic artifact associations.

Early Period

In 1752, a garrison of 51 men arrived in the area of Tubac with the purpose of creating the Royal Fort of Saint Ignatius. The Spanish troops, at this time, probably dispossessed the Indians occupying the Piman rancherfa in the vicinity, and utilized their dwellings as temporary shelter until permanent buildings could be constructed. It was decided to build a simple utilitarian structure, combining the military headquarters and the captain's residence. Other necessary buildings such as storehouses, barracks, and the post store were erected nearby.

After the initial habitation by the Spanish, Tubac went through a brief period of abandonment. This period was soon followed by the transfer of the Pima Indian Company to the fort. For a chronological summary of the historical data on Tubac, refer to the last two pages of this section.

While the headquarters began construction under Belderrain in the 1750s, it was not necessarily completed under his command. It seems likely from the architectural remains that the presidio was built in stages, possibly being completed under Anza's supervision, after 1763. An architectural plan of the presidio structure is reconstructed in Figure 40. The command post at Tubac was U-shaped, probably remaining open on the south side. A zaguán, through the north wall, separated the military and domicile sections of the building. An interior plaza was enclosed on three sides by the structure wings. During the Early period of occupation, all 10 rooms of the captain's residence were utilized, as were the two rooms excavated in the headquarters.

In general, it can be said that frontier residents did not accumulate much in the way of material possessions. Even the presence of imported goods such as majolica, tobacco pipes, and metal hardware, for instance, in Early-period contexts indicates a certain level of prosperity, because cost and the poor supply system were both restricting factors. The artifactual assemblage shows that frontier residents were purchasing inexpensive trade goods as they became available. Settlers were forced to use cheaper and more accessible indigenous wares in lieu of the more popular and socially prestigious imported ones.

Use of Space

Storage and preparation of food was centered in the southwest and northwest corners of the structure during the Early period. A great deal of these activities

also occurred in the extramural areas, especially Room Outliers 1 and 2. It is likely that Room 6 served as the main kitchen. The function of other rooms is not clear, but Room 11 may have served as a general storage area, and the remaining rooms may have been used as sleeping quarters. It has been inferred that most work such as building and equipment maintenance occurred in extramural areas.

Subsistence

The subsistence economy at Tubac throughout all phases was one devoted to ranching, and to a lesser extent, to farming. The standardizing of troop rations in 1766, supposedly provided for quantities of corn, wheat, chile, beef, mutton, and salted meat in the diet. Unfortunately, in trying to reconstruct the subsistence base at Tubac through the archaeological record, we were hampered by the scarcity of non-faunal food remains in excavation collections. Only corncobs were recovered from Early contexts.

Animal remains are abundant at the site, however. Almost the entire faunal sample from this period is of domestic animals, in particular bovids, pigs, and fowl. Other exotic fauna such as goose, fish, and cormorant were also recovered. Only five percent of the Early sample is undomesticated.

Although wild game was abundant in the Santa Cruz Valley, this natural resource was not exploited by the residents of Tubac to any extent. It has been suggested that the lack of undomesticated animal remains in European contact sites is a sign of early acculturation, as indigenous hunting practices decline after the introduction of Spanish culture (Deetz 1963; DiPeso 1953). At Tubac this hypothesis is supported.

Middle Period

The Middle period of site occupation witnessed the reestablishment of the Tubac presidio by the newly formed Mexican government. An initial period of affluence for the local residents was soon followed by social and economic decline. Indian assaults increased over the years and led to the eventual abandonment of the town in 1849. Tubac then served as a waystation for emigrants and surveyors.

The architectural plan for this period, as seen in Figure 41, indicates that the building has already undergone several changes, with rebuilding taking place in a number of rooms. A great deal of the reconstruction may have occurred with the Pima Company occupation in 1787. As this habitational phase continued until well after 1800, associated features can be considered a Middle-period development. It is likely that most structure rooms were still being utilized, at least during the majority of this term.

Trade lines improved only slightly after 1800. But Mexican products were reaching the post in ever increasing numbers. Metal items such as food containers and personal accessories, buttons, bottles, and other imported artifacts became more frequent in the assemblage. Tubac was as yet isolated from European and American markets. We do see a small influx of English wares, ceramics for example, first as contraband, and then as legal trade.

Use of Space

The majority of storage and food preparation was centered in the plaza during this period. So there was a definite shift from extramural-centered domestic activities in the Early period to plaza-centered activities in the Middle period. Several interpretations for this trend have been offered. Maintenance and military-related artifacts were still found mostly in extramural areas. A few rooms had been abandoned.

Subsistence

As in the period before 1800, botanical food remains were again scarce in the archaeological record. Only the presence of peaches and corn could be verified. Marine bivalves entered into the sample during this era however.

The majority of faunal remains are mostly of domestic bovids and pigs. It appears that a smaller number of domestic fowl were available during this period. Wild game still played only a minor role in the subsistence economy. The absence of undomesticated animals also suggests that friendly Papago and Apache settled near the fort had adopted a domestic food source. It is apparent that the Indians were not bartering for manufactured goods with wild game, at least not to any extent.

Late Period

Tubac was again occupied in the fall of 1851, with the establishment of a Mexican military colony. A number of problems soon arose for the newly formed community, including subsistence procurement and Apache harrassment. People eventually began to drift away to other areas, until by 1854, only a few Mexican soldiers remained at the site. After the Gadsden Purchase Treaty was ratified in that same year, these troopers moved south, and the town was temporarily abandoned. The penetration of American mining interests into the area resulted in the reoccupation of Tubac by 1855. The chronological summary at the end of this section details these events.

By 1850, it is likely that a large part of the presidial structure was in disrepair, and therefore abandoned. The mining company did make part of the building suitable for habitation. As the architectural reconstruction for this period (Fig.)42) indicates, the zagudn entrance was enclosed at this time to form another room in the north wing. Late-to-modern pit disturbances have unfortunately affected large areas of the site.

The Late period saw a tremendous increase in available trade goods at the site. After the Gadsden Purchase in 1854 opened up the area to American interests, the buying power of these isolated frontier residents was greatly increased. With availability, the better-made and more inexpensive English and American manufactured products began to supplant the Mexican market. Non-indigenous goods then started to replace indigenous products in importance in the household inventory at Tubac.

Use of Space

It appears from the artifactual assemblage that once again the southwest and northwest corners of the structure were the main focus of storage and food preparation, along with the plaza. Room 1 was possibly being used as a storeroom for munitions at some time during the later occupations. The remaining rooms and outliers apparently were not reused during the Late period except as trash dumping areas.

Subsistence

Ranching still played a more important role in the subsistence economy at Tubac than farming. The only botanical remains associated with Late-period

contexts were peach pits. Marine bivalves were present, but in small numbers.

Domestic bovids and pigs are dominant in the faunal sample. Domestic animal production became more important through time, although wild game was never a great factor in the subsistence base at the site. Again, undomesticated animals form less than five percent of the total faunal sample.

Conclusions

The basic questions asked at Tubac involve problems of adaptation and of acculturation. First, in what way did the site inhabitants interact with their natural environment, and second, in what way did they interact with their cultural environment? These issues around which interpretation of our data was centered reflect the cultural and functional diversity of the site.

We specifically investigated community function, communication and transportation, and social interaction as seen in acculturation and in caste and class relationships.

Community Function

It was thought that the changing function of the Tubac community may have influenced the degree to which various resources and technologies were utilized. Unfortunately, because of data limitations, related hypotheses could not be tested at this time.

Communication and Transportation

A number of implications tested for with the Tubac data tend to support our original hypothesis on transportation. To summarize, we believe that the principal restriction on adaptation to non-indigenous materials and artifact design at Tubac was their availability, which was dependent on the development of communication and transportation networks. Thus, the process of acculturation at Tubac was dominated by a trend toward adoption of non-indigenous traits by the Indian population and retention of those traits by the intrusive group.

Social Interaction

At Tubac we tried to acquire data which would deal with the mechanisms of acculturation and with the processes of caste and class leveling. Using implications posed originally by Deetz (1963) and Deagan (1973), we tested for the

presence of acculturative change at Tubac and tried to establish which mechanism, missionization or mestizaje, was dominant. We concluded that the missionary movement was the major mechanism for acculturative change at Tubac.

The archaeological record was also examined for correlates in caste and class relationships. We accepted Dobyns' argument that at Tubac, there was a significant diminution of caste and class differences following Mexican independence. Subsequent interpretations led to the development of a testable hypothesis which will allow future investigations along these lines.

We believe that we can now accept our central research hypothesis as posed in Chapter 3. To conclude, technology and resource utilization at Tubac were directly related to the following elements: the development of networks of communication and transportation, and patterns of social interaction between cultural groups. It is likely that the function of the Tubac community was also a correlate, but this area of investigation could not be pursued with our data base.

Chronological Summary, 1700 to 1864

1701	Spanish missionary contacts established.
1730s	Spaniards living at Tubac supervise mission farm.
1751	Pima Indians revolt against Spanish authority; Pimas abandon *rancheria* at Tubac.
1752	Upper Pimerla garrison founded under Captain Juan Tomes de Belderrain.
1753	Royal Fort of Saint Ignatius formally established at Tubac; presidio and town under construction during coming years.
1754-1757	Population at Tubac reaches 411.
1759	Captain Belderrain dies.
1763	Juan Bautista de Anza assumes command of the post and purchases the captain's quarters.
1766	The Marqués de Rubí inspects the Tubac garrison; Lieutenant Urrutia takes measurements for subsequent map.
1774	Anza leads first military expedition from Sonoran to Upper California.
1776	Saint Ignatius Company transfers from Tubac to Tucson; town population decreases to 150.
1779	Troop detachment at Tubac returns to Tucson post.
1783	Tubac abandoned.
1786	New Apache policy initiated.
1787	Saint Rafael Pima Indian Company transferred to Tubac.
1788	Great Offensive brings about surrender of the southern Athapascan; frontier is pacified.
1821	Mexican independence from Spain is achieved.
1824	Post at Tubac reestablished by Mexican government; Pima Company remains as infantry.
1830s	Resurgence of Apache leads to troop desertions and a population decrease on the frontier; presidial system begins to deteriorate.
1840	Complement of 30 men on duty to protect 400 residents.

1846-1848	Apache raids increase.
1849	Full-scale Indian assault leads to abandonment of Tubac, as settlers move north.
1849-1851	Tubac serves as waystation for emigrants and surveyors.
1851	Mexican military colony established.
1852	Mormon commercial farming venture fails; Tubac forces repeatedly defeated by Apache.
1853	Peaceful Apache rancheria moved to Tubac.
1854	Gadsden Purchase Treaty ratified; few remaining Mexican troops withdraw to the south.
1855	Tubac again temporarily abandoned; Charles D. Poston visits town for mining interests; population of several hundred people gathers.
1856	Sonora Exploring and Mining Company established with Poston as superintendent; Tubac partially rebuilt.
1858-1859	First Arizona newspaper printed at Tubac; town population of 800.
1861	Federal troops withdraw; 25 to 30 people remain behind.
1864	J. Ross Browne and Poston visit deserted town of Tubac.

REFERENCES

Albert, Alphaeus H.
1973 Supplement to Record of American Uniform and Historical Buttons. By the author, Hightstown, New Jersey.

Albert, Lillian Smith and Kathryn Kent
1949 The Complete Button Book. Doubleday & Company, Inc., New York.

Ayres, James E.
1965 Memorandum to Raymond H. Thompson regarding report on trip to Magdalena, Sonora, January 30-31, 1965.

Bancroft, Hubert Howe
1883 History of Mexico: Vol. II, 1521-1600. A. L. Bancroft & Company, San Francisco.

Barber, Edwin Atlee
1908 The Maiolica of Mexico. The Pennsylvania Museum and School of Industrial Art, Philadelphia.

1911 The Emily Johnston De Forest Collection of Mexican Maiolica. The Metropolitan Museum of Art, New York.

1915 Mexican Maiolica in the Collection of the Hispanic Society of America. The Hispanic Society of America, Publication No. 92, New York.

Barnes, Mark
1971 Majolica from Excavations at San Xavier Del Bac 1968-1969. The Kiva Vol. 37, No. 1: 61-64.

Barnes, Mark A. and Ronald V. May
1972 Mexican Majolica in Northern New Spain. Pacific Coast Archaeological Society Occasional Paper No. 2, Costa Mesa, California.

Bearse, Ray
1966 Centerfire American Rifle Cartridges 1892-1963. A. S. Barnes and Co., Inc., South Brunswick, New Jersey.

Bemrose, Geoffrey
n.d. Nineteenth Century English Pottery and Porcelain. Pitman Publishing Corp., New York.

Ben , Doris W.
1949 The History of Tubac, 1752-1948. MS, Master's thesis, University of Arizona, Tucson.

Berge, Dale L.
1968 Historical Archaeology in the American Southwest. Doctoral dissertation, Department of Anthropology, University of Arizona, Tucson, and University Microfilms, Ann Arbor.

Binford, Lewis R.
1961 A New Method of Calculating Dates from Kaolin Pipe Stem Samples. MS, paper read before the Second Annual Conference on Historic Site Archaeology, Macon, Georgia.

1962 Archaeology as Anthropology. American Antiquity Vol. 28, No. 2: 217-225.

1968 Archaeological Perspectives. In New Perspectives in Archaeology, edited by S. R. Binford and L. R. Binford, pp. 5-32. Aldine Publishing Co., Chicago.

Bolton, Herbert (ed.)
1948 Kino's Historical Memoir of Pimería Alta Vol. 1. University of California Press, Berkeley and Los Angeles.

Boudreau, Eugene H.
1971 Making the Adobe Brick. Fifth Street Press, Berkeley.

Brinckerhoff, Sidney B.
1965 Metal Uniform Insignia of the U.S. Army in the Southwest, 18614-1902. Museum Monograph No. 3, Arizona Pioneers' Historical Society, Tucson.

Browne, J. Ross
1974 Adventures in the Apache Country, A Tour through Arizona and Sonora, 1864. University of Arizona Press, Tucson.

Bunting, Bainbridge, Jean Lee Booth, and William R. Sims, Jr.
1964 Taos Adobes, Spanish Colonial and Territorial Architecture of the Taos Valley. Museum of New Mexico Press, Santa Fe.

Butler Brothers
1915 The Grocer's Catalog. Chicago.

C. Sidney Shepard & Co.
1895 Catalogue of Goods Manufactured and For Sale by Them. Chicago.

Caywood, Louis R.
1950 Hispanic Pottery as a Guide in Historical Studies. In For the Dean, edited by Erik K. Reed and Dale S. King, pp. 77-97. Hohokam Museums Association, Tucson, and the Southwestern Association, Santa Fe.

Colton, Harold S.
1953 Potsherds: An Introduction to the Study of Prehistoric Southwestern Ceramics and Their Use in Historic Reconstruction. Museum of Northern Arizona Bulletin No. 25, Flagstaff.

Corson, Richard
1967 Fashions in Eyeglasses. Peter Owens, London.

Danson, Edward B.
1946 An Archaeological Survey of the Santa Cruz River Valley from the Headwaters to the Town of Tubac in Arizona. MS, Arizona State Museum, University of Arizona, Tucson.

Deagan, Kathleen A.
1973 Mestizaje in Colonial St. Augustine. Ethnohistory Vol. 20, No. 1: 55-65.

Deetz, James J. F.
1963 Archaeological Investigations at La Purfsima Mission. Archaeological Survey Annual Report, 1962-1963. Department of Anthropology and Sociology, University of California, Los Angeles.

DeJarnette, David L. and Asael T. Hansen
1960 The Archaeology of the Childersburg Site, Alabama. Notes in Anthropology No. 6, edited by Charles H. Fairbanks. The Florida State University, Tallahassee.

Weso, Charles C.
1951 The Babocomari Village Site on the Babocomari River, Southeastern Arizona. The Amerind Foundation, Inc. No. 5, Dragoon.

1953 The Sobaipuri Indians of the Upper San Pedro River Valley, Southeastern Arizona. The Amerind Foundation, Inc. No. 6, Dragoon.

1956 The Upper Pima of San Cayetano del Tumacacori. The Amerind Foundation, Inc. No. 7, Dragoon.

Dobyns, Henry F.
1959 Tubac Through Four Centuries, An Historical Resume and Analysis. MS, Arizona State Museum, University of Arizona, Tucson.

1962 Pioneering Christians Among the Perishing Indians of Tucson. Editorial Estudios Andinos, Lima, Peru.

Eaton, John
1962 Pipe Stem Dating and the Date for Silver Bluff, S. C. Florida Anthropologist Vol. 15, No. 2: 57-62.

Faulk, Odie B.
1969 The Presidio: Fortress or Farce? Journal of the West Vol. 8, No. 1: 21-28.

Fitzhugh, William W.
1972 Environmental Archaeology and Cultural Systems in Hamilton Inlet, Labrador. Smithsonian Institution Contributions to Anthropology No. 16, Washington.

Fontana, Bernard L.
1968 Bottles and History: Tne Case of Magdalena de Kino, Sonora, Mexico. Historical Archaeology Vol. 2: 45 55. The Society for Historical Archaeology, Bethlehem, Pennsylvania.

1972 The Cultural Dimensions of Pottery: Ceramics as Social Documents. Offprints from Winterthur Conference R2port 1972: Ceramics in America. The University Press of Virginia.

Fontana, Bernard L. and J. Cameron Greenleaf
1962 Johnny Ward's Ranch: A Study in Historic Archaeology. The Kiva Vol. 28, Nos. 1-2.

Fontana, Bernard L., William J. Robinson, Charles W. Cormack, and Ernest E. Leavitt, Jr.
1962 Papago Indian Pottery. University of Washington Press, Seattle.

Frank, Larry and Francis H. Harlow
1974 Historic Pottery of the Pueblo Indians 1600-1880. New York Graphic Society, Boston.

French, Charles F.
1973 American Guide to U.S. Coins. Cornerstone Library, New York.

Gerald, Rex F.
1951 A Description of a Historic Papago Redware and Its Comparison with Other Late Redwares. MS, Arizona State Museum, University of Arizona, Tucson.

1968 Spanish Presidios of the Late Eighteenth Century in Northern New Spain. Museum of New Mexico Research Records No. 7, Santa Fe.

Germe rausen, Edward
Appendix II: Report of Text Excavations on Sites AA:5:6, AA:5.7, and AA:5:8. In "An Archaeological Survey of the Santa Rosa Wash Project," assembled by Veletta Canouts, pp. 132-144. Archaeological Series *No.* 18. Cultural Resource Management Section, Arizona State Museum, University of Arizona, Tucson.

Godden, Geoffrey A.
1964 Encyclopedia of British Pottery and Porcelain Marks. Bonanza Books, New York.

1971 The Illustrated Guide to Mason's Patent Ironstone China. Praeger Publishers, New York.

Goggin, John M.
1968 Spanish Majolica in the New World, Types of the Sixteenth to Eighteenth Centuries. Yale University Publications in Anthropology No. 72, New Haven.

Gould, R. A., D. A. Koster, and A. H. L. Sontz
1971 The Lithic Assemblage of the Western Desert Aborigines of Australia. American Antiquity Vol. 36, No. 2: 149-169.

Gregory, Hiram A. and Clarence H. Webb
1965 European Trade Beads from Six Sites in the Natchitoches Parish, Louisiana. The Florida Anthropologist Vol. 17, No. 3, Part 2: 15-44.

Hammack, Laurens C.
1971 The Peppersauce Wash Project. MS, Arizona State Museum, University of Arizona, Tucson.

Hammond, George P.
1929 Pimeria Alta after Kino's Time. New Mexico Historical Review Vol. 4, No. 3: 220-238.

Hanson, H. Lee
1970 Gunflints from the Macon Plateau. Historical Archaeology Vol. 4: 51-58. The Society for Historical Archaeology, Bethlehem, Pennsylvania.

Harlow, Francis H.
1967 Historic Pueblo Indian Pottery. Monitor Press, Los Alamos, New Mexico.

Harrington, J. C.
1954 Dating Stem Fragments of Seventeenth and Eighteenth Century Clay Tobacco Pipes. Quarterly Bulletin of the Archaeological Society of Virginia Vol. 9, No. 1.

Haury, Emil W.
1950 The Stratigraphy and Archaeology of Ventana Cave, Arizona. University of Arizona Press, Tucson, and University of New Mexico Press, Albuquerque.

Hayden, Julian D.
1959 Notes on Pima Pottery Making. The Kiva Vol. 24, No. 3: 10-16.

Hinton, Richard J.
1954 The Hand-Book to Arizona: Its Resources, History, Towns, Mines, Ruins and Scenery. Arizona Silhouettes, Tucson.

Hoover, J. W.
1935 House and Village Types of the Southwest as Conditioned by Aridity. Scientific Monthly Vol. 40.

Humboldt, Alejandro de
1941 Ensayo Politico sobre el Reino de la Nueva España, edited by Vito Alessio Robles. Editorial Pedra Robredo, Mexico.

Hunt, A. P.
1960 Early Man Sites Near Moab, Utah. American Antiquity Vol. 26, No. 1: 110-117.

Irwin, Carol
1959 Dating English Pipe Stems. Florida Anthropology Vol. 12, No. 3: 71-72.

Irwin-Williams, Cynthia
1973 The Oshara Tradition: Origins of Anasazi Culture. Eastern New Mexico University Contributions in Anthropology Vol. 5, No. 1, Portales, New Mexico.

Irwin-Williams, Cynthia and Henry J. Irwin
1966 Excavations at Magic Mountain: A Diachronic Study of Plains-Southwest Relations. Proceedings No. 12, Denver Museum of Natural History, Denver.

Kessell, John L.
1970 Mission of Sorrows, Jesuit Guevavi and the Pimas, 1691-1767. University of Arizona Press, Tucson.

Kinnaird, Lawrence
1958 The Frontiers of New Spain, Nicolas De Lafora's Description 1766-1768. The Quivira Society, Berkeley.

Lewis, Berkeley R.
1956 Small Arms and Ammunition in the United States Service, 1776-1865. Smithsonian Institution, Washington.

Lief, Alfred
1965 A Close-up of Closures, History and Progress. Glass Container Manufacturers Institute, New York.

Linton, Ralph
1936 The Study of Man. Appleton-Century Co., New York.

Logan, Herschel C.
1959 Cartridges, A Pictorial Digest of Small Arms Ammunition. The Stackpole Company, New York.

Lorrain, Dessamae
1968 An Archaeologist's Guide to Nineteenth Century American Glass. Historical Archaeology Vol. 2: 35-44. The Society for Historical Archaeology, Bethlehem, Pennsylvania.

Meigh, Edward
1960 The Development of the Automatic Glass Battle Machine. Glass Manufacturers' Federation, London.

Moorhead, Max L.
1961 The Private Contract System of Presidio Supply in Northern New Spain. Hispanic American Historical Review Vol. 41, No. 1: 31-54.

Morris, Percy A.
1966 A Field Guide to Shells of the Pacific Coast and Hawaii. Houghton Mifflin Company, Boston.

Morrison, Hugh
1952 Early American Architecture. Oxford University Press, New York.

Newcomb, Rexford
1937 Spanish-Colonial Architecture in the United States. J. J. Augustin, New York.

Newman, T. Stell
1970 A Dating Key for Post-Eighteenth Century Bottles. Historical Archaeology Vol. 4: 70-75, The Society for Historical Archaeology Bethlehem, Pennsylvania.

Noel Hume, Ivor
1972 A Guide to Artifacts of Colonial America. Alfred A. Knopf, New York.

Olsen, Stanley J.
1963 Dating Early Plain Buttons by Their Form. American Antiquity Vol. 28, No. 4: 551-554.

Ormsbee, Thomas H.
1959 English China and Its Marks. Channel Press, Deerfield Editions, Ltd., New York.

Putnam, H. E.
1965 Bottle Identification. H. E. Putnam, Jamestown, California.

Pye, David
1964 The Nature of Design. Reinhold Publishing Corporation, New York.

Randall, Mark E.
1971 Early Marbles. Historical Archaeology Vol. 5: 102-105. The Society for Historical Archaeology, Bethlehem, Pennsylvania.

Rathje, William L.
1974 The Garbage Project. Archaeology Vol. 28, No. 4: 236-241.

Renaud, E. B.
1942 Reconnaissance in the Upper Rio Grande Valley of Colorado and Northern New Mexico. University of Denver Publications in Anthropology for 1942, Denver.

Roebacker, Earl F.
1971 Stick-Spatter Ware. Antiques Vol. 99, No. 2, New York.

Rogers, Malcolm J.
1936 Yuman Pottery Making. San Diego Museum Papers No. 2, San Diego.

1939 Early Lithic Industries of the Lower Basin of the Colorado River and Adjacent Desert Areas. San Diego Museum Papers No. 3, San Diego.

Russell, Frank
1908 The Pima Indians. Twenty-sixth Annual Report of the Bureau of American Ethnology, Government Printing Office, Washington.

Sanford, Trent Elwood
1950 The Architecture of the Southwest. W. W. Norton and Company, Inc., New York.

Sayles, E. B. and Ernst Antevs
/1941 The Cochise Culture. Medallion Papers No. 29, Gila Pueblo, Globe.

Schiffer, Michael B.
1972 Archaeological Context and Systemic Context. American Antiquity Vol. 37, No. 2: 156-165.

Sears, Roebuck & Co.
1905 Special Catalogue of Mechanical Tools, Builders' Hardware, General Hardware. Chicago.

Serven, James E.
1965 Guns on the Arizona Frontier. Museum Monograph No. 2, Arizona Pioneers' Historical Society, Tucson.

Shepard, Anna O.
1956 Ceramics for the Archaeologist. Publication 609, Carnegie Institution of Washington, Washington.

Smith, Hale G.
1965 Archaeological Excavations at Santa Rosa, Pensacola. Notes in Anthropology Vol. 10, Florida State University, Tallahassee.

Snow, David H.
1965 The Chronological Position of Mexican Majolica in the Southwest. El Palacio Vol. 72, No. 1: 25-35.

The Social Science Research Council
1954 Acculturation: An Exploratory Formulation. American Anthropologist Vol. 56, No. 6, Part 1: 973-1002.

South, Stanley
1964 Analysis of the Buttons from Brunswick Town and Fort Fisher. Florida Anthropologist Vol. 17, No. 2: 113-133.

1972 Evolution and Horizon as Revealed in Ceramic Analysis in Historical Archaeology. The Conference on Historic Site Archaeology Papers 1971 Vol. 6, Part 1.

Sparks, Morris M.
1951 Adobe Brick Construction. U.S. Department of Commerce, Office of Technical Services, TAS 98, Mimeo.

Speth, John D.
1972 Mechanical Basis of Percussion Flaking. American Antiquity Vol. 37, No. 1: 34-60.

icer, Edward H.
1962 Cycles of Conquest. University of Arizona Press, Tucson.

Stewart, Janet Ann
1970 Territorial Ranch Houses of Southern Arizona, 1863-1912. MS, Master's thesis, Department of Art, University of Arizona, Tucson.

Stone, Lyle M.
1970 Formal Classification and the Analysis of Historic Artifacts. Historical Archaeology Vol. 4: 90-102. The Society for Historical Archaeology, Bethlehem, Pennsylvania.

Struever, Stewart
1968 Woodland Subsistence-Settlement Systems in the Lower Illinois Valley. In New Perspectives in Archaeology, edited by S. R. Binford and L. R. Binford, pp. 285-312. Aldine Publishing Co., Chicago.

Switzer, Ronald R.
1974 The Bertrand Bottles, A Study of 19th-Century Glass and Ceramic Containers. Archaeological Research Series No. 12, National Park Service, Washington.

/Teague, George A.
1975 The Lithic Assemblage from Alder Wash Ruin. MS, Arizona State Museum, University of Arizona, Tucson.

Toulouse, Julian Harrison
1969a A Primer on Mold Seams, Part I. The Western Collector Vol. 7, No. 11: 526-535.

1969b A Primer on Mold Seams, Part II. The Western Collector Vol. 7, No. 12: 578-587.

reutlein, Theodore E. (translator)
1949 Sonora, A Description of the Province by Ignaz Pfefferkorn. University of New Mexico Press, Albuquerque.

Tunnell, Curtis D. and J. Richard Ambler
1967 Archaeological Excavations at Presidio San Agustin de Ahumada. Archaeological Program Report No. 6, Texas State Building Commission. Austin.

United States Government Printing Office
1882 Specifications for Means of Transportation, Paulins, Stoves and Ranges, and Lamps and Fixtures for Use in the United States Army. Washington.

Urrutia, Joseph de
1766 Plano del Presidio de S. Ignacio de Tubac en la Provincia de Sonora. Additional Manuscripts 17,662, No. 8, The British Museum, London.

Utberg, Neil S.
1963 The Coins of Mexico, 1536-1963. Dansco, Venice, California.

Van Rensselaer, Stephen
1926 Early American Bottles and Flasks. Transcript Printing Co., Peterborough, New Hampshire.

Warner, Ted J.
1966 Frontier Defense. New Mexico Historical Review Vol. 41, No. 1.

Watson, James B.
1952 Cayuá Culture Change: A Study in Acculturation and Methodology. American Anthropologist Vol. 54, No. 2, Part 1.

er, Donald D.
1972 Investigation Concerning the Hohokam Classic Period in the Lower Salt River Valley, Arizona. MS, Master's thesis, Department of Anthropology, Arizona State University, Tempe.

Whitall, Tatum & Co. 1880
1971 American Historical Catalog Collections. The Pyne Press, Princeton.

Willey, Gordon R. and Philip Phillips
1958 Method and Theory in American Archaeology. University of Chicago Press, Chicago.

Wilmsen, Edwin N.
1970 Lithic Analysis and Cultural Inference: A Paleo-Indian Case. Anthropological Papers of the University of Arizona No. 16, University of Arizona Press, Tucson.

Wilson, Bill and Betty Wilson
1971 19th Century Medicine in Glass. 19th Century Hobby & Publishing Co., Eau Gallie, Florida.

Witthoft, John
1966 A History of Gunflints. Pennsylvania Archaeologist Vol. 36, Nos. 1-2: 12-59.

Woodbury, Richard B.
1954 Prehistoric Stone Implements of Northeastern Arizona. Papers of the Peabody Museum of Archaeology and Ethnology Vol. 34, Harvard University Press, Cambridge.

Woodward, Arthur
1960 Some Notes on Gun Flints. The Missouri Archaeologist Vol. 22: 29-39.

ACKNOWLEDGEMENTS

The research and laboratory analysis of the Tubac faunal collection was conducted at the Western Archaeological Center Faunal Laboratory, Tucson, Arizona, from June 1 to August 1, 1975. I would like to thank Stanley J. Olsen for his invaluable assistance in carrying through this project. Many thanks are extended to my colleagues in the Faunal Laboratory who often helped in identifying particularly difficult specimens, and who endured many questions and provided help while they were carrying on their own projects. These people are John Beezley, John Sparling, and Nancy Hamblin. George Teague and Lynette Shenk also provided much needed consultation at critical stages in the analysis. Lynette Shenk, John Sparling, and Stanley Olsen also assisted in editing the first draft of this report, for which the author is very grateful.

Dr. W. L. Minckley, Department of Zoology at Arizona State University, deserves special thanks for his donation of valuable time to identify the fish remains. Added thanks are extended to Dr. Robert R. Miller, Museum of Zoology, University of Michigan, who took time to help verify Dr. Minckley's identifications while on a short visit to Arizona. I would also like to thank Dr. Carl Roubicek, College of Agriculture, Animal Science Department of the University of Arizona, and Dr. E. Lendell Cockrum, Biological Sciences, Department of Ecology and Evolutionary Biology, also of the University of Arizona, for discussing various important aspects of the report, and providing much needed information. Thanks are also due my wife, Emily, for her patient criticism.

Introduction

In the preceding report Shenk and Teague presented their analysis of the artifacts from the historic Tubac presidio. Usually faunal remains receive separate treatment in archaeological reports because they present a class of data not amenable to ordinary techniques of description and interpretation. Nevertheless, faunal material is as artifactual as any culturally modified material; thus, the opportunity exists to afford it treatment in anthropological terms. Patricia Daly has phrased this idea. as follows:

> There is, in my experience, a tendency to regard animal remains as being of rather second-class status, ranking well below stone tools and potsherds in potential cultural significance. I should like to point out here that the use of the term "nonartifactual" for food remains is both inaccurate and midleading. Soil samples are nonartifactual; garbage is not. The remains of food animals have passed, in Reed's. . . classic phrase, "through the cultural filter." They do not constitute a chance assemblage, nor is their presence in the site due to anything but human behavior (1969: 146).

The following report is an analysis of the faunal material from the Tubac site. In addition to the more traditional task of description, the study is directed toward a number of problems concerning social regimentation and acculturation which were put forth by Shenk and Teague. The inadequate sample of data hampers any attempt to employ rigorously the method of multiple working hypotheses. Instead the conclusions drawn from the analysis will be compared with those presented by Shenk and Teague, and the degree of congruence will be noted. Given better spatial and temporal control, other hypotheses might be generated and evaluated; however, for reasons presented below, this will not be attempted.

Shenk and Teague divided the Tubac presidio into three time-stratigraphic units: Early period, Spanish colonial (1750-1800); Middle period, Mexican garrison (1800-1850); and Late period, U.S. Army, mining interests, and others (1850-1900). The obviously arbitrary dividions tend out of necessity to overlook sociocultural and temporal variability in short-term occupations; given the nature of the stratigraphy at the site finer divisions were not attempted

by Shenk and Teague. The site was divided spatially into rooms surrounding an interior plaza, as well as into use areas on the room-block exterior: Room Outliers 1 and 2; structure exterior, north; and structure exterior, southwest. Some of this reconstruction is conjectural, since the site was only partially excavated.

For reasons which are not clear, much of the bone recovered from the site is in very poor condition. Most of the sample consists of small fragments of unidentifiable mammal bone, termed "scrap" in this report. The percentage of all elements identified to the species, family, or superfamily level compared with the total bone recovered is only 6.9 percent (1,344/19,544). In comparison, the total proportion of identified bone from the Eschelman protohistoric site in Pennsylvania is)40.6 percent (23,614/58,119) (Guilday, Parmalee, and Tanner 1962: 59).

Another factor diminishing the usefulness of the sample is the percentage of bone from primary-refuse contexts. Primary refuse is defined as "material discarded at its location of use" (Schiffer 1972: 161). Contexts in which primary refuse is expected, although cultural and natural formation processes act to distort this expectation (Schiffer 1972), are room and exterior use-area floors, trash pits, and floor fill.

Secondary refuse contexts, or those containing objects which have been transported for discard, include surface sheet-trash deposits, trash pits, and trash dumps. In the Early period at Tubac 97.6 percent of the total number of identified faunal elements came from primary contexts. The situation for the Middle and Late periods is not as fortunate; the figure drops to 24.0 percent and 32.9 percent respectively. Furthermore, Late-period deposits underwent the most disturbance as a result of post-1900 activities. Thus the sample of bone becomes decreasingly reliable for the purposes of deriving cultural inferences as one proceeds from the Early period to the Late period. No bone was available for analysis from Room 9 and 10, nor was material from post-1900 or obviously disturbed contexts examined for this report.

Before considering the hypotheses offered by Shenk and Teague to account for the variability in material culture at Tubac, a discussion of the method and technique employed in classifying the faunal remains will be presented, followed by a determination of the minimum number of individuals for each species as well as a discussion of their significance. Once the MNI, minimum

number of individuals, has been reconstructed, the analysis will proceed to dietary inferences, evidence for butchering, and a short description of the bone tools recovered from the site.

Method and Technique

Faunal identification is not a uniform step-by-step technique, since morphological variation within species is often considerable, especially in domestic species where selection by man has created a diversity of races and breeds. Furthermore, age and sex variation increases the number of discernible attributes. To facilitate the determination of the minimum number of individuals as well as to make explicit the criteria employed in the laboratory analysis, a classification defining a number of relevant attributes drawn from several dimensions was devised. Intentionally defined classes are recognized by some workers as a prerequisite for further data manipulation (Dunnell 1973: 128-130), although in faunal analysis this step is seldom made explicit.

Since the problem is to provide a quantification of both numbers of individuals and their respective age groups, the classification employs several relevant dimensions: (1) age, (2) relative size, (3) sex, (4) element (tibia, maxilla, and others), (5) condition, and (6) orientation (left, right, axial). animal material, difficult at best, was not attempted except for sheep and goat, where good published criteria are available for certain elements (Boessneck 1969). Reliable identification of an element belonging to a species or larger taxon depends to a large degree on the abundance of comparative material available. The Tubac analysis relied on the adequate collections of the Western Archeological Center (formerly Arizona Archeological Center), National Park Service, Tucson.

Perhaps the most problematic dimensions in faunal classification are those of age and size. In this area of faunal identification it seems that the greatest potential subjective error exists, since, to the writer's knowledge, no attempts to formalize age and size classes for a faunal analysis have been published. Unfortunately, the available collection of domestic animals was not extensive enough for a quantitative definition of size classes for sheep, goat, and cattle; thus, the size attributes outlined below are not given explicit definitions. The assignation of a particular element to a particular size class is therefore largely subjective, although based on comparisons with known

adult or immature specimens. In the dimension of age it was possible to define a number of categories using the criterion of epiphyseal fusion. Aging criteria for teeth were obtained from standard references such as Silver (1969) and Watts (1965). These classes are discussed below.

Because centers of ossification fuse at different times in immature and young adult ungulates (Daly 1969: 1)48), it often became necessary to employ both age and size criteria. If the size of the element was average in relation to an adult, but the element had an unossified epiphysis, which does not ossify until the animal is fairly well grown, the element was classified as "young adult." Likewise, if the element was smaller than average, it was classified as "immature." The same procedure was applied to bones without centers of ossification, mainly carpals and tarsals, where age was not ascertainable according to the criteria applied below in the definition of age classes. Instead, size alone was used to infer age for the purpose of calculating MNIs. In short, age and size are perhaps the least reliable determinations made in this analysis; however, consistent application by a single analyst ought to minimize the relative error.

Four age classes were utilized in classifying the faunal material: newborn or fetal, immature, young adult, and adult. According to Carl Roubicek, epiphyseal fusion judiciously applied is one of the best objective criteria for aging bones, provided that times of ossification are considered. Size variation alone is difficult to objectify, as mentioned above, because of a number of factors including sexual dimorphism, sub-specific differences within populations of a species, individual genetic variation, and diet. Although newborn or fetal individuals are readily determinable, as are adults, the distinction between young adults and immature individuals is not so obvious given skeletal material alone. Information on degree of fusion and bone porosity is not readily available for use in classifying skeletal material, although such information would be invaluable, according to Roubicek. Given all of the possible sources of error in aging individuals from skeletal remains, it cannot be overstressed that the age classes defined here and the resulting identifications are not so much intended to reflect accurately the actual ages of the animals, as they are meant to be a useful means of organizing the faunal material. Table 9 lists the definitive criteria for each of the age classes.

The criteria employed in Table 9 were taken from Silver (1969) and are based largely on "'scrub' crossbred animals" rather than modern breeds (Silver 1969: 288). Domestic fowl are generally classified as "immature" and "mature" based on the ossification of the entire long-bone epiphysis, which occurs by six months (Silver 1969: 300). Very few spurs were noted on the tarsometatarsi of chickens. When present they generally indicate a male, although old females on rare occasions develop a spur as well (Silver 1969: 300).

No data on ossification were obtained for antelope, domestic cat, rabbit, rodent, or wild fowl, so the same classification for domestic fowl was applied, using epiphyseal fusion as the sole criterion (Table 10). Because of the scarcity of domestic.dog remains, they were treated in the preceding manner even though full data on bone ossification is available (Silver 1969).

Other attributes employed in the classification need not be defined formally ("size" attributes, for the reasons presented above). "Condition" refers to the relative completeness of the bone element, using anatomical terms established by conventional use; for example, "distal end," "proximal end without epiphysis," and "diaphysis only." The same usage applies to "elements." Dictionary definitions will suffice in both cases. "Orientation" is self-explanatory, as is "sex." For the sake of brevity, the complete classification listing all of the attributes employed in the faunal analysis will not be included here. For those interested, a manuscript containing this and other supplementary data is on file in the Arizona State Museum library.

Determination of MNIs

In actually calculating the MNI for each species, the most abundant element was tabulated, following White (1953), and taking into account, as well, age, size, and where possible, sex. Following the suggestion of Grayson (1973), the "maximum distinction method" was employed to the extent of subdividing the material into time-stratigraphic units. However, further division by spatial units, rooms or squares, for the purposes of calculating MNIs was not attempted because of the relatively small sample of total identified elements. An example is provided to illustrate the technique used to extract MNIs from the most numerous elements of Ovis aries/Capra hircus, Early period:

Adult	Young Adult	Immature	
2	1	1	1st Phalanx, R and L
1	3		Radius, R
3	2		Astragalus, R and L
	2		Tibia, L
1	1		Acetabulum, Pelvis, R
3	1		Metatarsus, R and L
3	3	2	Total MNI

The numbers in the table above refer to the MNI as determined from a particular element. Different elements give maximum counts of right or left, depending on the ages represented. In the example above, three adults, including two females and one male, are represented by the metatarsi and astragali, while a maximum of two immature individuals are represented by the acetabulae.

Taking age and sex into consideration when calculating the MNI tends to increase the numbers of individuals. This method helps to correct errors introduced where it is assumed, for instance, that in a collection of 20 right femurs and 15 left femurs, all 15 of the lefts matched 15 of the rights. Many zooarchaeologists have been reluctant to do this, as for example, White (1953) remarks:

> The method I have used in the studies on butchering technique is to separate the most abundant elements of the species found (usually the distal end of the tibia) into right and left components and use the greater number as the unit of calculation. This may introduce a slight error on the conservative side because, without the expenditure of a great deal of time with small return, we cannot be sure all of the lefts matched all of the rights (1953: 397).

Flannery observed in the Tehuacan Valley faunal material that the lefts frequently did not match all of the rights, altering the original MNI determination. "The most common difference observed was one of age--that is, the lefts might all be from very juvenile animals, while the single right was from an aged individual, and so on" (Flannery 1967: 157). See Daly (1969: 150) for a similar observation. Lacking the time and funds to ascertain exactly how many left elements matched right elements in the Tubac material, it was decided to use the age discrimination discussed above in an attempt to reduce the conservative nature of White's original (1953) technique.

MNIs for each taxon and time period are given in Tables 12, 13, and 14. The data from which these determinations are derived is on file in the Arizona State Museum library. A taxonomic list with common names appears in Table 11.

Fauna from the Tubac Presidio

Comparing the data from Tables 12-13 allows some inferences to be made concerning the utilization of food animals at Tubac. These inferences are based upon several assumptions. It is assumed that certain animals were not used as food, but were more likely pets; for example, the domestic dog and cat and the small exotic birds (Psittacidae: lovebirds, parakeets, and others). It is also possible, given the size of the elements, that the Psittacidae are in reality the native thick-billed parrot, Rhynchopsitta pachyrhynch (Olsen 1967: 67). There is no evidence for charring or butchering of the canid and felid remains, although the sample is very small. Likewise it is assumed that the passerines present at Tubac, robin and raven, were probably not food items. Robin is represented only by wing elements (humeri, coracoid, radius), and thus they may have been exploited for feathers. On the other hand, the presence of domestic cats leads one to speculate that the passerines were part of the residue of felid subsistence activities. The presence of frogs or toads, as well as the remains of one pocket gopher, may be fortuitous, due to the burrowing habits of these animals, although their use as a food source cannot be ruled out. Finally, it is assumed for analytical purposes that the sample of bones from each period is adequate to demonstrate the proportion of various species actually utilized. This, of course, is questionable on several grounds, as was pointed out in the introduction.

Assuming that the remaining species were indeed important food animals during the occupation of the presidio, a glance at Tables 12, 13, 14, and 17 leads to two obvious conclusions. First, there is little significant difference in the percentage distributions for each period, with the exception of a decline in the number of individuals of domestic chicken from Early to Late and a concomitant increase in the relative frequencies of sheep/goat and cattle. Second, the proportion of domestic to wild species is consistently very high, indicating that wild-animal protein was not very important in the diet of the Tubac inhabitants throughout the period of occupation. The implications of this data for the problem of acculturation have been discussed by Shenk and Teague in their report (see also DiPeso 1953: 237).

Quiburi Ruin, another historic site in southeastern Arizona with a joint Spanish and native, Sobaipuri, occupation, also yielded a high proportion of domestic to wild animal species, mostly cattle and sheep with some pig, chicken, fish, and jackrabbit (DiPeso 1953: 234-235).

The scarcity of deer, represented by one antler fragment, antelope, rabbit, and other wild animals abrogates Dobyns' statement that "during the Mexican Garrison occupation. . .wild game is thought to have been of importance" (1959: 577-580). This scarcity is undoubtedly due to sociocultural factors. The Tubac area, located in a riparian habitat in the more favorable, higher elevations of the lower Sonoran Desert, has always had a relative abundance of wild game, according to E. Lendell Cockrum. Potential wild game includes white-tailed and mule deer (Dama virginianus and D. hemionus); prong-horned antelope (Antilocapra americana); peccary (Tayassu = Pecari tajacu); various carnivores including coyote (Canis latrans), gray wolf (Canis lupus), gray fox (Urocyon cinereoargenteus), kit fox (Vulpes macrotis), ringtail (Bassariscus astutus), raccoon (Procyon lotor); a number of Mustelidae (weasels, skunks, and badgers); and in the mountains nearby, bighorn sheep (Ovis canadensis) and black bear (Euarctos americanus) (Cockrum 1960). Wild birds include great blue heron (Ardea herodias); Canada goose (Branta canadensis); several species of duck (Anatidae); hawk (Accipitridae); Gambel's quail (Lophortyx gambelii); turkey (Meleagris gallopavo); sandhill crane (Grus canadensis); thick-billed parrot (Family Psittacidae, Rhynchopsitta pachyrhyncha); and many species of passerines (Monson and Phillips 196)4).

There were a number of bone elements identified which came from mixed stratigraphic contexts. These proveniences, labeled Early to Middle and Middle to Late by Shenk and Teague, have been eliminated from the comparisons of faunal material. The only unusual occurrence in this data is the presence of prong-horned antelope, evidenced by six specimens, one individual, from the Early or Middle period. In all other respects this material, 233 identified elements, is not unlike the material from unmixed contexts. This data is available in the supplementary manuscript referred to previously.

The category "sheep/goat" (Ovis aries/Capra hircus) employed in the comparisons of fauna by period is a composite one comprising the taxa Ovis aries, cf. Ovis aries, Ovis aries/Capra hircus, and cf. Capra hircus. These taxa have been lumped for quantitative purposes, although it should be pointed out that the great majority if not all of the sheep/goat remains are probably sheep. In all but four instances where sheep and goat can be distinguished osteologically (Boessneck 1969), the elements matched those of sheep much more closely than those of goat. The four identifications of goat are tentative, based on two

Dietary Inferences

A number of recent publications have pointed out the inadequacy of inferring absolute food values from faunal remains in archaeological sites. This task has traditionally been accomplished by multiplying the minimum number of individuals of a given species by the estimated pounds of meat for that species; tables giving the pounds of usable meat for a large number of common mammal and bird species have been compiled for this purpose (White 1953: 397-398). In a recent article, Cook argues that the total calories represented by animal and plant remains from the Scovill prehistoric site in Illinois is well below that required by the estimated population, and far below the carrying capacity of the environment (Cook 1975: 35)4-356). Faunal remains from historic Fort Ligonier in Pennsylvania, according to John Guilday, "would have sustained only two men for the length of time of the known occupancy--or the entire garrison at full strength for just one day!" (1970, cited in Olsen 1971: 29). Disposal of animal residues in areas not excavated or not possible to be excavated, such as a river, or the use of salted meat, without bones, for a portion of the daily ration are among the factors which prevent even a reasonable estimate of the absolute dietary importance of various species. A simple calculation shows this to be the case for the Tubac material. Using Dobyns' information on the ration supposedly guaranteed every soldier and his family after 1766 (1959: 361), each family would consume ideally the equivalent of six cattle or 24 sheep per year. Estimating no more than four families occupying the presidio at any time (Early period), and estimating the total span of occupation during the Early period as 40 years, a maximum likely estimate of consumption for the Early period is 960 head of cattle. A minimum likely estimate can be obtained by assuming only two families, consuming half of the ideal ration, or 240 head of cattle. The Early-period MNI for cattle is only three; thus, we have a sample size of 0.3 percent to 1.3 percent (3/960 or 3/2)40). Quite obviously the only value such a sample has for dietary purposes is the rough estimation of the relative importance of a species during each period (Daly 1969: 150-151).

To determine the relative importance of the major food species--cattle, sheep, chicken, and pig--for each period (Table 17), an estimate of the usable meat each animal provides was obtained. According to Roubicek, cattle vary in

live weight from about 300 to 1000 lbs., calf to adult; one-year-old individuals weigh about 500 lbs. About 50 percent of the live weight is usable protein. Using this information we can define approximate average live weights for each of the age classes employed here and multiply by 0.50 to determine the usable meat. The same procedure can be applied to sheep, pig, and chicken. Sheep vary from 0 to 40 lbs., up to 6 months old, and attain an average adult live weight of about 80 to 100 lbs. About 40 percent of the live weight is usable protein. Suckling pigs, immature, seldom weigh over 40 to 50 lbs., while adults average about 100 lbs. About 50 percent of the live weight is usable protein. Chickens weigh less than 4 lbs. on the average, although the small adults encountered commonly in the Tubac faunal material are probably a smaller breed than those of the comparative collection in the laboratory. About 50 percent of the live weight is usable protein. Using the above information, an attempt was made to estimate the proportions of protein each species provided during each of the major time periods. The calculations and results are depicted in Tables 18 and 19. A slight increase in the proportion of bovids, cattle and sheep, from the Early to the Middle period is evident, while pigs decrease in frequency. Chickens decline in importance by 50 percent during each subsequent period.

From the data on inferred ages for individuals given in Tables 12, 13, and 14, it is apparent that no particular age class of bovids was selected over another. The admittedly inadequate sample of suid remains seems to indicate a preference for immature or suckling pigs. The largest portion of domestic chicken remains came from smaller adults, compared to the adults in the comparative collection. This may represent a small breed with sexual dimorphism (hens versus roosters) accounting for the adult or large adult individuals, although a preference for young adults, small adults by the criteria employed here, cannot be ruled out. The local canid population was evidently comprised of a variety of breeds ranging from toy-sized through large, with one dachshund or basset-sized individual. This is not to indicate that these AKC breeds were present; they are used for size comparisons only.

Evidence for Butchering

A number of bones were modified by butchering marks, distinguished from recent damage on the basis of their dark, weathered appearance, as opposed to the light color of freshly fractured or cut bone, and consistent size and shape.

Charts indicating the kinds of elements butchered were tabulated according to period and are on file in the ASM library. Table 20 describes the spatial and temporal distribution of butchered bone within the presidio. With few exceptions, cattle and sheep comprise the bulk of the butchered bone. Unidentified ribs, vertebrae, and long-bone fragments classified as cattle size and sheep size were the predominant elements butchered.

Four kinds of butchering marks were observed, although two of these are probably the same kind of cut differing in the degree of force applied. Thin, shallow cuts with little or no visible cross section, as well as deeper, V-shaped cuts comprised the bulk of the marks observed. As there is no formal difference between thin, shallow cuts and V-shaped cuts other than size and depth of cross section with no apparent break in the continuum from one to the other, it is probably best to consider these as the products of a single functional activity. Guilday, Parmalee, and Tanner (1962), in discussing their classification of butchering marks on bones from a protohistoric Indian site in Pennsylvania, infer that marks with V-shaped cross sections were made by metal knives, and note that most butchering with stone tools results in U-shaped cross sections. They further distinguish axe cuts on the basis of their "straight-walled sharply defined" sides (1962: 63). It is not clear whether they meant to include large V-shaped cuts in this latter category. Among the butchering marks identified in the Tubac faunal material are a number of deep hacks with straight sides converging to a "V", or hack marks either spaced in a series, or occurring individually with no regular cross sections. Intuitively these would appear to have been made by an instrument of great mass, such as an axe. In any case, the criterion established here for separating what may be knife cuts from axe cuts is size, the cut-off point being about 3 mm for depth of cross section. One other kind of butchering mark was noted, although as with hacks, the occurrence was rare. This was a parallel-sided notch, about 1 mm wide, interpreted as a saw mark. By and large, it appears that the great majority of butchering was accomplished with an instrument of relatively low mass, or with a heavy instrument applied with little force, most likely a metal tool such as a knife.

A consideration of the location of butchering marks does not lead to any strikingly unusual conclusions: the scapulae and acetabulae were frequently butchered, and a large number of proximal ends of scapulae and single acetabulae

were recovered, indicating that the entire leg was severed. Marks on the tibia and humerus indicate that the legs were cut up further, while the butchered ribs and vertebrae indicate that the head was severed and the rib cage dismembered and separated from the spinal column. Probably more relevant to this report is the observation that the entire animal was present when butchered; meat was kept at Tubac on the hoof rather than brought in as shank portions.

The fragmentary nature of most of the bone remains was noted earlier. Fragmentary long bone is often thought to have been broken to obtain marrow, sometimes involving the aboriginal technique of grooving and snapping (Guilday, Parmalee, and Tanner 1962: 64). There was no evidence that long bones were grooved to facilitate snapping, nor were the elaborate criteria employed by Sadek-Kooros (1972) for defining intentional fracture applicable, given the small sample of recognizable elements. The suggestion that bones broken or smashed into small pieces reflects the ethnographically-documented practice of making "bone grease" (Leechman 1951: 355; White 1953: 162) is intriguing, but in this context, untestable.

Worked Bone

Fifteen pieces of worked mammal bone were recovered at Tubac. Table 21 lists their dimensions according to the kind of modification the object exhibited. The length of the worked edge, where appropriate, is indicated following the slash mark.

Object A is a pointed, ground, and polished piece of bone with five facets (Fig. 53:b). It may have served as a projectile point or awl. The only other ground bone, Object B, was apparently cut into a rounded shape, although the object is broken and thus the original shape is undeterminable. Both faces exhibit parallel striations running perpendicular to the present long axis. What this may represent functionally is not known at present (Fig. 53:a).

Object C is a chipped point made from the splintered end of a long bone (Fig. 53:c). It may have served a piercing function, although it is possible that the chipping is fortuitous and that it is not a tool, but rather the product of bone splintering. Objects 2, E, F, G, and H are cattle-sized pieces of long bone with concave worn edges. Examples are illustrated in Figure 53: d, e. These are undoubtedly scraping tools of some sort, resembling chipped concave edges on stone tools often called "spokeshaves." The chipping is confined to the worked edge for the most part. Objects I, J, K, and L are similar

bone fragments with chipped convex edges. The two smaller examples, K and L, are not worn and appear to be unifacially worked bone flakes, possibly debitage. The other convex-edge tools exhibit unifacial chipping with large flake scars along the edge, much like a retouched convex edge on a stone tool. Objects M, N, and 0 are also cattle-sized long-bone fragments with fine chipping along a straight edge. One example (Fig. 53:f) has chipping extending away from the edge for some distance; however, in the other two the chipping is confined to the edge proper.

With one exception, Object N, the worked bone is confined to the Middle and Late periods. The significance of this material is difficult to assess given such a small sample. It is presumed that iron tools provided the bulk of the working edges needed for performing domestic tasks. The retention of some degree of aboriginal technology is reflected in these items of material culture.

Implications

Several hypotheses concerning spatial and temporal patterning in artifactual remains as it relates to inferred activity areas within the Tubac presidio were presented by Shenk and Teague in the preceding report. The use of space at Tubac will now be considered here using the results of the faunal analysis. Tables 20 and 22 indicate the amount of scrap, identified elements, burned bone, and butchered bone recovered from specific activity areas by period at the site.

During the Early period (1750-1800) of occupation, the extramural areas, including Room Outliers 1 and 2, contained together, the greatest amount of animal remains, and thus may have been the focus of food preparation. Rooms 2 and 6 also contained a fair amount of the sample, and may also have been involved in food-preparation activities. The paucity of remains from Rooms 1, 7, and 8 suggests that they were used for other purposes, and were not food oriented.

Faunal remains from Middle-period (1800-1850) contexts were highly concentrated in the structure exterior, southwest. The presence of close to 28 percent of the scrap sample in the plaza indicates its important role in food-preparation activities. Room Outliers 1 and 2 were less important to food preparation relative to the Early period.

The Late-period (post-1850) plaza is definitely important in its quantity of food residues. Room 2 may also have assumed a role in food-preparation activities. Bone remains in the other rooms are fairly scattered, suggestive of a non-intensive function, perhaps as sporadic trash dumps. This pattern may also be a result of the heavy disturbance seen in Late-period contexts.

In summary, the distribution of faunal remains of several kinds within the area of the presidio essentially conforms with the expectations generated by the Shenk and Teague analysis. The addition of a large quantity of animal residue in the structure exterior, southwest, during the Middle period is more likely a function of sclecting both primary- and secondary-refuse contexts for analysis (analysis of space by Shenk and Teague was limited to primary contexts), rather than reflecting cultural spatial patterning.

A major concern of Shenk and Teague's analysis of the Tubac artifacts is the hypothesis and conclusions concerning acculturation, which is thought to have been essentially complete by the time of the establishment of the presidio, a result of the work of Spanish missionaries. Two kinds of data from the faunal analysis support this conclusion. First is the ratio of domestic to wild species, discussed earlier, which shows that the Indian families in the presidio had shifted their food preferences from wild to domestic animals by the time of the occupation, assuming a mixed Indian/Spanish occupation during the Early period. Second is the relative scarcity of burned or charred bone, which accounts for only 2.3 percent of the total bone recovered. From this it is inferred that European methods of cooking, such as boiling and stewing using containers, replaced the aboriginal open-fire methods along with the introduction of dom-estic animals and other European influences.

Evidence for social stratification in terms of differential access to unusual foodstuffs is not great, although the contents of Trashpit B (Table 15) suggest that some items of food were not universally available. Perhaps the presence of largely immature or suckling pigs in the Early-to-Middle period in small quantities is the result of differential access. If pigs were important they would probably have occurred in large numbers and in a wider range of age classes. It is tempting to see the roast pig, fish, and exotic birds as destined for the commandant's table, while the ordinary troops and local Indians partook only of the abundant cattle, sheep, and chickens obtained nearby. Given the data base, this conclusion is, of course, only speculation.

Evidence for trade networks or supply routes can be seen in the occurrence of a small number of nonendemic species such as buffalo, squawfish, Sonora catfish, marine fish, and perhaps some of the wild birds.

Summary

The mammal, bird, and fish remains recovered from the Tubac presidio have been described and their distributions quantified and discussed. Additional support for the hypotheses advanced by Shenk and Teague was obtained from the faunal material. Inferences concerning acculturation and social stratification were presented within the limits of the available data. This report has attempted to show how an archaeological treatment of faunal data can aid in solving historic sociocultural problems.

Table 9

Age Dimension, Definition of Attributes for Domestic Sheep, Cattle, and Pig

Code	Class	Age (sheep)	Age (cattle)	Age (pig)	Ossification Criteria		
					Sheep	Cattle	Pig
1	Very immature	Before birth up to 3 mo.	Before birth up to 7 mo.	Before birth up to 3 mo.	1-4 fused or unfused	1-5 fused or unfused	1-4 fused or unfused
2	Immature	3 to 18 mo.	7 to 24 mo.	3 to 24 mo.	1-4 fused; 5-9 fused or unfused; 10-22 unfused	1-5 fused; 6-9 fused or unfused; 10-21 unfused	1-4 fused; 5, 6, 7, 9 fused or unfused; 8, 10-23 unfused
	Young Adult	18 to 36-42 mo.	24 to 42-48 mo.	24 to 42 mo.	1-9 fused; 10-12, 14, 15, 17, 18 fused or unfused; 19-21 unfused	1-9 fused; 10-14, 18 fused or unfused; 15, 16, 19-21 unfused	1-10, 12 fused; 11, 14, 22, 17 fused or unfused; 15, 18, 19, 20, 21, 23 unfused
4	Adult	Greater than 36-42 mo.	Greater than 42-48 mo.	Greater than 42 mo.	All fused	All fused	All fused

1. proximal epiphysis, metacarpus
2. proximal epiphysis, metatarsus
3. distal epiphysis, 1st phalanx
4. distal epiphysis, 2nd phalanx
5. vertebrae, body and arch
6. distal epiphysis, humerus
7. proximal epiphysis, radius
8. proximal epiphysis, 1st phalanx
9. proximal epiphysis, 2nd phalanx
10. distal epiphysis, metacarpus
11. distal epiphysis, metatarsus
12. distal epiphysis, tibia
13. fusion of proximal tibia-fibula
14. tuber epiphysis, calcaneum
15. distal epiphysis, radius
16. ulna, all centers
17. ulna, olecranon
18. proximal epiphysis, femur
19. proximal epiphysis, humerus
20. proximal epiphysis, tibia
21. distal epiphysis, femur
22. distal epiphysis, fibula
23. proximal epiphysis, fibula

Table 10

Age Dimension, Definition of Attributes
for All Other Mammals and Birds

Class	Age*	Criterion
1. Immature	Less than 6 mo. for domestic fowl; variable for all others	Epiphyses unfused, absent from long bone
2. Mature	Greater than 6 mo. for domestic fowl; variable for all others	Long bone epiphyses fused
3. Indeterminate	Not ascertainable	No centers of ossification present

*Ages for domestic fowl after Silver (1969: 300).

Table 11

Taxa Represented at the Tubac Presidio,
with Common Names

Class Osteichthyes
- Order Cypriniformes
  - Family Cyprinidae
    - Ptychocheilus lucius (Colorado River squawfish)
  - Family Catostomidae (suckers)
- Order Siluriformes
  - Family Ictaluridae
    - Ictalurus pricei (Yaqui catfish)
- Order Beloniformes
  - Family Belonidae (needlefishes)
- Order Perciformes
  - Family Sciaenidae (croakers or drums)

Class Amphibia
- Order Anura (frogs and toads)

Class Aves
- Order Pelecaniformes
  - Family Phalacrocoracidae
    - Phalacrocorax auritus (double-crested cormorant)
- Order Anseriformes
  - Family Anatidae (ducks, geese, and swans)
    - Anas platyrhynchos (mallard)
    - Anas acuta (pintail)
    - Anser spp. (wild and domestic geese)
- Order Galliformes
  - Family Phasianidae
    - Gallus gallus (domestic chicken)
  - Family Meleagrididae
    - Meleagris gallopavo (domestic turkey)
- Order Gruiformes
  - Family Gruidae
    - Grus canadensis (sandhill crane)
- Order Psittaciformes
  - Family Psittacidae (parakeets, parrotlets, lovebirds)
- Order Passeriformes
  - Family Corvidae
    - Corvus corax (common raven)
  - Family Turdidae
    - Turdus migratorius (robin)

Table 11 (cont.)

Class Mammalia
- Order Lagomorpha
  - Family Leporidae
    - Sylvilagus spp. (desert cottontail, eastern cottontail)
    - Lepus spp. (antelope jackrabbit, black-tailed jackrabbit)
- Order Rodentia
  - Family Geomyidae
    - Thomomys umbrinus (southern pocket gopher)
- Order Carnivora
  - Family Canidae
    - Canis familiaris (domestic dog)
  - Family Felidae
    - Felis domesticus (domestic cat)
- Order Perissodactyla
  - Family Equidae
    - Equus spp. (horse, burro, mule)
- Order Artiodactyla
  - Superfamily Suoidea
    - Family Suidae
      - Sus scrofa (domestic pig)
    - Family Tayassuidae
      - Tayassu (=Pecari) tajacu (collared peccary)
  - Superfamily Cervoidea
    - Family Cervidae
      - Dama spp. (white-tailed and black-tailed deer)
  - Superfamily Bovoidea
    - Family Antilocapridae
      - Antilocapra americana (prong-horned antelope)
    - Family Bovidae
      - Bos taurus (domestic cattle)
      - Bison bison (American buffalo or bison)
      - Capra hircus (domestic goat)
      - Ovis aries (domestic sheep)

Table 12

Abundance of Mammals and Avifauna, Early Period

Taxon	Number of Specimens	MNI[1]	Inferred Ages
Ovis aries/Capra hircus[2]	143	8	3 adult, 3 young adult, 2 immature[3]
Bos taurus[4]	57	3	1 large adult, 1 adult, 1 young adult
Gallus gallus[5]	105	12	9 small adult, 2 adult, 1 immature[6]
Sus scrofa	6	3	1 adult, 1 immature, 1 small immature
Bos taurus/Bison bison	2	1	1 large adult/small adult
Bovoidea[7]	33	4	1 adult, 3 young adult
Canis familiaris	1	1	Toy-sized adult
Sylvilagus spp.	2	1	Adult
Thomomys spp.	2	1	Adult
Meleagris gallopavo	5	2	1 large adult, 1 adult
Anser spp.[8]	7	1	Adult
Phalacrocorax auritus[9]	3	1	Adult
cf. Grus canadensis	2	1	Adult
TOTALS	368	39	

[1] Minimum number of individuals.

[2] Includes Ovis aries (86), cf. Ovis aries (12), Ovis aries/Capra hircus (43), and cf. Capra hircus (2).

[3] Includes 2 female adults, 1 male adult, and 1 female young adult, based on sex differences for astragali (after Boessneck 1969).

[4] Includes cf. Bos taurus (4).

[5] Includes cf. Gallus gallus (19).

[6] Includes 2 males, based on presence of tarsometatarsal spur.

[7] Sheep/goat size.

[8] Includes cf. Anser spp. (5).

[9] Includes cf. P. auritus (2).

Table 13

Abundance of Mammals and Avifauna, Middle Period

Taxon	Number of Specimens	MNI[1]	Inferred Ages
Ovis aries, Capra hircus[2]	178	8	3 adult, 4 young adult, 1 immature[3]
Bos taurus	120	6	1 large adult, 2 adult, 2 young adult, 1 immature[4]
Gallus gallus[5]	82	9	1 large adult, 1 adult, 6 small adult, 1 immature[6]
Bovoidea	18	3	Not ascertainable[7]
Bos taurus/Bison bison	3	1	Large adult/small adult
cf. Bison bison	2	1	Adult?
Sus scrofa	1	1	Immature
Tayassu tajacu	1	1	Adult?
Equus spp.	2	1	Adult
Canis familiaris	1	1	Large adult
Lepus spp.	2	2	1 adult, 1 immature
Corvus corax	2	1	Adult
cf. Anas platyrhynchos	1	1	Adult
Anatidae	1	1	Adult, size of A. acuta
Turdus migratorius	3	3	Adult, one large (male?)
Psittacidae	1	1	Adult
TOTALS	418		

[1] Minimum number of individuals.

[2] Includes Ovis aries (87), cf. Ovis aries (7), cf. Capra hircus (1), and Ovis aries/Capra hircus (83).

[3] Includes one female, based on astragalus.

[4] Includes cf. Bos taurus (6).

[5] Includes cf. Gallus gallus (9).

[6] One pathological right scapula, cf. Gallus gallus.

[7] Based on periotics, which were different to assess for age with regard to size.

Table 14

Abundance of Mammals and Avifauna, Late Period

Taxon	Number of Specimens	MNI[1]	Inferred Ages
Ovis aries/Capra hircus[2]	98	7	1 adult (male), 6 young adult
Bos taurus[3]	66	5	2 adult, 2 young adult, 1 immature
Gallus gallus[4]	19	3	1 adult, 2 small adult
Bovoidea	13	2	1 adult, 1 young adult
cf. Odocoileus spp.	1	1	None
cf. Sus scrofa	1	1	4 adult
Equus spp.	1	1	Young adult or adult
Canis familiarus	2	2	Adult, dachshund- or basset-size, and medium size
Felis domesticus	2	2	1 immature, 1 large immature
Sylvilagus spp.	1	1	Adult
Anas cf. acuta	1	1	Adult
Anatidae	1	1	Adult (duck-size)
Turdus migratorius	3	1	Adult
Psittacidae	1	1	Adult
TOTALS	210	29	

[1] Minimum number of individuals.

[2] Includes Ovis aries (41), cf. Ovis aries (7), and Ovis aries/Capra hircus (5-07.

[3] Includes cf. Bos taurus (3).

[4] Includes cf. Gallus gallus (2).

Table 15

Contents of Trash Pits by Period (Number of Specimens)

	Trash Pits by Period[1]																
	Early			Middle			Middle-Late		Late								
Fauna	B	C	K	[illegible]	H	M	A	J	D	E	F	G					
Sheep/goat	46	2			1	3	32	5	6	3			15	9			
Cattle	22		1		1	3	12	3	1	2	1		9		1		
Pig	6						1										
Chicken	57	2				1	2	1	4	1			1				
Domestic turkey	2																
Domestic goose	7																
Dog	0									1							
Cottontail rabbit	2																
Cormorant	3																
Sandhill crane	2																
Fish[2]	22																
Bovoidea	23					1		1					3				
Unidentified bird	26	1				2		1	2		1		4		1		
Unidentified mammal	1428	46	19	9	127	69	664	106	383	119	19	6	299	44	9	119	

[1] The proveniences are as follows: B and C, Room Outlier 1; J, structure exterior, southwest; H, structure exterior, north; D, K, N, plaza; O, Room 1; L and M, Room 2; A and I, Room 4; E, F, G, Room 12.

[2] Squawfish, sucker, catfish, and marine fish.

Table 16

Fish Remains (Number of Specimens) from the Tubac Presidio According to Period

	Early	Middle	Late
Ptychocheilus lucius	11	0	0
Catostomidae	2	1	3
Ictalurus pricei	3	0	0
Marine fish	2	3	1
Unidentified	3	8	1
TOTALS	21	12	5

[1] Material from mixed contexts, Early/Middle and Middle/Late, is not included.

Table 17

Relative Frequencies of Food Animals at the Tubac Presidio by Period

	Early Period				Middle Period				Late Period			
	Number of Specimens	Percentage		Percentage	Number of Specimens	Percentage		Percentage	Number of Specimens	Percentage		Percentage
Ovis aries/Capra hircus	143	43.3	8	25.0	178	46.1	8	27.6	98	52.7	7	36.8
Bos taurus	57	17.3	3	9.4	120	31.1	6	20.7	66	35.5	5	26.3
Sus scrofa	6	1.8	3	9.4	1	0.3	1	3.4	1	0.5	1	5.3
Gallus gallus	105	31.8	12	37.5	82	21.2	9	31.0	19	10.2	3	15.8
Meleagris gallopavo	5	1.5	2	6.3								
Anser spp.	7	2.1	1	3.1								
Tayassu tajacu					1	0.3	1	3.4				
Lagomorphs (rabbits)	2	0.6	1	3.1	2	0.5	2	6.9	1	0.5	1	5.3
Phalacrocorax auritus	3	0.9	1	3.1								
Grus canadensis	2	0.6	1	3.1								
Anatidae (ducks)					2	0.5	2	6.9	1	0.5	2	10.5
TOTALS	330	99.9	32	100.0	386	100.0	29	99.9	186	99.9	19	100.0

possible that a European domesticated goose is represented here. Sandhill crane (Grus canadensis) occurs in Arizona around the first of March as a transient (Robbins and others 1966). The double-crested cormorant is a rare visitor to this area, although it is common in the lower Colorado Valley (Monson and Phillips 1964: 182). Nearly all of these infrequent bird remains came from a single Early-period trash pit (Table 15). The Middle- and Late-period passerines are not unusual as mentioned above. The robin is a winter resident of the lower Sonoran Desert, while the raven occurs year-round. Both the mallard and pintail duck, found only in the Middle and Late periods, are winter residents as well (Monson and Phillips 1964: 186, 215, 221).

Fish and Amphibian Remains

Out of a total of 60 marine and freshwater fish bones, 32 specimens were identified by Dr. W. L. Minckley, Arizona State University. Table 16 lists the number of fish remains according to period. Of particular interest is the presence of Colorado River squawfish, Ptychocheilus lucius, a large predatory minnow at one time reaching weights as much as 100 pounds or more, and now nearly extinct in Arizona. A "big-river fish" inhabiting depths greater than one meter, it is highly unlikely that the squawfish were obtained locally, since the Santa Cruz was never a deep river, at least historically. The closest habitat for squawfish would have been the San Pedro River (Minckley 1973: 120-124). Another exotic species present is the Yaqui catfish, Ictalurus pricei, a native of the Rio Sonora in Mexico, not introduced into the Santa Cruz Basin until 1899 (Minckley 1973: 180). According to Minckley, possibly two families of marine fish, members of the Belonidae, needlefishes, and Sciaenidae, croakers or drums, are present in the Tubac material. The only local fish represented are moderately large freshwater suckers, Catostomidae, unfortunately not identifiable to genus or species. More detailed information concerning the fish remains is on file in the Arizona State Museum library.

Only three specimens of amphibians, represented by long bones lacking epiphyses, were present. Either frogs or toads, Ranidae or Bufonidae, these specimens occur in the Middle, Middle or Late, and Late periods, and may be intrusive.

third phalanges, a naviculocuboid, and a lumbar vertebra. This scarcity of goat is interesting, and may reflect a cultural preference. According to Roubicek, goat is often, at least in our society, considered to be "lower class" food; sheep may have been the preferred choice by the inhabitants of the presidio.

Several bone elements identified as cf. Bison bison and Bos/Bison were significantly larger and more rugose than the bulk of the Bos taurus remains. The difficulty in separating remains of large cattle or oxen and buffalo has been discussed by Olsen (1960: 3). It is possible to confuse buffalo with the large breeds of cattle, particularly Bos indicus, Brahma cattle or Zebu introduced into South Carolina in 1849, and the Texas longhorns, descendants of the hardy breeds of Andalusian cattle introduced by the early Spanish conquistadores (Olsen 1960: 3-4). Using criteria for the first and second phalanges and metacarpus (Olsen 1960: 10-11), it appears that the elements labeled cf. Bison bison are essentially correct. Comparative material of Bison bison on temporary loan to the Faunal Laboratory of the Western Archeological Center supports this assignment. Concerning the buffalo, Cockrum notes that "although Coues (1867) indicated that buffalo 'formerly ranged over Arizona--now absent', there is no good evidence that they occurred in the state within historic times except as introductions" (1960: 260; Roe 1951: 275). Buffalo could have been obtained from the plains of New Mexico or possibly from northern Arizona, perhaps in trade (Roe 1951: 274-276).

The scarcity of Equidae, horses, mules, burros, and others, is not surprising. Shenk and Teague mention that according to historical records, horses were stabled in corrals in the center of town rather than at the presidio proper. The presence of one possibly butchered equid's first phalanx from a Middle-period context is thus somewhat intriguing.

Several species of wild and possibly domestic birds were noted in the faunal material, aside from the very abundant domestic chicken. These include turkey and goose, which may have been domestic fowl kept at the presidio or nearby, although both occur as wild species in Arizona. Anser albifrons, white-fronted goose, was an uncommon transient especially in south-central Arizona, while turkey was once a common resident of the forested parts of the state, descending into the river valleys in the winter (Monson and Phillips 1964: 185, 193). The goose specimens were identified only to genus, thus it is

Appendix

THE FAUNAL ARCHAEOLOGY OF THE TUBAC PRESIDIO

by

James M. Hewitt
Arizona State Museum
University of Arizona

Domestic mammals	190	61.5	14	43.8	299	77.5	15	51.7	165	88.7	13	68.4
Domestic fowl	112	36.2	15	46.9	82	21.2	9	31.0	19	10.2	3	15.8
Wild mammals	2	0.6	1	3.1	3	0.8	3	10.3	1	0.5	1	5.3
Wild fowl	5	1.6	2	6.3	2	0.5	2	6.9	1	0.5	2	10.5
TOTALS	309	99.9	32	100.1	386	100.0	29	99.9	186	99.9	19	100.0
All domestic animals	302	97.7	29	90.6	381	98.7	24	82.8	184	98.9	16	84.2
All wild animals	7	2.3	3	9.4	5	1.3	5	17.2	2	1.1	3	15.8
TOTALS	309	100.0	32	100.0	386	100.0	29	100.0	186	100.0	19	100.0

Table 18

Calculation of Usable Protein for Each of the Major Food Species at Tubac

	Definition	Early Period	Middle Period	Late Period
Cattle	imm. 400# y. ad. ≈ 600# ad. 800# lg. ad. 1000#	1 lg. ad. ≈ 1000# 1 ad. 800# 1 y. ad. 600# ≈ 2400# X .50 1200# usable meat	1 lg. ad. 1000# 2 ad. ≈ 1600# 2 y. ad. ≈ 1200# 1 imm. 400# ≈ 4200# X .50 2100# usable meat	2 ad. ≈ 1600# 2 y. ad. 1200# 1 imm. 400# 2 3200# X .50 1600# usable meat
Sheep/Goat	imm. 50# y. ad. ≈ 70# ad. 90#	3 ad. 270# 3 y. ad. 210# 2 imm. 100# 580# X .40 232# usable meat	3 ad. 270# 4 y. ad. ≈ 280# 1 imm. 50# ≈ 600# x .40 240# usable meat	1 ad. 90# 6 y. ad. 420# ≈ 510# X .40 ≈ 204# usable meat
Pig	sm. imm. 20# imm. 40# y. ad. 70# ad. 100#	1 ad. ≈ 100# 1 imm. 40# 1 sm. imm. 20# 160# X .50 80# usable meat	1 imm. 40# 40# X .50 20# usable meat	1 y. ad. ≈ 70# 70# X .50 35# usable meat
Chicken	lg. ad. ≈ 5# ad. sm. ad. 3# imm. 1#	2 ad. 8# 9 sm. ad. 27# 1 imm. 1# 36# X .50 18# usable meat	1 lg. ad. ≈ 5# 1 ad. 6 sm. ad. 18# 1 imm. ≈ 28# X .50 14# usable meat	1 ad. 2 sm. ad. 6# 10# X .50 5# usable meat

Table 19

Relative Dietary Significance of the Major Food Species at the Tubac Presidio

	Cattle		Sheep		Pig		Chicken	
	Pounds of Usable Meat	Percent	Pounds of Usable Meat	Percent	Pounds of Usable Meat	Percent	Pounds of Usable Meat	Percent
Early period	1200	78.4	232	15.2	80	5.2	18	1.2
Middle period	2100	88.5	240	10.1	20	1.0	14	0.6
Late period	1600	86.8	204	11.1	35	1.9	5	0.3
TOTALS	4900	85.2	676	11.8	135	2.4	37	0.6

Table 20

Amount of Identified Elements, Butchered Bone, and Burned Bone by Period

	Early Period			Middle Period			Late Period		
	Total Elements Identified	Number Butchered	Number Burned	Total Elements Identified	Number Butchered	Number Burned	Total Elements Identified	Number Butchered	Number Burned
Plaza	26	4	14	77	34	23	55	17	38
S/E SW	3	0	20	179	61	62	19	6	8
S/E N	3	0	0	14	0	2	5	0	0
Rm. Out. 1	197	74	25	22	12	15	27	13	4
Rm. Out. 2	57	20	12	81	18	20	16	2	7
Room 1	0	0	0	1	2	2	2	5	3
Room 2	50	19	11	63	7	22	51	7	16
Room 3	13	9	9	0	1	0	0	0	0
Room 4	8	1	59	52	20	25	18	5	10
Room 5	2	0	4	6	0	4	0	0	0
Room 6	32	19	20	6	13	0	11	6	0
Room 7	3	2	8	3	1	1	0	0	0
Room 8	1	1	0	0	0	0	3	0	2
Room 11	0	0	0	0	0	0	0	0	0
Room 12	0	0	1	1	1	1	19	1	2
TOTALS	391	129	183	495	170	177	226	62	90

Table 21

Worked Bone, Dimensions of Object and/or Worked Edge (in mm)

	Provenience	Ground and Polished	Concave Edges	Convex Edges	Straight Edges	Comment
A.	Room Out. 2, Middle	43 x 10 x 8				5-faceted point (Fig. 53:b)
B.	?	44 x 9 x 2				Broken disc? (Fig. 53:a)
C.	Room 6, Middle to Late				68 x 29 x 30/31	Worked point (Fig. 53:c)
D.	Plaza, Late		121 x 38 x 6/36			Figure 53:d
E.	Room 2, Late		94 x 40 x 5/32			Figure 53:e
F.	Room 6, Middle to Late		68 x 34 x 8/25			
G.	Plaza, Middle		89 x 28 x 8/20			
H.	Plaza, Late		86 x 29 x 7/29			
I.	Room 4, Middle to Late			63 x 34 x 9/28, 30		Bi-convex edge
J.	Plaza, Middle			84 x 18 x 7/44		
K.	Plaza, Late			46 x 18 x 4		Unifacially-chipped bone flake
L.	Room 4, Middle			41 x 15 x 4		Unifacially-chipped bone flake
M.	S/E SW, Middle				81 x 39 x io/48	Figure 53:f
N.	Room Out. 1, Early				60 x 40 x 6/34	
0.	Room Out. 1, Middle to Late				70 x 34 x 5/37	Worked edge broken, incomplete

Table 22

Percentage Distribution of Total Scrap by Period

Early Period			Middle Period			Late Period		
Provenience	Number	Percent	Provenience	Number	Percent	Provenience	Number	Percent
Room Out. 1	1785	42.7	Plaza	1930	27.8	Plaza	1305	32.4
Room Out. 2	635	15.2	S/E SW	1600	23.1	Room Out. 2	420	10.4
Plaza	530	12.7	Room 4	930	13.4	Room Out. 1	375	9.3
Room 6	270	6.5	Room Out. 2	925	13.3	Room 2	355	8.8
Room 2	240	5.7	Room 2	620	8.9	Room 12	335	8.3
Room 3	130	3.1	Room Out. 1	450	6.5	Room 4	300	7.5
Room 4	130	3.1	S/E N	215	3.1	Room 6	290	7.2
S/E SW	130	3.1	Room 5	55	0.8	S/E SW	235	5.8
Room 5	125	3.0	Room 6	55	0.8	S/E N	185	4.6
Room 7	80	1.9	Room 1	50	0.7	Room 1	160	4.0
Room 8	50	1.2	Room 7	45	0.6	Room 8	65	1.6
Room 12	50	1.2	Room 3	25	0.4	Room 3	0	0
S/E N	20	0.5	Room 12	25	0.4	Room 5	0	0
Room 11	5	0.1	Room 11	10	0.1	Room 7	0	0
Room 1	0	0	Room 8	0	0	Room 11	0	0
TOTALS	4180	100.0		6935	99.9		4025	99.9

References

Boessneck, J.
1969 Osteological Differences Between Sheep (Ovis aries Linn) and Goats (Capra hircus Linn). In Science in Archaeology, edited by Don Brothwell and Eric Higgs, pp. 331-358. Praeger Publishers, New York.

Cockrum, E. Lendell
1960 The Recent Mammals of Arizona. University of Arizona Press, Tucson.

Cook, Sherburne F.
1975 Subsistence Ecology of Scovill. American Antiquity Vol. 40, No. 3: 354-356.

Daly, Patricia
1969 Approaches to Faunal Analysis in Archaeology. American Antiquity Vol. 34, No. 2: 146-153.

DiPeso, Charles C.
1953 The Sobaipuri Indians of the Upper San Pedro River Valley, Southeastern Arizona. The Amerind Foundation, Inc., No. 6, Dragoon.

Dobyns, Henry F.
1959 Tubac Through Four Centuries, An Historical Resume and Analysis. MS, Arizona State Museum, University of Arizona, Tucson.

Dunnell, Robert C.
1973 Fire, Air, Earth, and Water: A Rational Classificatory Scheme. Mankind Vol. 9., No. 2: 127-131.

Flannery, Kent V.
1967 The Vertebrate Fauna and Hunting Patterns. In The Prehistory of the Tehuacan Valley, Vol. 1, edited by Douglas S. Byers, pp. 132-177. University of Texas Press, Austin.

Grayson, Donald K.
1973 On the Methodology of Faunal Analysis. American Antiquity Vol. 38, No. 4: 432-439.

Guilday, John
1970 Animal Remains from Archaeological Excavations at Fort Ligonier. Annals of Carnegie Museum No. 42: 177-186.

Guilday, John E., Paul W. Parmalee, and Donald P. Tanner
1962 Aboriginal Butchering Techniques at the Eschelman Site (36 La 12), Lancaster County, Pennsylvania. Pennsylvania Archaeologist Vol. 32, No. 2: 59-83.

Leechman, Douglas
1951 Bone Grease. American Antiquity Vol. 16, No. 4: 355-356.

Minckley, W. L.
1973 The Fishes of Arizona. Arizona Fish and Game Department, Phoenix.

Monson, Gale and Allan R. Phillips
1964 The Species of Birds in Arizona. In The Vertebrates of Arizona, edited by Charles H. Lowe, pp. 175-248. University of Arizona Press, Tucson.

Olsen, Stanley J.
1960 Post-cranial Skeletal Characters of Bison and Bos. Papers of the Peabody Museum of Archaeology and Ethnology Vol. 35, No. 4.

1967 Osteology of the Macaw and Thick-billed Parrot. The Kiva Vol. 32, No. 3: 57-72.

1971 Zooarchaeology: Animal Bones in Archaeology and Their Interpretation. Addison-Wesley Modular Publications Vol. 1, No. 2.

Robbins, Chandler S., Bertel Bruun, and Herbert S. Zim
1966 Birds of North America. Golden Press, New York.

Roe, Frank G.
1951 The North American Buffalo. University of Toronto Press, Toronto.

Sadek-Kooros, Hind
1972 Primitive Bone Fracturing: A Method of Research. American Antiquity Vol. 37, No. 3: 369-382.

Schiffer, Michael B.
1972 Archaeological Context and Systemic Context. American Antiquity Vol. 37, No. 2: 156-165.

Silver, I. A.
1969 The Ageing of Domestic Animals. In Science in Archaeology, edited by Don Brothwell and Eric Higgs, pp. 283-302. Praeger Publishers, New York.

Watts, R. E.
1965 Aging Cattle by Examination of Teeth. Folder 96, Agricultural Experiment Station and Cooperative Extension Service, University of Arizona, Tucson.

White, Theodore E.
1953 A Method of Calculating the Dietary Percentage of Various Food Animals Utilized by Aboriginal Peoples. American Antiquity Vol. 18, No. 4: 396-398.