SWCA Anthropological Research Paper Number 11

Abundant Harvests

The Archaeology of Industry and Agriculture at San Gabriel Mission

John Dietler, Heather Gibson, and James M. Potter, editors

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Pasadena_2015

Contributors:
John Dietler
Sara Dietler
Aaron Elzinga
Sara Ferland
Heather Gibson
Suzanne Griset
M. Colleen Hamilton
Nicholas F. Hearth
Kholood Abdo Hintzman
Laura E. Hoffman
Alex Kirkish
Samantha Murray
Kim Owens
James M. Potter
Steven Treffers
Michael Tuma
Benjamin Vargas
Mary Ann Vicari

GIS and Graphics:
William Hayden
Chris Millington
Peter Von der Porten

Technical Editors:
Kari L. Chalker
John Pecorelli
Peter Von der Porten

ISBN No. 978-1-931091-34-5

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Table of Contents

APPENDICES

List of Figures

List of Tables

ACKNOWLEDGMENTS

One of the most satisfying things about archaeology is the fact that effective research requires teamwork. At each step, many sets of hands with a wide variety of skills must work together in unison to make progress. When this teamwork goes well, as it has for the San Gabriel Trench Archaeological Project, the result is far better than the sum of its parts. Successfully completing a large project such as this—a publicly funded study of a significant and beloved historical site that was conducted in a major transportation corridor spanning three cities—required an especially large team. Looking back over the course of what has been one of the most amazing projects we have been involved with, we are grateful to each of the people and institutions that contributed their time, ideas, and support.

More than 100 SWCA staff members participated in the data recovery phase of the project, including field and laboratory archaeologists; zooarchaeologists, osteologists, lithic analysts, ceramicists, and bead analysts; geoarchaeologists and historians; GIS specialists and technical editors; and senior scientists, interns, administrative assistants, and project managers. The research design, fieldwork, and ceramic analysis were conducted in partnership with Applied Earthworks. The efforts of each of these colleagues made important contributions to the project's success.

Several people contributed greatly to the project's overall design and execution, and the interpretation and presentation of its results. These include Senior Archaeologists Benjamin Vargas, Colleen Hamilton, Jim Potter, Sara Dietler, and Heather Gibson. I would also like to thank Holly Rendon for organizing our teaming partners, Sarah Edwards for overseeing the field logistics, and especially Cara Corsetti, SWCA Project Manager, for her leadership and support throughout this long project.

It is no easy feat to conduct fieldwork with up to 40 archaeologists working simultaneously within an active railroad right-of-way in an urban neighborhood. Our field team did a tremendous job in keeping the project on schedule, producing great results, and keeping both the staff and members of the public safe (Figure A.1). That team was capably led by Field Director Laura Hoffman, as well as Crew Chiefs Katie Martin, Keith Warren, and Marina Adame. Senior Archaeologists Benny Vargas and Colleen Hamilton provided oversight in the field. In addition to standard archaeological techniques, several outside groups provided specialized field support. Archaeologist and GIS Specialist Chris Millington coordinated the field mapping efforts and created the maps in this monograph. Torres Construction and Access Pacific provided heavy equipment and logistical support services. Billy Silva of Caltrans conducted multiple ground-penetrating radar surveys, which greatly helped our ability to locate buried archaeological features. Koral Ahmet of Southland Aerial Photography generated outstanding low-elevation aerial photographs using a custom helium balloon setup. Lastly, Mollenhauer Group provided laser scanning services, enabling the rapid and detailed documentation of complex architectural foundations.

Analyzing an assemblage consisting of nearly 300,000 artifacts, 80,000 faunal specimens, and 41 tons of building material was a daunting challenge, both in terms of logistics and data management. Laboratory Director Kim Owens, assisted by Cheryle Claypoole Hunt, did a wonderful job managing the process. To accomplish specialized studies of the plant remains we recovered, PaleoResearch Institute provided pollen, phytolith, macrofloral, protein, and organic residue analysis. Our custom artifact database was created by Database Specialist Kristine Kisman. GIS Manager William Hayden

kept the database running smoothly, while also creating and maintaining a dizzying array of spatial data capture and management technologies and programs. For what often feels like a low-tech science (Figure A.1 is an homage to Edith Webb's 1934 excavation photo, where she and her crew sit atop the excavated foundations of Chapman's Mill with their shovels and picks), I was often amazed by the sheer number of lasers that we had onsite.

The most visible accomplishment of this project was the preservation in place of Chapman's Mill and the relocation of a portion of Chapman's Millrace to Plaza Park, making it accessible to the public for the first time in nearly a century. Successfully moving a 15-ton piece of unreinforced masonry architecture without incident was amazing to watch, and enormously gratifying to see completed. The team responsible for this feat was led by Architectural Historian Shannon Carmack, and included Structural Engineer Mel Green of Melvyn Green and Associates, Historic Architect John Heller of ICF International, Mark Sauer Construction, Cen-Cal Heavy-Moving, Inc., pump expert Jon Rasmussen of the Pond Company, and artist Bill Matthies. The mill and millrace were documented prior to relocation by ICF Architectural Historian David Greenwood, Mr. Heller, and SWCA architectural historians; their Historic American Engineering Record (HAER) package is now curated at the Library of Congress.

The majority of the data recovery work took place within the Union Pacific Railroad right-of-way, and the railroad was a gracious and helpful host for our study. Track Supervisor Frank Beard, in particular, and a number of flaggers, were a constant presence during the fieldwork, both ensuring our safety and lending insight into railroad history and practices as they related to the site. Most of the study was located within the City of San Gabriel, and city staff were invaluable in facilitating our work. In particular, Bruce Mattern was a key figure in coordinating everything from street closures to Chinese translation for interpretative signs. Another supportive stakeholder was the San

Figure A.1. San Gabriel Trench Archaeological Project field crew.

Gabriel Mission, which provided access to research materials and facilities, and gave valuable input on the siting of the relocated portion of Chapman's Millrace. Business Manager Al Sanchez and Museum Coordinator John Fantz were particularly helpful.

We were extremely fortunate to have Caltrans as our lead agency, with Dr. Alex Kirkish at Caltrans District 7 serving as the archaeologist who oversaw our work for the duration of the project. Dr. Kirkish was a partner in designing the project, participating in its execution, conducting Native American consultation, and interpreting the project's results. Dr. Kirkish was always a willing sounding board, a source of new ideas, and an enthusiastic witness to each new discovery. It was a pleasure and a privilege to work alongside Dr. Kirkish throughout this process. Caprice "Kip" Harper initially contributed to the project as an SWCA staff member, later as a Caltrans archaeologist, and provided detailed and insightful comments on the draft of this monograph.

I would be remiss if I did not thank the following institutions for permitting the use of historical images: the Bancroft Library at the University of California, Berkeley, the Braun Research Library of Southwest Museum of the American Indian, the Los Angeles Public Library, the San Gabriel Mission Museum, the San Gabriel Historical Association, the University of Southern California Digital Archive, Santa Bárbara Mission Archive-Library, and the Old Mill Foundation. Special thanks also go to the primary facilities that will house the collections derived from this study, including the Fowler Museum at the University of California, Los Angeles, the San Gabriel Mission Museum, the Union Pacific Railroad Museum, and the San Gabriel Historical Association.

A special thank you goes to Michael J. Hart, former general manager of the nearby Sunny Slope Water Company, who shared his unique insight into the history of water management in the San Gabriel Valley. Much of the historical research presented in this book concerning Joseph Chapman and the mills of San Gabriel builds upon Mr. Hart's decades of research, and on his historically accurate and visually stunning hand-painted maps of the Mission-period facilities and waterworks. A true renaissance man and a selfless colleague, he generously permitted the use of his illustration of Chapman's Mill for the cover of this volume and for project signage. For that and more, we are truly in his debt.

The input that we received from the mission community's descendants was invaluable, particularly the Native American descendants who worked with us daily as advisors and monitors. Andy and Adrian Morales and Chief Red Blood Anthony Morales of the Gabrieleno/Tongva Band of Mission Indians of San Gabriel were present throughout the data recovery work, sharing their knowledge of their history, traditional songs, and advising the archaeologists regarding the respectful treatment of objects found onsite. Andy Salas and Chief Ernest Perez Tautimes Salas of the Kizh Nation Gabrieleño Band of Mission Indians also contributed valuable insight and history in the course of the study. One of the most unexpected moments of the project came when we were joined by Carlos Chapman at the ribbon cutting ceremony for the relocated portion of Chapman's Millrace, which his direct ancestor Joseph Chapman designed nearly 200 years before. Many thanks to Mr. Chapman for making the long trip to join us at that special event, and for sharing his family history with us.

Lastly, we are extremely grateful for the constant support and careful management of the Alameda Corridor–East Construction Authority. Rick Richmond, Mark Christoffels, Sylvia Novoa, Ricky Choi, Paul Hubler, and especially Phil Balmeo were wonderfully patient, understanding, and supportive throughout the project. Thanks to you all.

John Dietler

PREFACE: AN ARCHAEOLOGY OF SAN GABRIEL MISSION

John Dietler

> *The present establishment [San Gabriel Mission] had land and water in abundance, the former of middling quality, the latter likewise constant all the year round. With these good qualities correspond the harvests of all grains, and it can not be denied that the activity and efforts of the Mission Fathers have equaled the fertility of the fields which have been cultivated by them. In this way they have been able to provide abundantly for the maintenance of its Indians; have succored the greatest needs which have been experienced in the territory, their succor reaching even as far as Lower California; have facilitated the expeditions and very costly enterprises which would have been almost impracticable without its supplies. It is to a great extent true that it has sustained the conquest (of California). Its Indians possess the character of the lazy, the cowardly, and the thievish, even in the disturbances or the semblance of the revolt in which for a short time they were engaged. These qualities have been noted in them. At present they continue quiet and peaceful. To the possession of the herds correspond the said abundant harvests.* (Pedro Fages, 1787, as quoted in Engelhardt 1927a:59).

A 1787 report written by California's second governor, Pedro Fages, includes the above passage, which aptly summarizes the triumph and tragedy that simultaneously characterize San Gabriel Mission. Earning the nickname "the Pride of the Missions," the community's second (and current) location was among the most favorable of Alta California's 21 missions, having fertile soil and access to a year-round supply of water. Additionally, the mission had control over tens of thousands of acres of pasturage, on which they raised immense herds of cattle and sheep. Governor Fages' assessment of the mission is authoritative and credible when it comes to the effects of this noteworthy agricultural and pastoral productivity. Not only was the mission self-sufficient, but its tremendous output also subsidized nearby settlements, including the young Pueblo of Los Angeles, missions as far away as Baja California in present-day Mexico, and expeditions throughout the region.

Equally noteworthy, however, is Fages's ethnocentric and demonstrably inaccurate assessment of the human factors behind this productivity. While there is little doubt that the Franciscan priests stationed at San Gabriel Mission worked tirelessly to further its success, historical records are very clear that the bulk of the labor at the California missions—including San Gabriel Mission—was performed by Native Americans at great demographic and cultural costs. In 1787, only two priests were stationed at San Gabriel Mission, and they were joined by a handful of soldiers and artisans of European descent. That same year, according to the priests' records, 924 baptized Native Americans belonged to the mission community. Together with many unbaptized indigenous people, this group was most directly responsible for the mission's output of 5,448 bushels of grain, countless fruits and vegetables, and 6,361 head of livestock that year (Engelhardt 1927a), along with the wine, vinegar, olive oil, hides, tallow, and soap that were derived from these abundant herds and harvests. Contemporary accounts are also clear that Native Americans were responsible for making most of the numerous implements, tools, containers, and household items that were used on a daily basis by San Gabriel Mission community members, including leather goods, pottery, basketry, clothing, blankets, milling stones, iron implements, and building materials such as tiles and adobe bricks (Peréz 2006:108).

Recent historical research has resulted in a more balanced view of the forces behind the Spanish colonial period in California as well as its impacts. This research presents the roles and perspectives of both the colonizer and the colonized, and the effects of their actions (e.g., Hackel 2005; Sandos 2004). These scholars make it clear that just as the padres were responsible for the design and general organization of the mission community, the padres and the accompanying soldiers were also accountable for the great toll that missionization took on the vibrant Native Californian societies that came from the relentless demands of physical labor, harsh corporal punishment and cultural repression, and unsanitary conditions that fostered the spread of contagious European diseases for which they had no defense. It is also clear that Native Americans were not passive recipients of Spanish influence, but rather active participants in the shaping of the mission community, both in alignment with and, often, in resistance to the desires of the colonizers.

The following study represents the first in-depth examination of the San Gabriel Mission using archaeological data, which differ substantially from the evidence available to historians. Archaeological data has an important role to play in telling the story of San Gabriel Mission's history because the majority of the evidence from the Mission period available to historians comes from accounts like Fages's, which reflect the biases of their authors and the era. While Mission histories are typically drawn from the written records created by colonial administrators, archaeology draws from the materials left behind by the entire mission community. These materials can be used to answer any number of research questions about the community's social, religious, economic, political, environmental situation during the site's approximately 60-year history as a functioning mission.

Drawing its data from San Gabriel Mission's formal garden area, our study's primary contribution to this field of inquiry centers on the community's economy—the materials left behind by the countless Native American workers who were compelled to produce, store, and process the abundant harvests that Fages lauded in his report. The increasing industrialization of the mission's agricultural processes, and the resulting impacts on mission residents, come into sharp focus with the examination of these materials. Because this is only one of the stories that can be told using the material remains, this book is not intended to represent *the* archaeology of San Gabriel Mission, but rather *an* archaeology of the mission. By presenting the results of our study here, in a publicly accessible format, our hope is to engage as broad of an audience as possible in the search for understanding, lessons, and inspiration from our history. We hope this will be the beginning of a rich conversation about the people, processes, and events at San Gabriel Mission that had such a lasting impact on Southern California.

CHAPTER 1: INTRODUCTION

John Dietler and James M. Potter

Today, California's missions are vibrant centers of modern Catholicism. Each of the 21 missions are also important monuments to California's rich past. This past is most visibly embodied and preserved in the architectural grandeur of California's mission churches, the romantic images of which adorn art books and symbolize an important phase of California's history. But in the late eighteenth and early nineteenth centuries, these places were much more than the churches they contained. Beyond their function as places of worship and religious conversion, missions were designed to be self-sufficient agricultural communities that would provide food and other products to nearby ranchos, pueblos, presidios, and local indigenous populations.

San Gabriel Mission, as it is known today, was founded under the name La Misión San Gabriel Arcángel in honor of St. Gabriel the Archangel (Engelhardt 1927a:4). It was the fourth mission built in Alta California (Figure 1.1) and was established to provide agricultural products to a large, centralized community of converts. Founded on fertile lands, surrounded by thousands of acres of good pasture, and home to a large local Native American population that supplied labor, San Gabriel Mission was among the most successful missions in terms of agricultural and pastoral output.

The mission fathers directed the neophyte (Native American convert) labor to clear the thickly forested riparian environment into orchards and gardens and establish vast vineyards and grazing lands. At the pinnacle of its production, San Gabriel Mission boasted 25,000 cattle, 15,000 sheep, 150 goats, 200 pigs, 2,000 horses, and 100 mules, and it produced 31,600 bushels of grain and 500 barrels of wine and brandy (Engelhardt 1927a:279; Sugranes 1909:75). Other pursuits included tanning hides and producing tallow and soap—key exports in the late eighteenth and early nineteenth centuries. San Gabriel Mission's remarkable economic prosperity contributed directly to the rise of Los Angeles, which would eventually become the United States' largest western city.

Archaeology is particularly well suited for revealing the economic aspects of the mission system, encompassing the vastness and complexity of its agricultural machinery. The excavations conducted by SWCA Environmental Consultants (SWCA) at San Gabriel Mission, which are the focus of this volume, uncovered elements of the agricultural system at the mission. This system included a central town (the mission complex); nearby agricultural fields, waterworks, and mills; and large, outlying tracts used for animal pasturage. The mission community grew and become more elaborate over time, and at its peak its main components were the church, a cemetery, residential and workshop buildings arranged into rectilinear quadrangles with central open spaces, housing for neophytes, numerous granaries, a mill and millrace fed by earthen ditches called *zanjas*, gardens, an orchard, and a vineyard (Figure 1.2).

This study, which represents the first large-scale and systematic archaeological excavation at the site, was conducted within the mission's garden area, bringing to light the foundations of the mill, the millrace (see Figure 1.2), a previously undocumented building that may have been a granary, and several previously undocumented reservoirs (see Chapter 6). The garden area investigations provided information on the crops residents grew. Studies of the granary provided insight into the volume and variety of agricultural products residents stored. The mill excavations yielded evidence of grinding these products. And recovered faunal remains allowed for the quantification of the scale of the mission's cattle industry, confirming it as the mission's greatest economic activity, by far.

Archaeology is also uniquely equipped to shed light on the daily lives of the residents of the mission, especially what they ate and in what proportions, what they hunted and fished, the animals they raised, the plants they gathered, the types of pottery they used, the clothes they wore, how they disposed of their refuse, and their daily interactions. Although the documentary record for San Gabriel Mission is substantial, it is far from comprehensive and was largely written by the missionaries and their church-affiliated successors (see, e.g., Engelhardt 1927a). Because they reveal the material remains of everyday life, archaeological studies can help place the mission's underrepresented majority—its Native American residents and laborers—at the center of the mission's story.

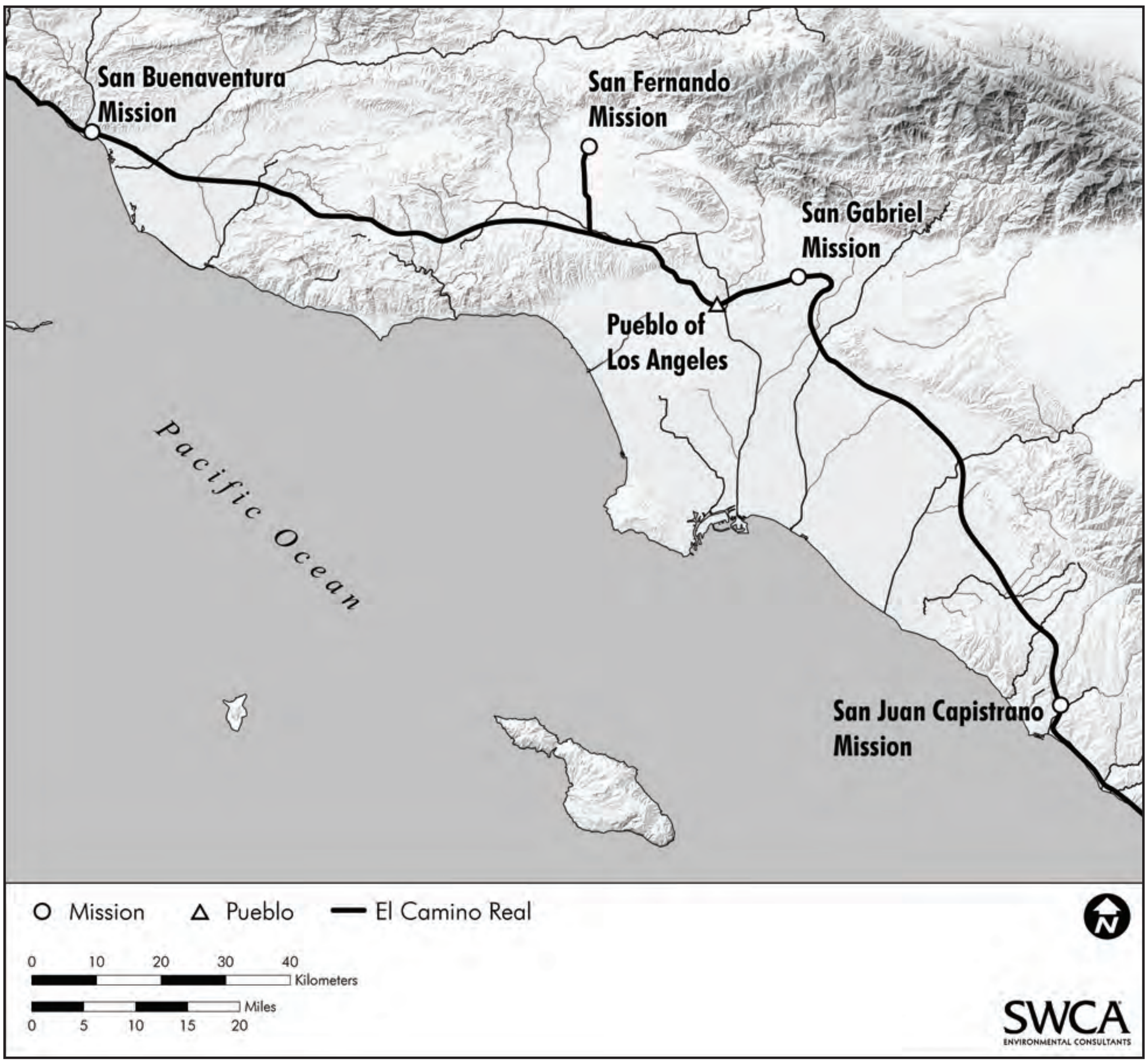

Figure 1.1. The location of San Gabriel Mission in southern California.

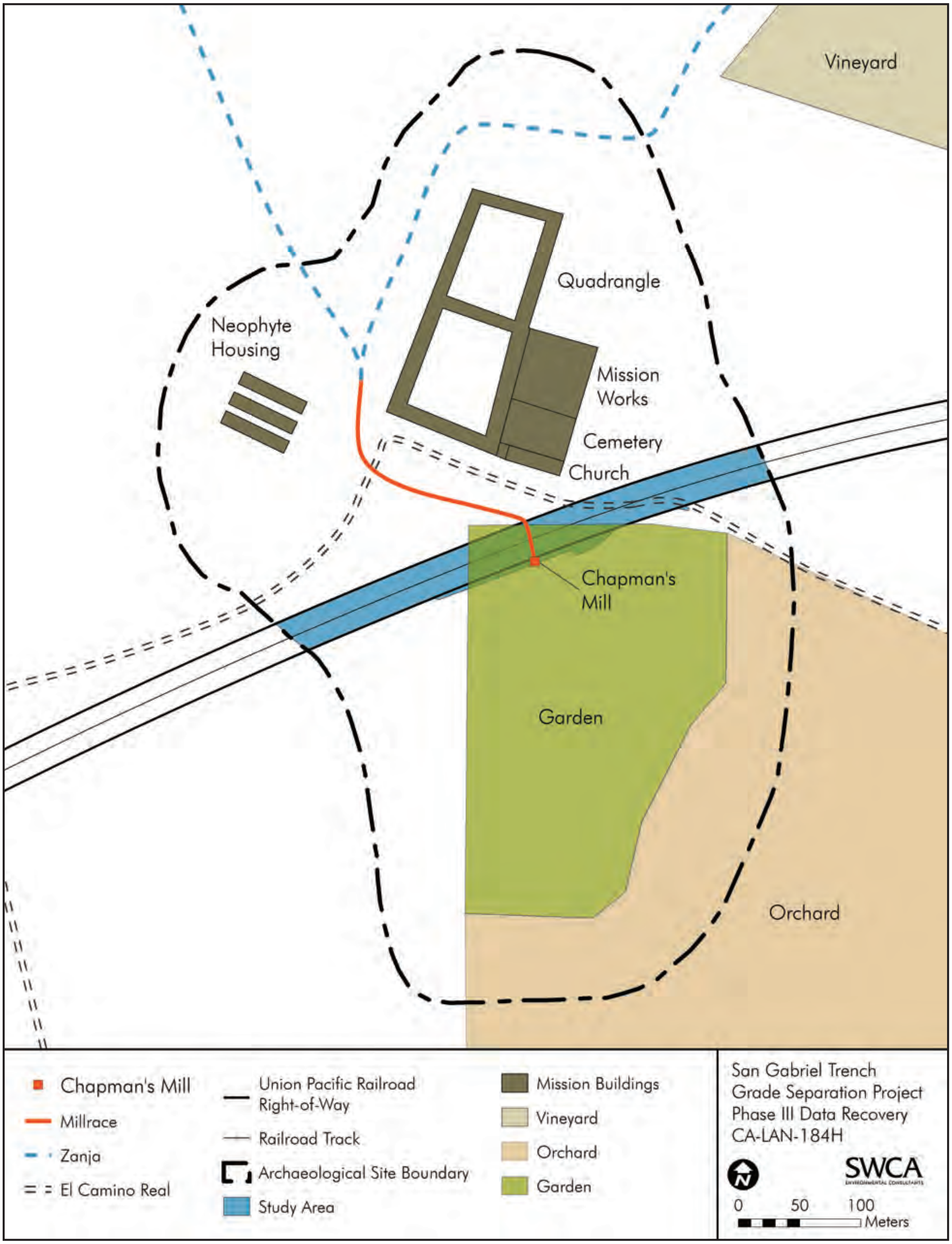

Figure 1.2. The San Gabriel Mission complex.

These two intersecting themes, the industry of the mission and the daily lives of the mission residents, provide a framework for this report of SWCA's excavations at San Gabriel Mission.

The San Gabriel Trench Archaeological Project

The San Gabriel Trench Archaeological Project took place as part of the Alameda Corridor–East Construction Authority's (ACE) implementation of the 2.2-mile San Gabriel Trench Grade Separation Project, which will lower the Union Pacific Railroad tracks (which had been the Southern Pacific Railroad before 1996) beneath original grade through the mission's old garden area. All work was undertaken in accordance with the project memorandum of agreement (California Department of Transportation 2010) between the California Department of Transportation (Caltrans), the lead agency for compliance with Section 106 of the National Historic Preservation Act, and the California Office of Historic Preservation. The work was guided by the *Treatment Plan for CA-LAN-184H and Three Archaeological Resource Locations for the San Gabriel Trench Grade Separation Project, Cities of San Gabriel, Alhambra, and Rosemead, Los Angeles County, California* (Dietler and Harper 2010), which prescribes the approach for the data recovery and public outreach aspects of the project.

The archaeological work, conducted in three major phases (Phase I and Extended Phase I, Phase II, and Phase III; see Figures 1.3 and 1.4), was part of a larger environmental study that included survey and evaluation of the area's rich architectural history (Smith 2009; Smith et al. 2009). The work took place within a formally defined area of potential effects (APE). In this report, the term "study area" refers to the portion of the San Gabriel Mission archaeological site (CA-LAN-184H) within the Union Pacific Railroad right-of-way and adjacent City of San Gabriel property where Phase III (data recovery) took place. The earlier phases of work included additional archaeological resources located within the APE but outside of the study area. Table 1.1 provides a brief summary of the archaeological resources investigated and the work accomplished per phase, including evaluations of eligibility for the National Register of Historic Places (National Register).

Phase I and Extended Phase I Resource Identification and Delineation

During Phase I, SWCA conducted archival research and a pedestrian survey, identifying seven archaeological resources (see Figure 1.4): the San Gabriel Mission archaeological site (CA-LAN-184H), the Spruance Fruit Company Warehouse (CA-LAN-4076), the Lime and Cement Storage building (CA-LAN-4077), the T. J. Wilson Warehouse, the Southern Pacific Railroad San Gabriel Depot site (CA-LAN-2548), a concrete pipe culvert, and a concrete map culvert (Ramirez et al. 2009). Drawing from historic maps and previous archaeological research, SWCA redefined the boundary of San Gabriel Mission archaeological site to encompass most of the mission's core structures that existed at its peak in the 1820s (see Figure 1.2 and Chapter 2). The area covered by the archaeological site is larger than the current property owned by San Gabriel Mission.

During Extended Phase I, SWCA used ground-penetrating radar, surface mapping, artifact collection, and shovel test pits to investigate five of the seven archaeological resources in the APE (Ramirez and Dietler 2009). This phase of research established the integrity and dimensions of the portion of the San Gabriel Mission archaeological site (CA-LAN-184H) that would become the study area for the purposes of Phase III, data recovery. Extended Phase I located ground-penetrating radar anomalies in the mapped locations of CA-LAN-4076, CA-LAN-4077, and CA-LAN-2548. No evidence of the T. J. Wilson Warehouse was identified, and it was excluded from later studies.

Phase II Resource Evaluation

During Phase II, SWCA used manual and mechanical excavation and laboratory analyses to evaluate the eligibility of three of the

Table 1.1. Archaeological Resources and Work Accomplished Per Phase

Archaeological Resource	Site Number	Phase I and Extended Phase I	Phase II	Phase III (Data Recovery)
San Gabriel Mission archaeological site	CA-LAN-184H	Intact site found and delineated.	Determined eligible for the National Register.	Data recovery.
Spruance Fruit Company Warehouse	CA-LAN-4076	Identified through historic research; anomaly found through ground-penetrating radar.	Determined not eligible for the National Register.	No further work.
Lime and Cement Storage building	CA-LAN-4077	Identified through historic research; anomaly found through ground-penetrating radar.	Determined not eligible for the National Register.	No further work.
T. J. Wilson Warehouse	None assigned	Identified through historic research; no anomaly found through ground-penetrating radar.	No further work.	No further work.
Southern Pacific Railroad San Gabriel Depot site	CA-LAN-2548	Identified through historic research; anomaly found through ground-penetrating radar.	Site was inaccessible.	Evaluated for National Register eligibility after data recovery phase.
Concrete pipe culvert	None assigned	Identified through historic research.	Site was inaccessible.	Evaluated for National Register eligibility after data recovery phase.
Concrete map culvert	None assigned	Identified through historic research.	Site was inaccessible.	Evaluated for National Register eligibility after data recovery phase.

archaeological resources (CA-LAN-184H, CA-LAN-4076, and CA-LAN-4077) for the National Register. Due to safety concerns and the likelihood of ground-penetrating radar signal interference related to the proximity of active rails, the two culvert features could not be included in the Extended Phase I ground-penetrating radar survey or in the Phase II study. SWCA recommended that identification, National Register evaluation, and, if necessary, data recovery be undertaken for these two resources, and for the Southern Pacific Railroad San Gabriel Depot site, concurrently with the construction phase of the project. These efforts will be described in a subsequent report.

The investigated portion of the San Gabriel Mission archaeological site (CA-LAN-184H) contained foundation elements of Chapman's Mill and Millrace and what was at the time thought to be the mission garden wall (reinterpreted in this study as a granary), as well as archaeological deposits reaching a depth of 150 centimeters (cm) below the modern grade. Because of this data potential, CA-LAN-184H was found eligible for the National Register under Criterion D. It is a contributor to San Gabriel Mission, which was listed in the National Register in 1971 for its architectural elements.

Excavation at the former location of the Spruance Fruit Company Warehouse (CA-LAN-4076) revealed a layer of charcoal and unburned wood likely related to the 1927 fire that destroyed the warehouse. No diagnostic artifacts or building foundations were identified in this location. Excavation at the former location of the Lime and Cement Storage building (CA-LAN-4077) identified a buried concrete building foundation with a single diagnostic artifact. Due to a lack of data potential and integrity, neither site is eligible for the National Register under any criterion.

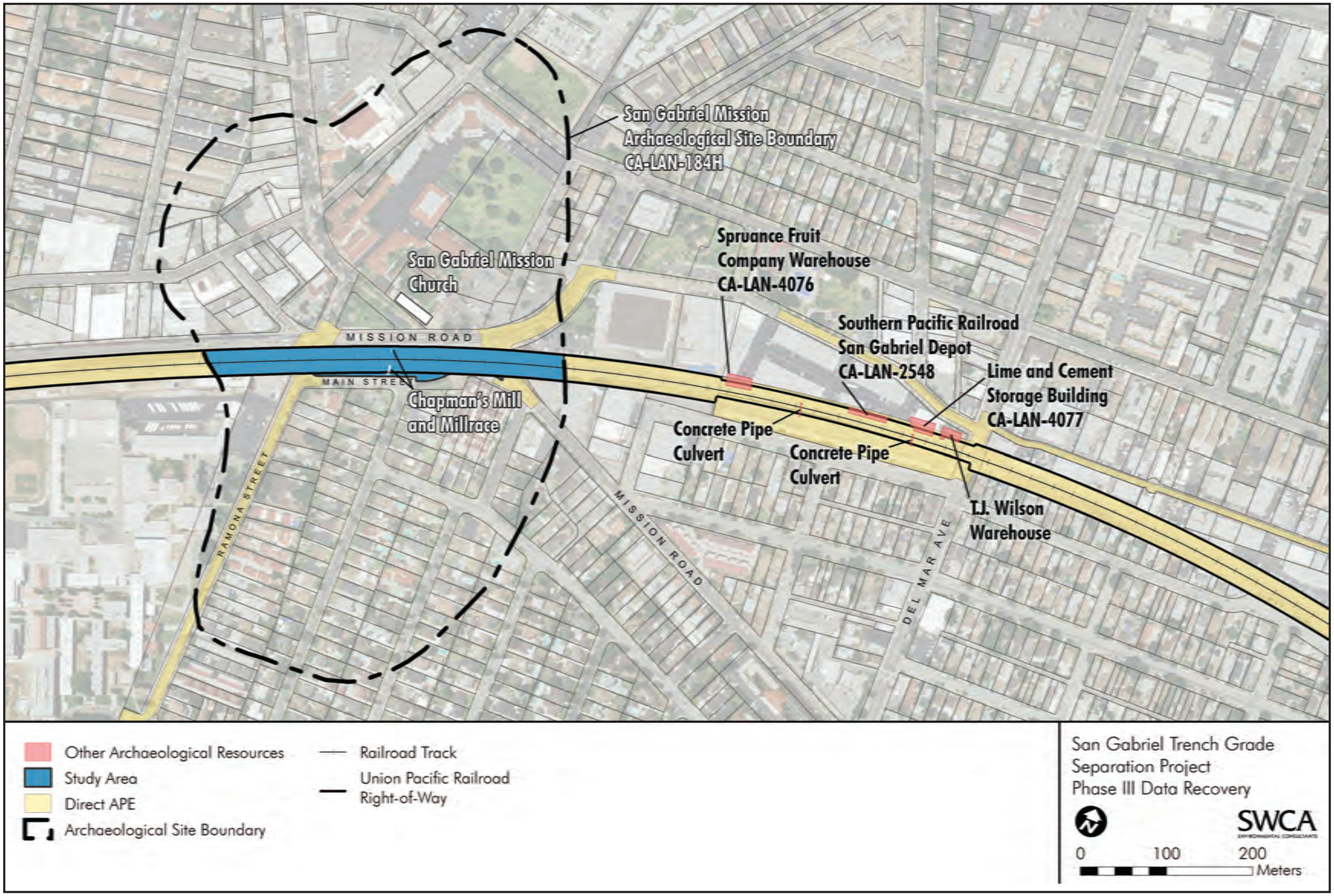

Figure 1.3. Archaeological resources in the APE.

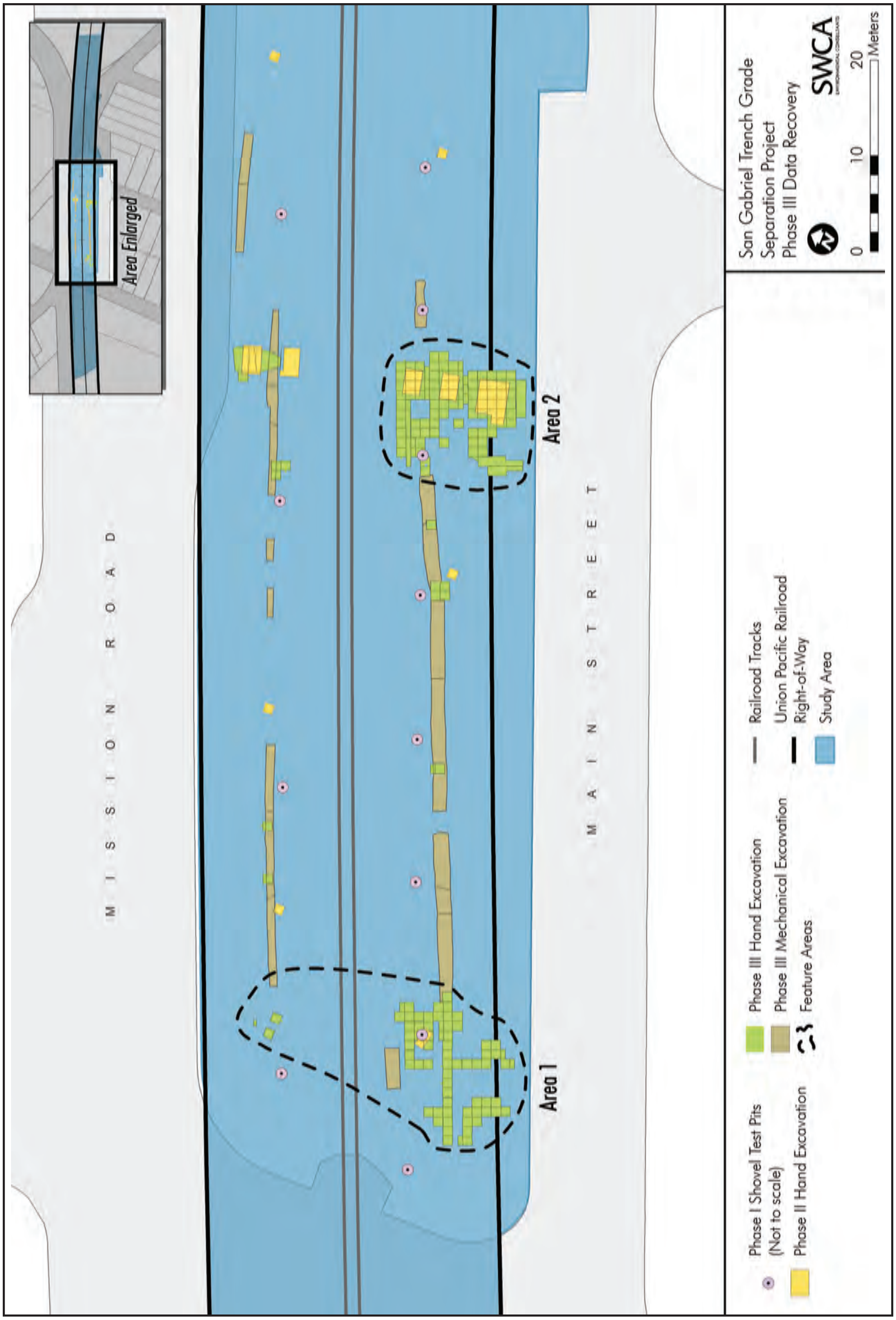

Figure 1.4. Locations of the three phases of research in the study area.

Following the Phase II study, SWCA analyzed the effects that the proposed project was expected to cause according to the Criteria of Adverse Effect (36 Code of Federal Regulations 800.5[a][1] and [2]) to assess whether the project may adversely affect historic properties in the study area. Application of the Criteria of Adverse Effect resulted in Findings of Adverse Effects for four archaeological resources: the San Gabriel Mission archaeological site (CA-LAN-184H), the Southern Pacific Railroad San Gabriel Depot (CA-LAN-2548), and two historic culverts. SWCA prepared a Finding of Adverse Effect and submitted the document to Caltrans, the Alameda Corridor–East Construction Authority, and the California Office of Historic Preservation. Data recovery was recommended for the San Gabriel Mission archaeological site (CA-LAN-184H) to mitigate project effects.

Phase III Data Recovery

SWCA conducted data recovery excavations at the San Gabriel Mission archaeological site, with most work occurring between November 28, 2011, and April 10, 2012. The portion of the site that was investigated during data recovery (see Figure 1.4)—the study area—covered 3,326 square meters (m^2). The study area contained 51 features, including a large granary, a reservoir complex, and Chapman's Mill and Millrace, which were exposed by 185.6 m^2 of hand excavation and an additional 180.2 m^2 of archaeologically directed mechanical excavation. A total of 286,652 artifacts were cataloged, in addition to 79,487 animal bones, 646 shells, 557 botanical samples, and two human bones. The majority of these items were recovered during the data recovery phase.

Because the data recovery involved the large-scale archaeological excavation of a beloved historic resource in the heart of a busy city, this phase of the project included a strong public outreach effort. A project webpage focused on the archaeological research, and a webcam provided real-time views of the excavation as it progressed. Although the dig site was located within an active railroad right-of-way, SWCA was able to construct a viewing platform that allowed safe, in-person visits. Partnering with the Alameda Corridor–East Construction Authority and Gabrielino consultants, who represent the Native American descendants of the mission's inhabitants, SWCA archaeologists spoke to more than 3,000 visitors, including schoolchildren, members of local historical societies, politicians, and members of the media.

As originally designed, the proposed grade separation project would have destroyed the ruins of Chapman's Mill and Millrace, which represent the largest and most significant pieces of architecture in the study area. SWCA worked closely with the Alameda Corridor–East Construction Authority to demarcate the mill's foundations and ensure that they would be avoided by project construction. After the complete excavation and documentation of the millrace, SWCA moved the best-preserved segment out of the construction area, restored it to its historic appearance, and installed interpretative signage. After nearly two centuries of neglect, this important piece of California's history now sits in front of the San Gabriel Mission church, forming a focal point for the education and enjoyment of the public.

The Data Recovery Report

This document reports the findings of the data recovery excavations at the San Gabriel Mission archaeological site (CA-LAN-184H). It addresses the research questions posed in the research design (Dietler and Hoffman 2011) as summarized in Chapter 3 and provides a stand-alone summary of the study results for the scientific community and other interested readers. In addition, it presents new ideas and insights about the archaeological record of the area.

The report is organized into 12 chapters. Chapters 1 and 2 provide an introduction and context for the study, including descriptions of the cultural, historical, and environmental backgrounds. Chapter 3 summarizes the research design that guided the excavations, and Chapter 4 details the methods used to recover data that would address the questions and data requirements put forth in the research design, including field, laboratory, curation, public outreach, and Native American coordination strategies. Chapter 5 is a site overview that provides context for the results presented in Chapters 6 through 10. Chapter 6 describes the features encountered during excavations. Chapters 7 and 8 present the results of the flora and fauna analyses, respectively. Chapters 9 and 10 present the analyses of ceramics, lithics, beads, metal and glass objects, and other artifacts. Chapter 11 presents spatial and temporal analyses, and the final chapter, Chapter 12, summarizes the results and offers concluding interpretations. Additional project data are provided in digital format as appendices. Appendix A is the ground-penetrating radar study technical report, and Appendix B provides the laser scanning data. Appendix C is the pollen, phytolith, macrofloral, protein, and organic residue analyses report. Appendix D is the artifact catalog database, Appendix E is the Historic Architectural Engineering Record for Chapman's Millrace, and Appendix F provides details of the shell and glass bead typologies.

CHAPTER 2: SITE CONTEXT

John Dietler and Steven Treffers

Introduction

To understand the archaeological data revealed in the course of this study, it is first necessary to understand San Gabriel Mission's environmental, ethnographic, and historical context. In providing this context, this chapter reviews the documentary evidence for the rise, decline, and revival of the mission.

Founded in the lushly vegetated heart of the San Gabriel Valley adjacent to an established Native American village, the mission quickly rose to prominence as the "pride of the missions" due to its unparalleled agricultural success (Engelhardt 1927a). Profits from a thriving hide and tallow export business were reinvested in mission infrastructure, including a network of water control features, a rich formal garden, and a revolutionary, New England–style mill built by an ingenious American named Joseph Chapman. Sold into private hands in 1834, much of the mission complex fell into ruin. Despite its clear regional importance, accessibility, and proximity to several world-class research universities, previous studies of the mission have been limited to excavations by non-professionals, accidental discoveries in the course of construction, and small-scale archaeological projects performed by cultural resource management firms.

Environmental Setting

The study area is in the city of San Gabriel in the western San Gabriel Valley and runs along the Union Pacific Railroad (formerly the Southern Pacific Railroad) tracks between Alhambra Wash and Rubio Wash (Figure 2.1). Today, this is a highly urbanized area with mixed commercial and residential development, and most of the native vegetation has been removed and replaced by nonnative trees and grasses. Before modern development, however, the San Gabriel area was well-watered and heavily vegetated. When the mission was established in this location in 1775, the padres described a nearby oak grove from which timber could be harvested, as well as a great plain of moderate-quality soil that could be made fruitful through the use of an irrigation ditch (Hackel 2003:648).

In 1852, Hugo Reid, who owned the mission property at the time, described the area's condition before the mission was developed:

> The site occupied by the principal building of the mission, the vineyards and gardens, was at the conquest of this country, a complete forest of oaks, with considerable underwood. The water [Alhambra Wash], which now composes the lagoon of the mill [El Molino Viejo] (one mile and a half distant), being free, like everything else, to wander and meander where it pleased, came down into the hollow nearest to the mission, on the [Los] Angeles road. This hollow was a complete thicket, formed by sycamores, cottonwood, larch, ash and willows; besides, brambles, nettles, palma cristi, wild roses and wild grapevines lent a hand to make it impassable, except where footpaths had rendered entrance to its barriers a matter more easy of accomplishment. This hollow, cleared of all encumbrance, served to raise the first crops ever produced at the mission, and although now a washed waste of gravel and sand, nevertheless, at that time it rejoiced in a rich black soil. On the side of this hollow, stood the lodge [Native American village] of Sibagna. Bears innumerable prowled about their dwellings and large quantities of deer sported in the neighborhood. (Reid 1978 [1852]:263–264)

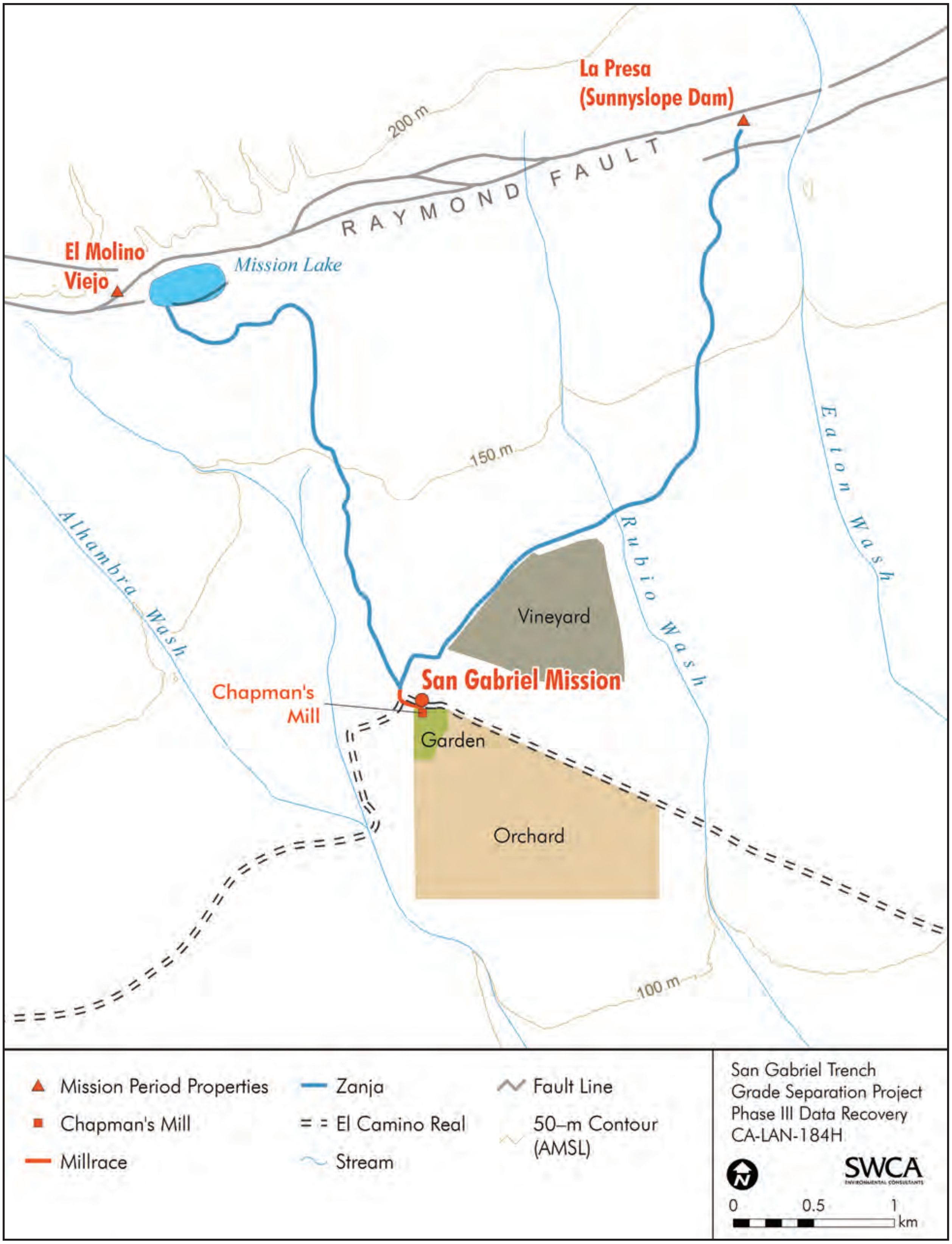

Figure 2.1. Mission period features of the San Gabriel Valley.

The study area is in the Los Angeles Basin physiographic province, which is subdivided into four structural blocks bounded by major fault zones extending into underlying crystalline basement, particularly within the northeastern block, which is characterized as a triangular wedge about 35 miles in length from north to south and about 18 miles wide from east to west. The northwestern boundary of the block is delineated by the Raymond fault, which creates a topographic break between sedimentary and basement rocks to the north and deep alluvium to the south (Yerkes et al. 1965:A51). The study area is immediately underlain by Pleistocene-age and Holocene-age alluvium composed of undivided alluvial and fluvial deposits locally dominated by sand and gravel (Tan 1997; Yerkes et al. 1965). The surficial alluvial and fluvial sediments making up the floor of the San Gabriel Valley are derived from alluvial fan and floodplain deposits of the numerous local washes. The depth of these valley deposits may reach as much as 200 feet (Yerkes et al. 1965).

Elevations in the study area range from 320–480 feet above mean sea level. The nearest water sources include the now-channelized Alhambra and Rubio Washes. These water sources provided seasonal water, fertile soil, and associated riparian plants and animals that would have been attractive to prehistoric and historic human settlers. During the Mission period (1769–1834), water was brought to San Gabriel Mission on a year-round basis from a series of springs along the Raymond fault's topographic break by a system of simple earthen ditches, or zanjas. This system is discussed in detail below.

Ethnography

The San Gabriel Trench Grade Separation Project is in the heart of Gabrielino territory (Bean and Smith 1978:538; Kroeber 1925:Plate 57). Surrounding Native American groups were the Chumash to the northwest, the Tataviam/Alliklik to the north, the Serrano and Cahuilla to the east, and the Luiseño/Juaneño/Acjachemen to the south. There is well-documented interaction among the Gabrielino and their neighbors in the form of intermarriage and trade.

The name Gabrielino, historically spelled Gabrieliño or Gabrieleño (McCawley 1996:9), denotes those people who were administered by the Spanish from San Gabriel Mission. By the same token, Native Americans in the sphere of influence of Mission San Fernando Rey de España were historically referred to as Fernandeño (Kroeber 1925:Plate 57). The San Fernando group is now considered to be a regional subgroup of the Gabrielino with their own dialect; other dialects included Santa Catalina Island and San Nicolas Island variants (Bean and Smith 1978:538). San Gabriel Mission's Native American residents included natives of the greater Los Angeles area, as well as members of surrounding groups such as Kitanemuk, Serrano, and Cahuilla.

There is little evidence that the people we call Gabrielino had a broad term for their group (Reid 1978:222); rather, they identified themselves as inhabitants of specific areas or communities through the use of locational suffixes; for example, a resident of Yaanga was called a Yabit, in much the same way that a resident of Los Angeles is called a Los Angeleno (Johnston 1962:10).

Native words that have been suggested as labels for the broader group of Native Americans indigenous to the Los Angeles region include Tongva and Kizh. Tongva, or Tong-vā (Merriam 1955:77–86), was a term for the people living near Tejon, but the similar sounding Tōŋwe was the name for a village near San Gabriel (see San Gabriel Mission in the Mission Period below). Tobikhar may have been used to denote the people living near San Gabriel; it means "settlers," and it may be derived from *tobohar* or *tovaar*, meaning "earth" (McCawley 1996:9). Kizh, Kij, or Kichereño (Kroeber 1907:141; Sugranes 1909:29), may be derived from the word meaning "houses." The term was first recorded by Horatio Hale between 1838 and 1842 as the name of the language spoken at San Gabriel Mission (Barrows 1900:12). One of Harrington's native advisors specifically attached the name to people living in the Whittier Narrows area, near San Gabriel Mission's original location, stating that "Kichereño is not a placename, but a tribename, the name of a kind of people" (McCawley 1996:43).

Many present-day descendants of these people have taken on Tongva as a preferred group name because it has a native rather than Spanish origin (King 1994:12). Recently, however, some descendants have come to prefer Kizh instead. Because there is no agreement over the most appropriate indigenous term for this group, Gabrielino is used in the remainder of this study to designate native people of the Los Angeles Basin and southern Channel Islands and their descendants.

Gabrielino lands encompassed the greater Los Angeles Basin and three Channel Islands: San Clemente, San Nicolas, and Santa Catalina. Their mainland territory was bounded on the northwest by the Chumash at Topanga Creek, the Serrano at the San Gabriel Mountains in the east, and the Juaneño on the south at Aliso Creek (Bean and Smith 1978:538; Kroeber 1925:636). The mainland area occupied by the Gabrielino included four macro-environmental zones (Interior Mountains/ Adjacent Foothills, Prairie, Exposed Coast, and Sheltered Coast) that encompass the watersheds of the Los Angeles, Santa Ana, and San Gabriel rivers (Bean and Smith 1978:538).

The Gabrielino language, as well as the neighboring Luiseño/Juaneño/Acjachemen, Tataviam/Alliklik and Serrano languages, belongs to the Takic branch of the Uto-Aztecan language family, which can be traced to the Great Basin area (Mithun 2004:539, 543–544). This language family's origin differs substantially from that of the Chumash to the north and the Ipai, Tipai, and Kumeyaay farther south. The language of the Ipai, Tipai, and Kumeyaay is derived from the California-Delta branch of the Yuman-Cochimi language family, which originated in the American Southwest (Mithun 2004:577). The Chumash language is unlike either the Yuman-Cochimi or Uto-Aztecan families, and may represent a separate lineage (Mithun 2004:390). Linguistic analysis suggests that Takic-speaking immigrants from the Great Basin area began moving into southern California around 500 B.C. (Kroeber 1925:579). This migration may have displaced both Chumashan- and Yuman-speaking peoples, but the timing and extent of the migrations and their impact on indigenous peoples is not well understood.

Gabrielino society was organized along patrilineal non-localized clans, a characteristic Takic pattern. Clans consisted of several lineages, each with their own ceremonial leader. The chief, or *tómyaar*, always came from the primary lineage of the clan/ village. One or two clans generally made up the population of a village. Even though the Gabrielino did not have a distinctly stratified society, there were two general classes of individuals: elites and commoners. The elites consisted of primary lineage members, other lineage leaders (who maintained a separate ceremonial language), the wealthy, and the elite families of the various villages who commonly married among themselves. The commoner class contained those from "fairly well-to-do and long-established lineages" (Bean and Smith 1978:543). A third, lower class consisted of slaves taken in war and individuals, unrelated to the inhabitants, who drifted into the village.

The Gabrielino established large, permanent villages in the fertile lowlands along rivers and streams and in sheltered areas along the coast, stretching from the foothills of the San Gabriel Mountains to the Pacific Ocean. The total population of the Gabrielino has been estimated to have been at least 5,000 (Bean and Smith 1978:540), but recent ethnohistoric work suggests that a number approaching 10,000 seems more likely (O'Neil 2002). Several Gabrielino villages appear to have served as trade centers, due in large part to their centralized geographic position in relation to the southern Channel Islands and to other tribes. These villages maintained particularly large populations and hosted annual trade fairs that would bring their population to 1,000 or more for the duration of the event (McCawley 1996:113–114).

Houses constructed by the Gabrielino were large, circular, domed structures made of willow poles thatched with tule (or bulrush; *Scirpus* sp.) that could hold up to 50 people (Bean and Smith 1978). Other structures served as sweathouses, menstrual huts, ceremonial enclosures, and probably communal granaries. Fields were cleared adjacent to Gabrielino villages for races and games such as lacrosse and pole throwing (McCawley 1996:27). The San Gabriel area was home to at least four important Gabrielino communities in the late eighteenth century: Shevaanga, Sonaanga, Sheshiikwanonga, and ‘Akuuronga. These communities were closely knit and shared a regional dialect that the Franciscan priests called Simbanga (McCawley 1996:41). Kroeber (1925:621) associated the Simbanga dialect with the community of Siba (also called Shevaanga; see below), indicating the local prominence of this village.

The Gabrielino subsistence economy was centered on gathering and hunting. The surrounding environment was rich and varied, and the group exploited mountains, foothills, valleys, and deserts, as well as riparian, estuarine, and open and rocky coastal ecological niches. As with most California Native Americans, acorns were the staple food. Acorns were supplemented by the roots, leaves, seeds, and fruits of a wide variety of flora, such as cactuses, yuccas, sages, agaves, and *islay* (*Prunus ilicifolia*), an evergreen that produces an edible cherry. Freshwater and saltwater fish, shellfish, birds, reptiles, insects, and large and small mammals were also consumed (Bean and Smith 1978:546; Kroeber 1925:631–632; McCawley 1996:119–123, 128–131).

Various tools and implements were used by the Gabrielino to gather and collect food. These included the bow and arrow, traps, nets, blinds, throwing sticks and slings, spears, harpoons, and hooks. Many plant foods were collected with woven seed beaters, several forms of burden baskets, carrying nets, and sharpened digging sticks, sometimes with stone weights fitted onto them. Groups residing near the ocean used an ocean-going plank canoe known as a *ti’at*, which could hold from six to 14 people, and tule balsas for fishing, travel, and trade between the mainland and the Channel Islands and for near-shore fishing (Blackburn 1963; McCawley 1996:117–127).

Gabrielino people processed food with a variety of tools, including portable and bedrock mortars, pestles, basket hopper mortars, manos and metates, hammer stones and anvils, woven strainers and winnowers, leaching baskets and bowls, woven parching trays, knives, bone saws, and wooden drying racks. Food was consumed from a number of woven and carved wood vessels. The ground meal and unprocessed hard seeds were stored in large, finely woven baskets, and the unprocessed acorns were stored in large granaries woven of willow branches and raised off the ground on platforms. Santa Catalina Island steatite was used to make comals, ollas, and cooking vessels that would not crack after repeated firings. Steatite was also used to make effigies, ornaments, and arrow straighteners (Blackburn 1963; Kroeber 1925:629; McCawley 1996:129–138).

The Gabrielino participated in an extensive exchange network, trading between islands and mainland and between coast and interior. They exported Santa Catalina Island steatite (both finished and unfinished items), roots, seal and otter skins, fish and shellfish, red ochre, and lead ore. In exchange, they received ceramic goods, deer skin shirts, obsidian, seeds such as acorns and pine nuts, and other items. The Serrano to the east were a major trading partner, while the Cahuilla, Chemehuevi, and Mohave acted as middlemen for transactions extending to the Colorado River and beyond. This burgeoning trade system was facilitated by the use of craft specialists and a standard medium of exchange (usually olivella bead currency, although barter was common as well), as well as the regular destruction of valuables in ceremonies, maintaining a high demand for these goods (Bean and Smith 1978:547; Kroeber 1925:630; McCawley 1996:112–115; Reid 1978:243–244).

In the early nineteenth century, the basis of Gabrielino religious life was the Chinigchinich cult, which centered on the last figure in a series of heroic mythological figures. Chinigchinich gave instructions on laws and institutions, and he taught the people how to dance, the primary religious act for this society. He later withdrew into heaven, where he rewarded the faithful and punished those who disobeyed his laws (Kroeber 1925:637–638). The Chinigchinich religion seems to have been relatively new when the Spanish arrived. It was spreading south into the southern Takic groups even as Christian missions were being built, and may represent a mixture of native and Christian beliefs and practices (McCawley 1996:143–144).

Deceased individuals were either buried or cremated; inhumation was reportedly more common on the Channel Islands and the neighboring mainland coast, and cremation predominated throughout other parts of the coast and in the interior (Harrington 1942; McCawley 1996:157). Inhumations were buried in distinct burial areas, either associated with villages (e.g., Altschul et al. 2007) or without apparent village association (e.g., Applied Earthworks 1999; Frazier 2000). Cremation ashes have been found buried in archaeological contexts in stone bowls and in shell dishes (Ashby and Winterbourne 1966:27), as well as scattered among broken ground stone implements (Altschul et al. 2007; Cleland et al. 2007). Archaeological data such as these correspond with ethnographic descriptions (e.g., Boscana 1846:314) of an elaborate mourning ceremony that included a wide variety of offerings including seeds, stone grinding tools, otter skins, baskets, wood tools, shell beads, bone and shell ornaments, projectile points, and knives. Offerings varied with the sex and status of the deceased (Johnston 1962:52–54; McCawley 1996:155–165; Reid 1978:234–235). At the behest of the Spanish missionaries, cremation essentially ceased after Spanish contact (McCawley 1996:157).

History

The post-Contact history of California is commonly divided into three periods reflecting the region's changing national affiliation: the Spanish period (1769–1822), the Mexican period (1822–1848), and the American period (1848–present). For the purposes of this study, however, the time scale is divided into four periods to reflect the creation, control, and demise of the mission system. These periods are the Initial Contact period (1542–1769), the Mission period (1769–1834), the Secularization period (1834–1847), and the American period (1847–present). This breakdown provides a better context for the interpretation and evaluation of the archaeological materials encountered in the course of data recovery at the San Gabriel Mission archaeological site.

Initial Contact Period (1542–1769)

The first European visitors to present-day California were members of the 1542 Juan Rodriguez Cabrillo expedition, who made stops at what would later be named Santa Catalina Island, Santa Monica Bay, and San Pedro Bay. Cabrillo, a Spaniard, named the latter the "Bay of the Smokes," a possible reference to Native American campfires. Sebastián Vizcaíno led a second Spanish exploratory cruise up the California coast in 1602, visiting and naming Santa Catalina Island and San Pedro. Spurred by rumors of Russian activity in the northern Pacific in 1769, Captain Gaspar de Portolá, then governor of Baja California, led an overland expedition from the newly established Spanish settlement at San Diego to Monterey (Gumprecht 2001:35–36; McCawley 1996:4–5). During this period, the Native Americans in the San Gabriel Valley may have received European-made goods such as glass beads in either direct or indirect trade.

Mission Period (1769–1834)

Captain Portolá and Franciscan Father Junipero Serra established the first Spanish settlement in Alta California at San Diego in 1769. Mission San Diego de Alcalá was the first of 21 missions built by the Spanish between 1769 and 1823. In the process of exploring the region, the 63-member Portolá expedition crossed Gabrielino territory three times over the course of a year (Johnston 1962:116), naming the canyons, rivers, and other geographic features as they proceeded north. The expedition passed through the San Gabriel Valley in 1769, camping near modern-day San Gabriel on July 31 (Gumprecht 2001:36–37). Portolá continued north, reaching San Francisco Bay on October 31, 1769.

Franciscan padres established San Gabriel Mission in 1771, beginning the process of converting the local Native American population to Christianity through baptism and relocation to mission grounds (Engelhardt 1927a). The San Fernando Mission was founded 26 years later, in 1797, and its location was chosen as a stopping point between the San Gabriel and San Buenaventura Missions (Engelhardt 1927b). Most Native Americans from the Los Angeles Basin were persuaded to settle in the vicinity of the two missions. These included the eastern Gabrielino of the plains as far south as the Santa Ana River and west to the Los Angeles River. The padres also proselytized the Serrano of the San Gabriel and San Bernardino mountains, as well as the Vanyume Serrano of the Mojave Desert, many of the western Cahuilla in the Coachella and San Jacinto Valleys, some Luiseño of the San Jacinto Valley, and the western Gabrielino of the plains west of the Los Angeles River, San Fernando Valley, and the southern Channel Islands. The missions were charged with administering to the Native Americans in their areas. Although mission life gave the Native Americans new skills they would need to survive in their rapidly changing world, the close quarters and regular contact with Europeans transmitted diseases for which they had no immunity, decimating their populations (McCawley 1996).

The Spanish Governor of California, Felipe de Neve, recognized the need to establish a settlement north of San Gabriel Mission to help supply Spain's presidios, or military forts, in California and to help maintain Spain's control over the region. On September 4, 1781, 12 years after the Portolá party's initial visit, 44 settlers from Sonora, in present-day Mexico, accompanied by the governor, soldiers, mission priests, and several Native Americans, arrived at a chosen site along the Rio de Porciúncula, which was later renamed the Los Angeles River (Ríos-Bustamante 1992; Robinson 1979:238). At this site, they founded a pueblo called La Reyna de los Angeles, or "the Queen of the Angels" (Treutlein 2004; contrary to Weber 1980a). The last leg of this journey began at San Gabriel Mission, located 9 miles away, and this procession is reenacted annually by descendants and members of San Gabriel Mission parish.

The site chosen for the new pueblo was on a broad terrace one-half mile west of the river (Gumprecht 2001). It was a planned pueblo, one of only three in California, and 4 square leagues (about 28 square miles) of land were set aside for the settlement and farming (Gumprecht 2001; Robinson 1979). The area's rich, well-watered soils created an ideal locale for a town meant to supply livestock and feed to the presidios of San Diego and Santa Barbara, and to serve as a home for retired Spanish soldiers. To expand their herds of cattle, colonists enlisted the labor of the surrounding Native American population (Engelhardt 1927b). By 1786, the flourishing pueblo attained a measure of economic independence, and funding by the Spanish government ceased (Gumprecht 2001). The pueblo's church, an *asistencia* (or satellite church) of San Gabriel Mission, was staffed by the mission's priests until 1832 (Weber 1980b). The pueblo likely had numerous other connections to the mission as well, serving as trading partner and sharing a Native American labor pool.

San Gabriel Mission in the Mission Period

The first permanent Euro-American settlement in Los Angeles County came with the founding of the fourth Alta California mission. Fathers Pedro Benito Cambón and Josef Angel Fernandez de la Somera established La Misión San Gabriel Arcángel (San Gabriel Mission) on September 8, 1771, on the banks of the Rio de Nombre de Jesus de los Temblores ("River of the Name of Jesus of the Earthquakes," near the present-day confluence of the Rio Hondo and San Gabriel River; Engelhardt 1927a). Perhaps because the site of La Misión Vieja, as the original location came to be known, flooded frequently, or perhaps due to insufficient agricultural yields, the mission was moved 5 miles northwest to its current site in 1775 (Engelhardt 1927a:4–28).

The mission's second and final location was situated near a Gabrielino village, although it is not entirely clear what this village was called. One possibility is that it was the village of Shevaanga (sometimes spelled Sibanga and alternately known as Sibàpet or šivápet, meaning "stones" or "flint"). A Native American consultant told ethnographer J. P. Harrington that šivápet was located at a place near San Gabriel, in a ravine "near where the old Los Angeles road crossed the river" (McCawley 1996:41). This accords well with Reid's account, quoted above, that places the village on the side of a fertile hollow near the mission on the Angeles road. However, Harrington's consultant went on to state that the name referred to the whole locality around San Gabriel, or to a place a little beyond the mission, and not to San Gabriel itself. The name *Sibanga* was used by San Gabriel Mission padres to refer to one of four local dialects in an 1812 report (Engelhardt 1927a:97). A French visitor to the mission in 1841 noted that San Gabriel was "situated in the center of a large and beautiful plain, on the site of the Indian villages of Juyubut Cayuillas, and Sibaput tribes" (Engelhardt 1927a:199).

A second possibility is Toviscanga (variants: Tuvasak or Toviska-, meaning "white earth" or "old man") or Tōŋwe (meaning a place where people grind their seeds on rocks). The cover page of the San Gabriel Book of Confirmations, penned by Junipero Serra in 1778, reads "*San Gabriel de los Temblores alías Toviscanga*" (Engelhardt 1927a:55). Writing in 1860, Alexander Taylor noted that the "site of the Mission was called Toviscanga, and near by was a large rancheria" (McCawley 1996:41). He didn't say which mission site he was referring to, but the second site is more likely. Since he was writing in 1860, he is likely to have called the first site Mision Vieja, or the old mission.

Contemporary Gabrielino (Kizh) historian Andrew Salas (personal communication to John Dietler 2014) feels that Shevaanga was located near La Misión Vieja, in the Whittier Narrows area, which may have been thought of as a part of the broader San Gabriel area at the time. Based on oral history and early twentieth century maps, he believes that the name for the 100-acre Savannah ranch, established in the 1850s in what is now the city of Rosemead, was derived from the earlier place name, Shevaanga. Thus, Rosemead's Savannah School on Rio Hondo Avenue is in the approximate location of Shevaanga, or at least its outskirts. Based on the notation in Serra's 1778 book of confirmations, Mr. Salas believes that the name of the closest community to the current San Gabriel Mission location was Toviscanga.

It is possible that these names were synonymous, that one name supplanted the other over time, or that one (Toviscanga) applied to a specific neighborhood, while the other (Shevaanga) referred to the broader region.

Nearby place names include 'Apātšijan, meaning "swamp" or "marsh," and referring to a lake or the "place where the water entered for San Gabriel;" this place was a little to the side of the pear orchard, according to José Zalvidea (McCawley 1996:42). The village of 'Akuuronga, which was occupied by 12–15 families through the 1870s, was near the stone dam referred to as La Presa ("the dam"), which still stands on the property owned by the Sunny Slope Water Company approximately 2.5 miles northeast of the mission church. Known as "the Rancheria," this village was about 5 acres in extent and consisted of small earth-floor huts made from tule harvested from the nearby wetland. The huts featured external lean-to kitchens with open hearths built from flat stones (Rose, Jr. 1959:54–55). A historic photograph of the village on display at the water company today shows a dog and several children dressed in Euro-American-style dresses in front of rectangular houses matching this description. Nineteenth-century Native American homes at San Gabriel Mission presumably had a similar appearance.

San Gabriel Mission was an important crossroads during the Mission period. Because it was a welcomed stop for weary travelers and renowned for its comforts and the generosity of its priests, many of the region's major transportation routes passed through the mission complex. Alta California's main north–south route—El Camino Real—connected San Gabriel Mission to the great string of missions up and down the coast. It was also a key stop on the Anza Trail, an overland route from Sonora, Mexico, to Monterey, California, via the Colorado River crossing at Yuma, pioneered by Captain Juan Bautista Anza's party in 1774 (Engelhardt 1927a:24). The more rugged Old Spanish Trail, formalized in the 1830s, connected San Gabriel Mission to Santa Fe by way of the Great Basin. Several roads led to the Pueblo of Los Angeles and on to the new port of San Pedro, through which supplies from Mexico and manufactured goods from England and the United States were traded for mission exports.

Like the other California missions, the mechanisms by which San Gabriel Mission was connected to the outside world through trade varied greatly throughout its history. In the early years, a strict mercantilist system was in place; supplies came in and exports went out almost exclusively through San Blas, in the modern Mexican state of Nayarit. It was through this trade that the missions were initially connected to broader trade networks, including the Asian trade as facilitated by the Manila galleons (Archibald 1976:229). However, limited cargo space and fixed prices made this arrangement unsatisfying for the missions, and the need for relaxation of mercantile restrictions and liberalization of trade became increasingly obvious (Archibald 1978:115, 140). For San Gabriel Mission, which found itself producing substantial surplus within its first few decades of operation, a more direct connection to broader trade networks through illicit trade was important from at least the 1790s through the end of the Mission period in the 1930s, not only as a source of imported goods but as an outlet for the mission's products (Archibald 1976, 1978). Trade via vessels from San Blas stopped after 1810, with government support of the California missions severed by the Mexican Revolution. Trade opportunities expanded substantially in the period after 1810, with American and Russian ships joining Spanish vessels in the California maritime trade. Beginning in 1821, Mexico opened its ports, including those in California, to legitimate foreign trade, and the missions continued to play an important role in trade with American, British, and Russian vessels up until the time of secularization.

In addition to the large church, San Gabriel Mission's facilities included priests' quarters; guest rooms; housing for neophytes; workshops for blacksmithing, carpentry, spinning, and weaving; a kitchen; a cemetery; and many other structures. Although many of these buildings were made of adobe, the Gabrielino residents of the mission lived in traditional brush structures (Engelhardt 1927a:20). The physical center of the mission complex initially consisted of a large, open plaza. The mission complex expanded as the community grew, and by 1790, a quadrangle bounded by the adobe church, residential apartments, and storerooms had been built. A grand, new stone-and-masonry church was constructed between 1790 and ca. 1801, featuring architectural details such as capped buttresses and long, narrow windows that gave the building a distinctly Moorish appearance, evoking the cathedral in Cordova, Spain, the home town of its designer, Father Antonio Cruzado. Later additions to the mission complex included a second quadrangle, a tannery, at least 10 granaries, a hospital, several water-powered mills, a hen house, a fountain, a girls' dormitory, and soldiers' barracks (Weber 1979:18–21). Several rows of neophyte apartments, consisting of 47 individual units, were constructed to the southwest of the main quadrangle in 1807 and 1808 (Figure 2.2; Engelhardt 1927a:75). The "Mission of the Earthquakes" (Reid 1978:264) was aptly named. An earthquake in 1805 destroyed the original vaulted ceiling of the stone church, and an even more powerful earthquake in 1812 destroyed the church's three-bell tower and severely damaged the priest's quarters and mission work rooms (Engelhardt 1927a:73,92). The bell tower was replaced with a picturesque six-bell *campanario* ("bell wall") that came to be the most iconic aspect of the mission's appearance.

Agriculture in the Mission Period

An agricultural settlement at its heart, San Gabriel Mission's garden, orchard, vineyard and winery, animal pens, and grazing lands, along with the aqueducts that watered them, were essential. Due to its extensive and productive land holdings, including 24 associated ranchos (Older 1938:61), and its large pool of Native American neophyte labor, with more than 1,700 workers by 1817 (Engelhardt 1927a:268), San Gabriel Mission was among the most prosperous missions in Alta California. The mission reached its religious, population, agricultural, and industrial pinnacle ca. 1830. Livestock possessions in 1829 included approximately 25,000 cattle, 15,000 sheep, 150 goats, 200 pigs, 2,000 horses, and 100 mules (Engelhardt 1927a:279). At its peak, the mission reportedly held 20,000 *fanegas* (equivalent to 1.67 bushels) of grain and 500 barrels of wine and brandy (Sugranes 1909:75). The mission's productivity supported a lumber mill, carpentry and leather shops, a tile kiln, and facilities for the industrial production of tiles, leather, hides, tallow, and soap (Williams 2005:19).

Figure 2.2. Painting by Ferdinand Deppe depicting San Gabriel Mission as it looked in 1832. Courtesy of the University of Southern California, on behalf of USC Libraries.

The products derived from the mission's unrivalled herds of cattle were its primary source of income. Methodically slaughtering up to 3,000 head of cattle at a time (Dale 1918:200); processing them for hides, tallow, and soap (meat was apparently a secondary byproduct); transporting these products by ox cart to the port at San Pedro, and shipping them to New England represented the mission's most important economic activity. This industry made San Gabriel Mission among the most economically successful of the chain of missions and earned it the nickname "Pride of the Missions" (Engelhardt 1927a:v). Harrison G. Rogers, a member of Jedediah Smith's party, which visited the mission in 1826, estimated that the mission exported "20 to 25 thousand dollars' worth of hides and tallow, and nearly 20 thousand dollars' worth of soap annually" (Dale 1918:205). Rogers noted the following:

> This Mission, if properly managed, would be equal to [a] mine of silver or gold; there [sic] farms are extensive; they raise from 3 to 4,000 bushels of wheat annually, and sell it to shippers for $3 per bushel. There [sic] annual income, situated as it is and managed so badly by the Ind[ian]s, is worth in hides, tallow, soap, wine, ogadent [aguardiente or brandy], wheat, and corn from 55 to 60,000 dollars. (Dale 1918:212)

San Gabriel Mission's formal *huerta* (garden and orchard), known as "Bishop's Garden," was established sometime before 1783 and was enclosed by a wooden wall by 1830 (Figure 2.3) (Reid 1895:52; Webb 1952:166; Williams 2005). The cultivated area was expanded to the south and east in 1809 with the planting of an innovative hedge of prickly pear cactus that enclosed 40 acres (Figure 2.4; see also Figure 1.2). Not only did this thorny barrier keep foraging animals away from the garden plots, but the cacti themselves provided a valuable source of food (Benthald 1979:189; Berger 1941:163). Although the garden had disappeared by 1938, a portion of the 12-foot-high cactus hedge remained as a testament to Spanish agricultural prowess (Older 1938:61, 71). Rancho Las Tunas, Spanish for "Prickly Pear Cactus Ranch," was named for the adjacent hedge (Woodbridge 1988:238). Sometime before 1852, the garden was enclosed by an adobe wall measuring 6 feet high and 2 feet wide, and it continued to be used into the early twentieth century. An 1855 surveyor's description lists among mission property "an orchard and garden, situated in front, and south of said Church, at a distance of some seventy or eighty feet from the same, as the same is enclosed with adobe walls and a fence, being the same which was long used by the Padres of said Mission" (Engelhardt 1927a:250–251).

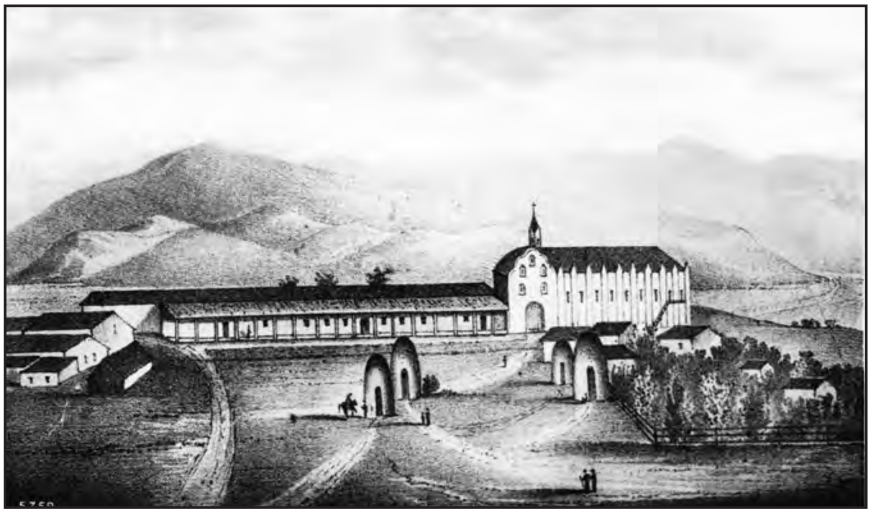

Figure 2.3. Illustration of San Gabriel Mission in 1846. Courtesy of the University of Southern California, on behalf of USC Libraries.

Figure 2.4. Cactus hedge at San Gabriel Mission, ca. 1886. Courtesy of the University of Southern California, on behalf of USC Libraries.

Formal garden areas, where resident neophytes could raise food for personal use, were commonly found in mission communities. The locations of these garden plots varied based on mission layout. The San Gabriel Mission garden may have been associated with the four rows of adobe neophyte apartments that were located a short distance northeast. The large compound contained vegetable plots, and an orchard area is depicted in its southwest corner on an 1854 map (Figure 2.5). The orchard, which contained apple, peach, orange, and fig trees, was apparently off limits to the neophytes. In 1826, Fr. Sanchez reportedly requested the manufacture of "a large trap for him to set in his orrange [sic] garden, to catch the Ind[ian]s in when they come up at night to rob his orchard" (Dale 1918:210).

The garden and orchard produced grains (wheat, barley, and corn), fruits (pears, oranges, and prickly pears), and vegetables (beans and peas, among others) (Engelhardt 1927a:273ff). Other produce included citrons, limes, apples, peaches, pomegranates, and figs (Robinson 1846:32). Like other mission gardens, it likely produced spices, nuts, flowers, medicinal herbs, and other plants such as cotton, gourds, and tobacco, as well (Williams 2005) (see Chapter 8).

The tools used in the garden would have included digging implements (e.g., plows, hoes, digging sticks, forks, weed hooks, mattocks, and picks), cutting tools (e.g., axes, machetes, mallets, and saws), and carrying devices (e.g., baskets, buckets, carts, and gourds). Descriptions from contemporary gardens at other Spanish settlements suggest that the San Gabriel Mission garden may have served both utilitarian and ornamental purposes, acting as a place for meditative reflection for the community as well as a source of food (Williams 2005).

Mission records describe the construction of at least 10 granaries between 1804 and 1821. The earliest granaries, dating to 1804 and 1805, consisted of one or more small rooms inside adobe buildings that seem to have been a part of the mission quadrangle; other rooms in these buildings served a variety of functions. Later granaries were long, narrow adobe buildings dedicated to the purpose of housing grain. The importance of grain storage appears to have increased substantially in the second decade of the 1800s, as six of these dedicated granaries were built between 1809 and 1813. The last two granaries whose construction is recorded in the mission's annual reports were built in 1821 (Engelhardt 1927a:74–75, 93).

Water System

Vital to the success of the mission was the development of an extensive water conveyance system. San Gabriel Mission was originally located directly on the Rio de Jesus de los Temblores, and water was taken from the river and other small creeks and springs in the surrounding plains (Engelhardt 1927a:20). Repeated flooding demonstrated the folly of settling too close to a river in southern California, and the padres chose higher ground for their second location. Although the threat of flood was decreased, there was no longer a year-round water source within easy reach of the settlement. Fortunately, the new location was situated downhill from the San Gabriel Valley's most important water source.

> Extending [the San Gabriel Valley's] full length east and west, about midway between the floor of the valley and the mountains, there was…a strip of water-bearing land, varying in width from seven or eight hundred to a thousand feet, from which constantly flowed streams of pure, crystal-clear spring water, which percolated through the many strata of gravel from the Sierra Madres, five miles distant. All that was necessary to develop a fine stream was to open a trench and give it an outlet. (Rose, Jr. 1959:43)

We now know this strip of water-bearing land as the Raymond escarpment, a geological feature created by the east-northeast-trending Raymond fault (see Figure 2.1). Running about 15 miles between the Elysian Park anticline and the Sierra Madre fault zone, it is a left-lateral, strike-slip fault, meaning that it is moving both horizontally and vertically. The vertical movement produces a topographic break, offsetting the valley bottom

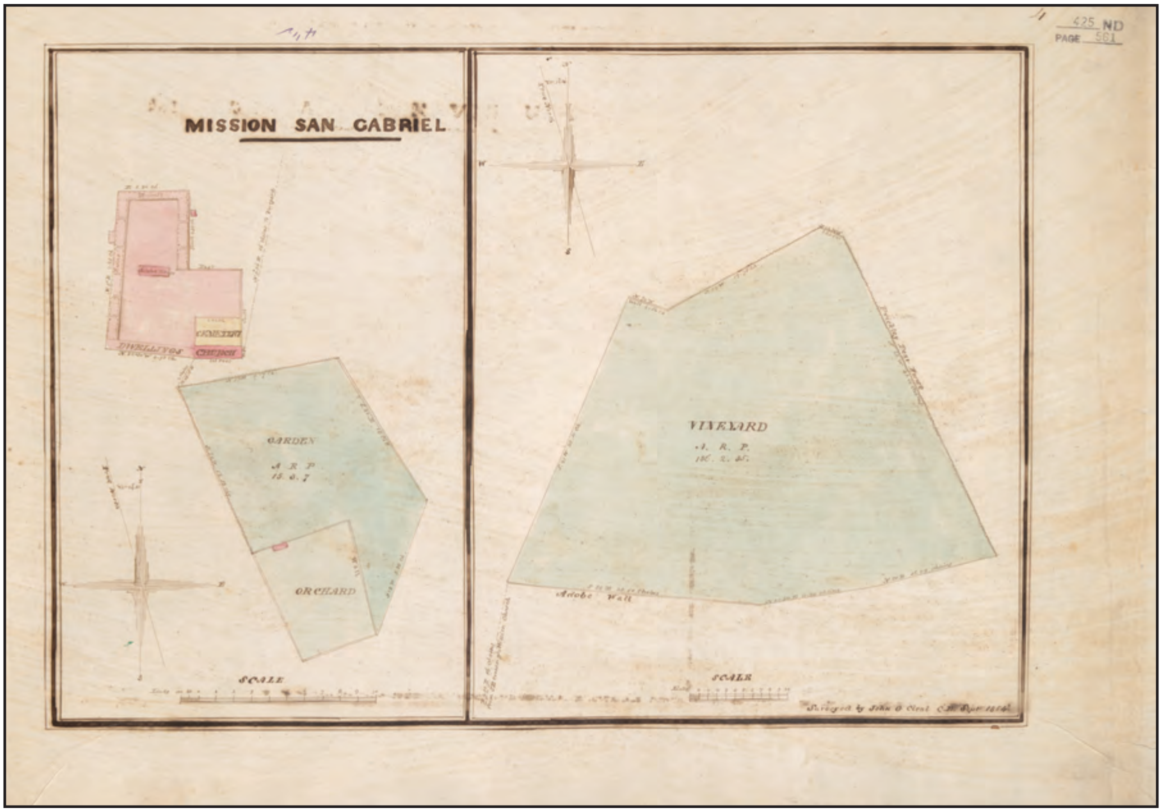

Figure 2.5. Historic plan of San Gabriel Mission, as surveyed by J. G. Cleal in 1854. Image courtesy of The Bancroft Library, University of California, Berkeley.

alluvial surface and sedimentary rocks towards the foothills (Weaver and Dolan 2000; Yerkes et al. 1965:A51). This escarpment has resulted in an upwelling of ground water, creating the productive strip noted in the quote above. This strip still hosts a number of the valley's most lush properties, including El Molino Viejo (described below), Lacy Park, the Sunny Slope Water Company property, the Huntington Library and Gardens, and the Hugo Reid (and subsequently, Elias Jackson "Lucky" Baldwin) property, now the Los Angeles County Arboretum and Botanic Garden.

With the establishment of the mission in its current location in 1775, the padres of San Gabriel Mission became the first to systematically tap this water for off-site use. An earthen ditch initially directed water to the mission for domestic and agricultural purposes from an artesian spring approximately 2 miles northwest of the mission at the intersecting mouths of Mission (or Los Robles) Canyon and Mill Canyon. Located in present-day San Marino and feeding what is now known as Alhambra Wash, this was the most important source of water for San Gabriel Mission during the Mission period. Before this improvement, the water pooled in this location, forming a swampy area known variously as Mission Lake, Wilson Lake, and Kewen Lake (Dryden 2008:4). Today, Lacy Park occupies the former location of the lake. The first zanja passed between the dwellings of the padres and the neophytes and then ran into the adjacent agricultural fields (Engelhardt 1927a:30).

With the continued growth of the mission came an increasing demand for additional water sources, and to fill this need the padres expanded the system of zanjas and added brush and dirt dams (Reid 1895:51). They tapped a second spring along the Raymond fault at what is now called Eaton Wash, approximately 2.6 miles northeast of the mission. This water source was soon dammed with the massive stone and mortar dam called La Presa.

The system became increasingly complex after the arrival of master masons and potters from the south in the 1790s; they constructed substantial structures with stone and fired tiles set in mortar. Under the direction of Father José María de Zalvidea ca. 1816, the mission began a series of substantial investments in and improvements to the system. Native American laborers lined the zanjas with tiles and constructed a dam at the lower end of Mission Lake. The outflow was used to power a sawmill, a wool-washing works, and a tannery, all located close to the mission (Dryden 2008:4).

Gristmills

Under Zalvidea's direction, neophytes constructed San Gabriel Mission's first gristmill in 1816 at the site of the Mission Canyon spring (Engelhardt 1927a:107–108). The mill, one of the earliest in the region, was a dramatic improvement over the manual grain processing technique using manos and metates upon which the mission had previously relied. This dramatic improvement in the efficiency of grain processing both sped up the production of flour and freed a large number of Native American women to engage in other work (Cleland 1951:8). This facility eventually came to be known as El Molino Viejo (the Old Mill). After turning the mill's wheel, the water ran into Mission Lake (Dryden 2008:4).

Constructed with sturdy adobe and volcanic tuff walls, the mill suffered from a critical flaw. The newly ground meal was dampened by the water that powered the mill, necessitating a labor-intensive drying operation. Although its location took advantage of a reliable source of water, it was a long cart ride from the mission's grain fields and from its residents, requiring a substantial time investment. Because of these inconveniences, Zalvidea sought a replacement for the old mill soon after its construction (Cleland 1951).

Initial construction of a new gristmill at the mission began by 1820. Reports from that year describe the commencement of the construction of two mills, one a water-powered mill for grinding grain and one for oil production, presumably also water-powered (Engelhardt 1927a:112). In late 1821 or 1822, American Joseph Chapman was brought in to supervise mill construction.

Born in Ipswich, Massachusetts, in 1788 or 1789, Chapman was educated as a young boy before being apprenticed to a Boston shipwright as a teenager (Sweet and Bradshaw 1989:17). By the age of twenty, he was serving on a whaling ship in the Pacific Ocean. While at port in Hawaii (known then as the Sandwich Islands), Chapman was impressed into the service of Hippolyte de Bouchard, a Frenchman who engaged in raids in the Philippines and along the California coast. While his raids were justified by letters of marque provided by the rebellious Argentine Republic, Bouchard and his crew were labeled pirates by their Spanish victims. Chapman was captured and imprisoned in 1818 during one of the pirate's raids on the Ortega Ranch in Refugio Canyon, near Santa Barbara (Hoover 1992:49; Scott 1956:242).

Remarkably, this Protestant foreigner who did not speak a word of Spanish eventually befriended his captors and secured his own release. When he learned of Governor Pablo Vicente de Solá's desire to install a fulling (wool processing) mill at Santa Inés Mission, Chapman drew up plans using design elements from New England, where the Industrial Revolution was just beginning. The existing grist mill at Mission Santa Inés was a traditional Spanish-style mill. Drawing from an ancient Mediterranean tradition that featured fine stone masonry, fired ceramic tiles, arched openings, and simple gravity-operated water power, that mill had an internal, horizontal water wheel that turned a millstone above attached to the same axle (Hoover 1992).

New England mills in the early nineteenth century were different from Spanish-type mills in that they were made with vertical water wheels. The wheels generated power by turning wooden gears that provided quiet and efficient power and helped turn the grinding stones. The teeth of the gears were easy to create, replace, and maintain (Hamilton 1964:11, 19).

Chapman's mill design at Santa Inés Mission featured a brick building (Engelhardt 1986:29), a large exterior vertical waterwheel, and complex internal gearing. One of two sketches of his design survives as an attachment to a letter sent by Father Francisco Uría de Ayzara to Governor Pablo Vicente de Solá in December 1820 requesting approval for the idea (F.X. Uría to P.V. de Solá, letter, 19 December 1820, Santa Barbara Mission Archive-Library CMD 2019). The governor was evidently impressed, for Chapman successfully added his fulling mill to the Santa Inés milling complex in 1821, taking advantage of existing infrastructure to lessen the construction effort (Hoover 1992). That the padres and the governor were pleased with the result is also clear; in September 1821, Solá ordered Chapman to San Gabriel Mission to construct a similar mill later that year (Bancroft 1886:568).

As at Mission Santa Inés, Chapman used existing waterworks to build his San Gabriel mill, including the zanja system and possibly including elements of the gristmill that was begun by others in 1820 (Engelhardt 1927a:144). The improvements to the water system at this time went well beyond the construction of the mill itself. With the installation of dams at Mission Canyon and at La Presa, strong flows of water from the northwest and northeast were joined together into a single waterway just west of the mission quadrangles. From here, Chapman needed to direct the water sharply to the left across and then parallel to El Camino Real, then sharply right through the garden wall and finally straight into the mill's wheel pit. Forcing a large volume of water through an "S" curve over a distance of just over 200 feet required more than an earthen or tile-lined ditch, which would have been quickly overtopped. To solve this engineering challenge, Chapman cleverly installed a massive masonry flume, or millrace.

It may seem remarkable that Chapman, who lacked formal training as a millwright or an engineer, could design and build a successful gristmill. His work was certainly revolutionary from the perspective of nineteenth-century Spaniards. From a New England perspective, however, his work is less remarkable. According to Hamilton (1964:19),

> [T]here was nothing in the design or construction of [these mills] that a reasonably clever handy man could not pick up by studying an existing mill and asking questions of an amiable miller. He probably would make some mistakes and have to learn the hard way, but I believe that many a successful mill was built by a carpenter without any millwrighting experience. Save for the millstones, there were no parts of the gristmill that could not be contrived by a competent carpenter assisted by the local blacksmith. The stones were the problem, and they must either be quarried out of local stone or brought in from outside, a difficult job because of their great weight.

Fortunately for Chapman and the padres of San Gabriel Mission, the same Native Americans that populated the mission had been working local granite into grinding implements for many thousands of years. In them, the self-taught millwrights likely found a number of skilled stoneworkers. It is clear from the scope of Chapman's later works—various blacksmith tasks, building adobes, making charcoal, harvesting timber for the roof of Los Angeles's first church, dabbling in surgery, and, perhaps most impressively, constructing the 60-ton schooner *Guadalupe* at San Gabriel Mission (Peréz 2006:109; Scott 1956)—that he was more than a "reasonably clever handy man." In the eyes of a contemporary American acquaintance, Chapman was "a jack of all trades, and naturally a very ingenious man" (Dale 1918:216). Bancroft (1886:757) repeats the "jack of all trades" assertion, going on to state that Chapman "apparently could make or repair anything that was needed."

According to historian Edith Webb (1952:166), Chapman's Mill stood about 200 feet south of the mission church and featured a 13.5-foot-diameter undershot waterwheel housed in a masonry chamber that drove large millstones in a separate gear room. It was fed by a 6-foot-wide and 2.5-foot-deep millrace. Chapman dug the wheel pit low into the ground to gain as much power from the rushing water as possible and created high foundation walls to keep water away from the grain, seeking to avoid the troubles that plagued El Molino Viejo. Regarding the millstones, historian Hiram Reid (1895:52) wrote

> The grinding stones of this mill were made from great boulders of gray granite or syenite near the mouth of Santa Anita Canyon, and were laboriously pecked into shape by the Indians. The stones were three feet six inches in diameter and about one foot thick. One of them was broken in two and lay there with the ruins in the Bishop's orchard or garden for many years. In 1889 Mrs. Jeanne C. Carr of Pasadena procured one of the broken halves, and now has it for a doorstep at the west front of her unique residence on Kensington place…I did not learn what became of the other half of the broken mill-stone. Theodore Lopez said the stone that was not broken was taken away to use in a mill somewhere else, but he did not know the place. The grinding stones of the first Mission mill [El Molino Viejo], and also of the Dan Sexton mill [built in the 1870s], were made from volcanic tufa instead of granite.

A series of photographs of an "Indian Gardener's Adobe" at San Gabriel Mission, dated ca. 1900, depicts a millstone similar to Reid's description standing next to the building as apparent decoration (Figure 2.6). A shattered red volcanic millstone, perhaps one of the tufa stones described by Reid, is on display in the mission quadrangle today.

The written histories of early mission mills contain a substantial amount of contradictory information concerning mill type and dates of construction. Santa Inés Mission's milling complex contains two mills; an earlier gristmill and a later fulling mill. Several authors, including Webb (1952:155) and Sweet and Bradshaw (1989), incorrectly attribute the gristmill to Chapman. A plaque at the site contains the same erroneous information. Hoover (1992) convincingly attributes the later fulling mill to Chapman, drawing directly from contemporary letters on the subject. That the fulling mill was motivated by a vertical water wheel is further evidence that this mill was designed by a New Englander (Figure 2.7); the wheel would have rotated around the horizontal wooden axle that projected from the building into the reservoir.

Figure 2.6. "Indian Gardener's Adobe" at San Gabriel Mission, ca. 1900. Courtesy of the University of Southern California, on behalf of USC Libraries.

Figure 2.7. Chapman's fulling mill at Mission Santa Inés as it appears today.

At San Gabriel Mission, there is much confusion over the construction dates of El Molino Viejo, with authors placing it as early as 1810 and as late as 1820 (Webb 1952:156). Engelhardt (1927a:107–108), working directly from the mission's annual reports, fixes the construction date as 1816, noting that the dimensions and materials closely match the old mill, which still stands. The same author indicates that construction of another gristmill at San Gabriel Mission was begun in 1820 and that gristmills were completed in 1823 and 1825 (Engelhardt 1927a:112, 144). Webb (1952:156) correctly asserts that Chapman could not have been involved in the 1820 mill construction, as he was otherwise occupied at Santa Inés Mission. Additionally, the order from Governor Solá to build a mill at San Gabriel did not come until September 1821 (Bancroft 1886:568). Taking all of the above into account, Chapman likely began his mill at San Gabriel Mission in late 1821 or 1822 and completed it in either 1823 or 1825. One possible scenario is that Zalvidea's workers began the construction of a replacement mill for the flawed El Molino Viejo in 1820 and Chapman took over the project in mid-construction in 1821 or 1822, completing his work in 1825. It is unclear what the 1823 gristmill completion date refers to; it may be that Chapman's mill was completed in some form by that date, was found to need some redesign once it was up and running, and then re-opened in 1825.

Chapman's Mill appears to have fallen into disuse shortly after secularization (see the Secularization Period section below) and fell into ruin in the succeeding decades (Figure 2.8). As was the case with other mission structures, its timbers and tiles were likely taken by neighbors to build their own homes in the 1850s (Marshall 1982:15). The mill was virtually ignored by historians and tourists alike for the next century, being overshadowed by the stately church across the street and the largely intact El Molino Viejo to the northwest. What remained of Chapman's Mill was mostly destroyed during the construction of Main Street and an adjacent subdivision in 1941 (Webb 1952:166). The millrace was cut by the installation of the Southern Pacific Railroad tracks in 1873 (Figure 2.9) and demolished or buried by subsequent railroad upkeep, road grading, and construction along most of its length (Figure 2.10).

Figure 2.8. Watercolor of the ruins of Chapman's Mill at San Gabriel Mission by Eva Scott Fenyes, 1904. Courtesy of the Braun Research Library, Autry National Center, Los Angeles; Object ID FEN.149.

Figure 2.9. Chapman's Millrace in 1884, cross-cut by the Southern Pacific Railroad tracks. Image Courtesy of San Gabriel Historical Association.

Figure 2.10. Chapman's Millrace north of the railroad tracks, ca. 1935. Image courtesy of San Gabriel Mission Museum.

An article announcing the construction of a new Southern Pacific Railroad depot in 1886 states that the "'Old Mission ditch,' the first Los Angeles aqueduct that many a day brought water to quench the thirst of Father Junipero Serra, is at last being put out of sight underground, in a fine iron pipe" (Los Angeles Times, 14 July 1886). This may well be a reference to the final burial of Chapman's Millrace.

Native Americans at San Gabriel Mission

Although managed by Spanish or Mexican *gente de razon* ("people of reason," a Mission period class distinction for people of Hispanic descent and culture), California's missions were Native American towns. Like most missions, San Gabriel Mission normally had a complement of two priests, six soldiers, and the soldiers' families (Engelhardt 1927a). In addition, more than 1,700 Native American neophytes resided at the mission in 1817, its most populous year (Engelhardt 1927a:268).

The California missions were of the *reducción* or *congregación* variety, meaning the missionaries began the conversion process by physically relocating dispersed, unconverted Native Americans (known as *gentiles*) to the missions (Forbes 1982:39). Thousands of Native Americans moved into mission communities over the next generation, both voluntarily and through coercion. Upon the Anza expedition's 1776 visit to San Gabriel Mission, Father Pedro Font wrote,

> [T]he method which the fathers observe in the conversion is not to oblige anyone to become a Christian, admitting only those who voluntarily offer themselves, and this they do in the following manner; Since these Indians are accustomed to live in the fields and the hills like beasts, the fathers require that if they wish to be Christians they shall no longer go to the forest, but must live in the mission; and if they leave the ranchería, as they call the little village of huts and houses of the Indians, they will go to seek them and will punish them…[They are] attracted by the pozole (porridge), which they like better than their herbs and the foods of the mountain; and so these Indians are usually caught by the mouth. (Font 1913)

Therefore, while initial entry into the missions may have been voluntary (at least in the first decades of the period), it is likely that the Indians who joined these communities did not understand the irreversibility of their decision. In addition to novel foods, Native Americans were attracted to mission life because of the protection from traditional enemies and access to European goods that it offered. In 1821, the number of neophytes residing at California missions stood at 21,000; by 1831, approximately 80,000 Native Americans had been baptized (Phillips 1996).

The Spanish-induced effects on the traditional Native American ways of life made the Native Americans increasingly dependent on the mission's institutions. Before the arrival of the Spanish, the Gabrielino diet consisted of acorns, deer, antelope, and fish. Their diet was enhanced by seeds from sweet grasses that grew abundantly in the surrounding fields, which they would regularly renew by burning the fields and forest understory (Sandos 2007). When the Spanish missionaries arrived in 1771, they brought with them horses, cattle, mules, sheep, pigs, and goats. These animals grazed the grasslands to the point of non-renewal and displaced the native deer and antelope. The number of livestock owned by San Gabriel Mission grew from 128 in 1773 to nearly 5,000 by 1785 (Engelhardt 1927a:278). With the destruction and displacement of native food sources, the Gabrielino had little choice but to join the mission or flee the area.

Having no resistance to virulent Old World diseases, large numbers of Native Americans perished in the late eighteenth and early nineteenth centuries from epidemics that were both frequent and far-reaching. Outbreaks of smallpox, measles, dysentery, pleurisy, pneumonia, and syphilis were particularly lethal (Castillo 1978). Overcrowding and poor sanitation ensured that diseases spread rapidly in the confines of mission communities, which held on average more than 1,000 neophytes at any given time (Hackel 2005:176; Sugranes 1909:75). Approximately 45 percent of native population loss during the Mission period has been attributed to disease. Poor nutrition due to a meager, starchy, and monotonous diet very unlike that of traditional hunter-gatherers caused many more fatalities (Castillo 1978:103), and scholars have estimated that more than 90 percent of the native population of California perished between 1770 and 1900 (Cook 1978). San Gabriel Mission records indicate that the Gabrielino experienced an average death rate of 95 per 1,000 between 1781 and 1831, greatly outpacing the birth rate of 44 per 1,000, with women and children having the greatest mortality rate. Because the population was not self-sustaining, missionaries were forced to actively recruit neophytes from outlying areas to ensure the community's survival (McCawley 1996:197).

Mission residents also suffered greatly at the hands of soldiers who routinely raped women and brutally punished men, women, and children for even minor offenses. Native Americans were the primary workforce of California throughout the Mission and Secularization periods. The mission and presidio system was built and maintained with Native American hands, as were many of the nearby ranchos. Native American laborers were loaned out to private landowners, many of whom were former soldiers. In exchange for the laborers' hard work, the missions—not the laborers—were paid. In the words of an ex-neophyte from Mission San Luis Rey, "They did not pay us anything—they only gave us food, a loin cloth and a blanket every year, and many beatings for any mistake" (Castillo 1978:102).

Gabrielino culture, as well as the individual people, was adversely affected by missionization. Traditional seasonal movements, religious beliefs, and other practices were systematically repressed. Leadership roles within the mission were granted to people other than traditional leaders as a way of breaking down native political structures (Miller 1991). Although sympathetic historians (e.g., Engelhardt 1927a) have focused on the mission system's intent to improve Native American lives, more critical scholars have likened the impact of missionization to enslavement and even genocide (e.g., Costo and Costo 1987; Forbes 1982). An American visitor to San Gabriel Mission in 1826 did not mince words when he wrote "the Ind[ians… are kept in great fear; for the least offense they are corrected; they are compleat [sic] slaves in every sense of the word" (Dale 1918:205).

These hardships came to a head in October 1785 when Gabrielino from as many as eight villages, led by a neophyte named Nicolás José, attacked San Gabriel Mission and attempted to kill the friars. Nicolás José, a leader from Sibapet who had attained some authority within the church, had been denied the ability to practice native dances and traditions, including the important Mourning Ceremony. He recruited an unbaptized woman named Toypurina, and, through her, recruited captains (local leaders) from nearby villages and mission neophytes to the cause (Hackel 2003). The mission's soldiers learned of the intended revolt and prevented it from taking place. Three dozen Native Americans were implicated in the uprising and punished with public lashing, hard labor, or permanent exile. This was one of many attempted revolts in California, including at least two others at San Gabriel Mission (Hackel 2003), and these revolts were only the most visible of many different forms of native resistance to missionization. Passive resistance to the process included fugitivism (retreating to the mountains and deserts that were beyond mission control), abortion, infanticide of mission-born children, and the retention of native religious practices (Castillo 1978; Miller 1991). Despite these efforts, most surviving Gabrielino had entered the mission system by the early 1800s (Jackson 1999). San Gabriel Mission's neophyte population more than doubled between 1780 and 1788; by 1817, more than 1,700 people called the mission home (Engelhardt 1927a:268; Sugranes 1909:69).

Following the Mexican Revolution against the Spanish crown (1810–1821), all Spanish holdings in North America (including both Alta and Baja California) became part of the newly formed Mexican republic. Alta California became a Mexican state in 1821, and Los Angeles selected its first city council the following year. Independence and the removal of economic restrictions attracted settlers to Los Angeles, and the town slowly grew in size, expanding to the south and west. The population of Los Angeles nearly doubled during this period, rising from 650 to 1,250 between 1822 and 1845 (Weber 1992:226). Until 1832, Los Angeles was essentially a military post, with all able-bodied males listed on the muster rolls and required to perform guard duty and field duty whenever circumstances required (Los Angeles County 1963). The Mexican Congress elevated Los Angeles from pueblo to city status in 1835, declaring it the new state capital (Robinson 1979:238–239). This designation, coupled with the effects of secularization, signaled the shift of the region's political and demographic center from the San Gabriel Mission area to Los Angeles.

Secularization Period (1834–1847)

The authority of the California missions gradually declined, culminating in their secularization by the central Mexican government in 1833, and by the Alta California legislature in 1834. The padres surrendered control of San Gabriel Mission on November 14, 1834. Although the Mexican government directed each mission's lands, livestock, and equipment to be divided among her neophytes, most of these holdings quickly fell into nonnative hands. Former mission lands were divided and granted to private citizens for agricultural and pastoral use, and mission buildings were abandoned and fell into decay (Engelhardt 1927a:174–176).

After years of surreptitious commerce, the first party of American immigrants arrived in Los Angeles in 1841. It included William Workman and John Rowland, who soon became influential landowners. As the possibility of a takeover of California by the United States loomed large in the 1840s, the Mexican government increased the number of land grants in an effort to keep the land in Mexican hands (Wilkman and Wilkman 2006:14–17). Governor Pío Pico and his predecessors made more than 600 rancho grants between 1833 and 1846, putting most of the state's lands into private ownership for the first time (Gumprecht 2001).

In the 1840s, Rowland and Workman began strategically acquiring key ranch properties that had once belonged to San Gabriel Mission. The mission's population steadily declined, as former neophytes were forced to become migrant workers for surrounding ranchos. If mission life was difficult for Native Americans, secularization was worse. After two generations of dependence on the missions, they were suddenly disenfranchised.

After secularization, "nearly all of the Gabrielinos went north while those of San Diego, San Luis and San Juan overran this county, filling the Angeles and surrounding ranchos with more servants than were required" (Reid 1978:282).

Unscrupulous civil administrators oversaw the theft of most of the mission's portable goods. Without proper caretakers, San Gabriel Mission's grounds quickly fell into disrepair. By 1843, little remained but the church itself, the ruined friary, and the overgrown vineyards. The state government sold the grounds of San Gabriel Mission to Hugo Reid and William Workman on June 8, 1846, to repay an outstanding debt (Engelhardt 1927a:216–229).

American Period (1847–Present)

The United States took control of California in 1846, seizing Monterey, San Francisco, San Diego, and Los Angeles with little resistance. Los Angeles soon slipped back into Mexican control, however, and needed to be retaken in 1847. Approximately 600 U.S. sailors, marines, Army dragoons, and mountain men converged under the leadership of Colonel Stephen W. Kearney and Commodore Robert F. Stockton in early January of that year to challenge the California resistance, which was led by General Jose Maria Flores. The American party scored a decisive victory over the Californios (Spanish speakers born in California) in the Battle of the Rio San Gabriel and at the Battle of La Mesa the following day, leading to the signing of the Treaty of Cahuenga and the end of hostilities in California (Harlow 1992:193–218).

Signed on January 13, 1847, at the Campo de Cahuenga near present-day North Hollywood, the Treaty of Cahuenga did not formally end the war, but required the Californios to surrender their arms, return to their homes, and not renew hostiles while the war continued (Harlow 1992:232). The treaty was drafted by José Antonio Carrillo and approved by Mexican Governor Andrés Pico and American Lieutenant-Colonel John C. Frémont. A former second lieutenant of the Corps of Topographical Engineers, Frémont arrived in California as part of a surveying expedition in 1846 when the war had first been declared. He was soon authorized by Commodore Stockton to serve as brevet major of the newly established California Battalion, a motley group of army troops, mountain men, Delaware Indians, and partisans of the Bear Flag Revolt, Frémont's short-lived rebellion in Sonoma that presaged the war. Frémont would eventually lead the California Battalion to Los Angeles (Harlow 1992:223; Starr 2007:68).

With the signing of the Treaty of Cahuenga, Frémont believed he was the rightful military governor of California, having been named such by Commodore Stockton before Stockton returned to the East (Starr 2007:70). However, in the aftermath of the treaty, the military hierarchy of California was unclear, and Stockton's ability to make such a decision was not entirely legitimate. Disagreeing with Frémont's new appointment was Brigadier General Stephen W. Kearney, whose battalion had contributed to the conquest of California, and who believed himself the rightful governor due to his superior rank to both Frémont and Stockton. However, Kearny recognized the fragility of the situation and left Los Angeles to wait until a clearly appointed military governor arrived to void Frémont's claim (Starr 2007:70).

The California Battalion was by this time billeted at San Gabriel Mission, where Frémont had sent them following the signing of the Treaty of Cahuenga. When he signed the treaty, Frémont claimed to have some 400 mounted riflemen, and this claim is evidence of an approximate number of troops stationed at the mission as of January 1847 (Harlow 1992:234). With its ample resources, the mission provided the battalion with an ideal location as they waited for further instruction. Due to his own sense of growing responsibilities as acting governor, Frémont appointed his confidant Jacob R. Snyder to superintendent of the mission on February 22, 1847, granting Snyder the authority to "make all needful [sic] repairs and to do aught else with said Mission, as in his judgment and discretion may conduce, by such expenditure and labour [*sic*] to the public interest" (Spence and Jackson 1973:307).

Colonel Richard B. Mason brought orders from President Polk and Secretary of War William L. Marcy to San Gabriel Mission in late February 1847, confirming Kearny's appointment as military governor. However, California's new government was still undefined, and Kearny ordered Frémont to meet him at the new state capital in Monterey and enlist the California Battalion volunteers into regular military service (Harlow 1992:256). Thinking this a temporary inconvenience, Frémont departed for Monterey on March 22, not anticipating that he would be away from San Gabriel Mission for more than 20 days. Before heading north, he instructed the California Battalion to remain at the mission and not to take orders from anyone but him until his return (Spence and Jackson 1973:320).

Shortly after Frémont's departure, two of Kearny's representatives were sent to the mission to inspect the California Battalion. Upon their arrival, they found two howitzers in the mission yard, one of which had been presumed lost at an earlier battle. The California Battalion was ordered to send both to Kearny, but the battalion refused to turn over the artillery, maintaining that they were to follow orders from no one but Frémont. On March 24, 1847, Colonel Mason arrived at the mission to inspect the troops. Upon learning that Frémont was no longer governor and that they would not be paid, the California Battalion left the mission and disbanded, having been stationed at San Gabriel for a period of 51 days (Harlow 1992:259).

Hostilities with Mexico officially ended with the signing of the Treaty of Guadalupe Hidalgo in 1848, in which the United States agreed to pay Mexico $15 million for the conquered territory, including California, Nevada, Utah, and parts of Colorado, Arizona, New Mexico, and Wyoming; land that represented nearly half of Mexico's pre-1846 holdings. California joined the Union in 1850 as the thirty-first state (Wilkman and Wilkman 2006:15).

At the request of Archbishop Jose Sadoc Alemany, the U.S. Army handed the San Gabriel Mission church, friary, cemetery, and gardens over to the local Catholic diocese in 1853. After determining that the 1846 sale was illegal under Mexican law, a U.S. court issued a patent formally returning the immediate mission grounds to the Catholic Church in 1859 (Engelhardt 1927a:224; Williams 2005:23). In the wake of the California Gold Rush between 1848 and 1855, thousands of settlers and immigrants continued to pour into the state, particularly after the completion of the transcontinental railroad in 1869.

Although San Gabriel Mission was an important population center during the Spanish period, it found itself on the margins of the increasingly urban Southern California landscape during the early American period. Partly due to the effect of the railroads, the secular town of San Gabriel expanded along with the rest of Los Angeles County in the 1880s (Dumke 1991:76–92). The old Hispanic settlement pattern centered on the mission plaza gave way to a linear Euro-American pattern focused on major transportation routes like the Southern Pacific Railroad and what is now known as Mission Road (Williams 2005:23). Although the railroads brought in great numbers of new residents, the subdivision of the large ranchos set the stage for the intensive development of the San Gabriel Valley. In 1890, San Gabriel was a small village of several hundred people centered on Mission Drive, which was lined with small homes, businesses, and taverns. San Gabriel incorporated as a city in 1913, and a new city hall was constructed a decade later (Herbert 1999).

After decades of neglect, San Gabriel Mission was restored in the early twentieth century. The Claretians assumed control of the property in 1908 and opened a parochial school soon thereafter. The architectural style known as the Mission Revival movement was a natural fit for San Gabriel Mission, and the urban core of the city was greatly influenced by that architectural style as it developed through the 1920s (Williams 2005). Although print media, such as Helen Hunt Jackson's popular novel *Ramona*, are often associated with the romanticization of the missions, the nascent California film industry also played a role. Legendary director D. W. Griffith filmed his first all-California film, *The Thread of Destiny*, at San Gabriel Mission in 1910 (Starr 2007:275), presaging the emergence of Southern

California as a major center of film production. A sentimental and sensationalistic stage show called *The Mission Play*, written and promoted by John Steven McGroarty and performed at the custom-built San Gabriel Mission Playhouse southwest of the mission church, reportedly drew more than 2.5 million viewers between 1912 and 1929 (Starr 1985:87–88). A street west of the mission now bears McGroarty's name.

Interest in the missions led to historical research, amateur archaeological work, and preservation and reconstruction efforts at San Gabriel Mission in the 1930s. Spurred by the popularity of the Mission Revival architectural movement, the mission chapel was designated State Historic Landmark No. 158 in 1935, and restoration of the site began in earnest in 1938. A new church was constructed on the mission grounds in 1957 (Herbert 1999), and the original church was listed in the National Register in 1971.

As late as the 1920s, the western San Gabriel Valley contained a series of small towns, such as Alhambra, San Gabriel, San Marino, Monterey Park, Pasadena, South Pasadena, El Monte, and Montebello, separated by large grain fields, citrus orchards, and sheep pastures. Much of this open space was filled in by post–World War II suburban development and the creation of towns such as Temple City and Rosemead, as well as the infilling of unincorporated areas of the county. Although automobile roads and rail lines already linked these communities to Los Angeles and the rest of the state, the construction of freeways such as the Arroyo Seco Parkway (later State Route 110) and the San Bernardino Freeway (Interstate 10) in the San Gabriel Valley just prior to and following World War II spurred the infilling of the landscape. Land subdivision, freeway building, and the construction of tract homes—the hallmarks of Southern California development—continued in earnest in the valley through the 1970s (Herbert 1999). During this era, the urban core of San Gabriel lost some of its Mission Revival style cohesion, and the area took on its present appearance.

The Southern Pacific Railroad

In the late nineteenth century, greater Los Angeles was transformed from a small, rural town into a demographic and commercial center of national significance. The coming of the railroad was largely behind this transformation, and the Southern Pacific Railroad was the most important line in the region. Under the leadership of the "big four" railroad magnates—Collis P. Huntington, Leland Stanford, Charles Crocker, and Mark Hopkins—Southern Pacific Railroad reached a landmark agreement with the City and County of Los Angeles in 1872. In exchange for a promise to construct 50 miles of track on three new lines out of the city, Southern Pacific Railroad received public funding, 60 acres of right-of-way, and title to the fledgling Los Angeles and San Pedro Railroad, which connected Los Angeles with the port of Wilmington (Mullaly and Petty 2002:9–13).

Southern Pacific Railroad began connecting Los Angeles with neighboring towns to the north, east, and south in 1873. The eastern route, known as the Los Angeles Division, began at the San Fernando Street rail yard, crossed the Los Angeles River, and ran through the San Gabriel Valley. Landowners throughout the San Gabriel Valley immediately began to lobby for the construction of railroad terminals in their communities. Stations were ultimately constructed at San Gabriel, El Monte, and Puente. The line ended at the Spadra stage stop, just west of present-day Pomona. The route commenced regular operations in January 1874, and freight houses were added to the San Gabriel, El Monte, and Spadra stops the same year. In 1875, the line was extended to Colton, with crews continuing to lay tracks in the direction of Yuma, Arizona. Without rail connections to the rest of the country, the materials needed for the expanding Los Angeles Basin railroads had to be brought by ship through the Wilmington port. With the completion of the San Fernando tunnel on September 9, 1876, Los Angeles was finally connected to northern California by rail (Mullaly and Petty 2002:12–17, 21).

The Southern Pacific Railroad enjoyed a decade of prosperity, becoming Southern California's single largest employer by 1880. Its monopoly within the San Gabriel Valley ended with the completion of the Atchison, Topeka, and Santa Fe Railroad transcontinental line in 1885, which connected San Diego to Colton, California, via Cajon Pass. Although the competing railroads initially agreed to use the existing Los Angeles Division line jointly, the Atchison, Topeka, and Santa Fe Railroad soon built a parallel line for their exclusive use. An all-out rate war between the companies followed shortly, resulting in an explosion of traffic into Southern California. The competition for passengers and the intense promotion of the sale of property along existing rail lines led to an unprecedented growth spurt in Southern California known as the "boom of the eighties." The San Gabriel Valley developed rapidly with increased immigration, and seven new combination stations were built along the Southern Pacific Railroad line in the valley in 1887 alone (Mullaly and Petty 2002:20–22).

More settlers continued to head west, and the demand for real estate skyrocketed. As real estate prices soared, land that had been farmed for decades was sold for residential development. The large ranchos that surrounded Los Angeles were each annexed, subdivided, and developed in turn. Los Angeles's population more than quadrupled in a decade, from 11,183 in 1880 to 50,395 by 1890 (Meyer 1981:45; Robinson 1979; Wilkman and Wilkman 2006:33–34).

The completion of the Sunset Route to New Orleans in 1889 was a major coup for the Southern Pacific Railroad. This shorter, southerly route was ideal for the shipment of citrus fruits and other agricultural products, which were frequently damaged on longer, colder routes. The new route allowed Southern California's farmers to get their products to eastern markets rapidly over lines exclusively owned by the Southern Pacific Railroad for the first time. The well-promoted connection to a warmer climate had an additional benefit for Southern California. In the late 1870s and 1880s, people seeking relief from tuberculosis, asthma, rheumatism, and other illnesses flooded into the area. The influx of these "health seekers" spurred the construction of health facilities, hotels, and residential developments (Mullaly and Petty 2002; Starr 2007).

Although the land boom faded in the 1890s, the Southern Pacific Railroad continued to expand its lines. With the acquisition of the defunct San Gabriel Valley Rapid Transit Railway in 1894, the Los Angeles Division was connected to Monrovia. Southern Pacific Railroad built a spur line to Pasadena, also connecting at Shorb Junction (later renamed Alhambra Depot), the following year (Mullaly and Petty 2002:20–22, 47).

After the turn of the twentieth century, the construction of additional competing railroad lines continued to spur the development of the San Gabriel Valley. Henry P. Huntington (nephew of Southern Pacific Railroad baron Collis P. Huntington) extended his interurban Pacific Electric Railway into the San Gabriel Valley in 1904, with a line that passed directly in front of the mission's famous campanario (Sugranes 1909:12). Southern Pacific Railroad purchased Pacific Electric Railway in 1912. Pacific Electric Railway operations were closed in 1928, and most of its tracks and facilities were disassembled by 1931. The San Pedro, Los Angeles & Salt Lake Railroad, another competing transcontinental rail company, installed a line that paralleled the Southern Pacific Railroad line to the south in 1905 (Mullaly and Petty 2002:33–34, 49).

Due to engineering and safety advances, such as the introduction of the diesel-electric locomotive and the streamlined passenger train, the original materials and structures on early lines like the Los Angeles Division were obsolete by the 1930s. These included structures built to serve steam engines such as water tanks, wells, and pumping stations. Rapid post–World War II development resulted in the dismantling of additional buildings and equipment. By 1952, most of the original Los Angeles Division facilities had been replaced. Union Pacific Railroad acquired Southern Pacific Railroad in 1996, and the Los Angeles Division continues to carry freight and passengers today (Mullaly and Petty 2002).

Previous Research

Surprisingly, little professional archaeological research had taken place at the San Gabriel Mission archaeological site (CA-LAN-184H) prior to the San Gabriel Trench Grade Separation Project (Figure 2.11). This is partly explained by several non-professional archaeological excavations that took place in the early twentieth century, which likely reduced the integrity of the site's archaeological deposits in several locations. The lack of subsequent work likely relates to the fact that the mission complex was urbanized by the 1940s, leaving little open space within which archaeologists could examine the area's subsurface cultural resources. This section briefly summarizes the studies that were conducted prior to SWCA Environmental Consultants' (SWCA) data recovery efforts, as well as a number of discoveries reported in local newspapers.

Dr. Hiram A. Reid, a medical doctor and historian, wrote an important early history of the San Gabriel Valley titled *History of Pasadena*. While conducting research for the book in 1894, Reid collected descriptions of Chapman's Mill from written histories and local consultants, including at least one man who had observed the mill while it still functioned. He also examined the ruins of Chapman's Mill that were visible at that time and, based on his observations, described the mill's design (Reid 1895:51–52). It is possible that Reid excavated a portion of the mill during his investigation.

In 1921, Father Camillo Terrente, a Spanish priest assigned to San Gabriel Mission, excavated parts of the mission grounds, especially the mission's old cemetery and work area, exposing the brick-making ovens, laundry facility, and wine presses, as well as the graves of several of his Franciscan predecessors (Benthald 1979). Terrente was not a trained archaeologist and did not publish his findings.

In early 1934, an intensive investigation of Chapman's Mill took place under the direction of J. Marshall Miller and H. P. Webb in conjunction with the Pioneer Club of Fremont High School. The work was undertaken at the behest of Edith Webb, an artist and instructor at Fremont High, who was interested in the study of California mission gristmills. Historian Thomas Workman Temple also contributed to the project (Los Angeles Times, 27 March 1934). The team excavated the mill's head race, the bed of the sluice box, and part of the wheel pit (Figure 2.12), and recorded their findings through measurements and photographs. According to Webb (1952:166), "the [mill] ruins were entirely cleared of forty years' accumulation of debris." This statement suggests that Hiram Reid excavated the mill in 1894 while studying it.

The Miller and Webb team concluded that the mill contained a 13.5-foot-diameter undershot waterwheel housed in a masonry chamber that drove horizontal millstones. Webb (1952:166) further noted that "the gear room stood at the right of the inflow end of the masonry wheel-chamber. The millstones were set up on the floor above the gear room." The water that powered the mill shot through a 6-foot-wide and 2.5-foot-deep masonry flume (millrace), down an inclined sluiceway, and into a 4-foot-wide masonry channel (wheel pit) that housed the large wooden wheel. The team concluded that the mill itself was housed in an adobe structure that stood on the east side of the flume (Los Angeles Times, 27 March 1934).

Beginning in late 1930 and continuing until 1935, Fr. Andrew Resa directed workmen in the excavation of the foundations of the mission winery, olive press room, kitchen, and priests' living quarters. These buildings represented elements of the mission quadrangle that were destroyed in the 1812 earthquake. His crew also excavated more than two miles of pipeline running from an old water mill (presumably El Molino Viejo) to the mission tannery. The intent of the project was to "uncover the entire foundations of the ruined mission" and erect exact replicas of the original buildings (Los Angeles Times, 28 March 1935). Fundraising for the restoration continued into the late 1930s (Los Angeles Times, 30 November 1938).

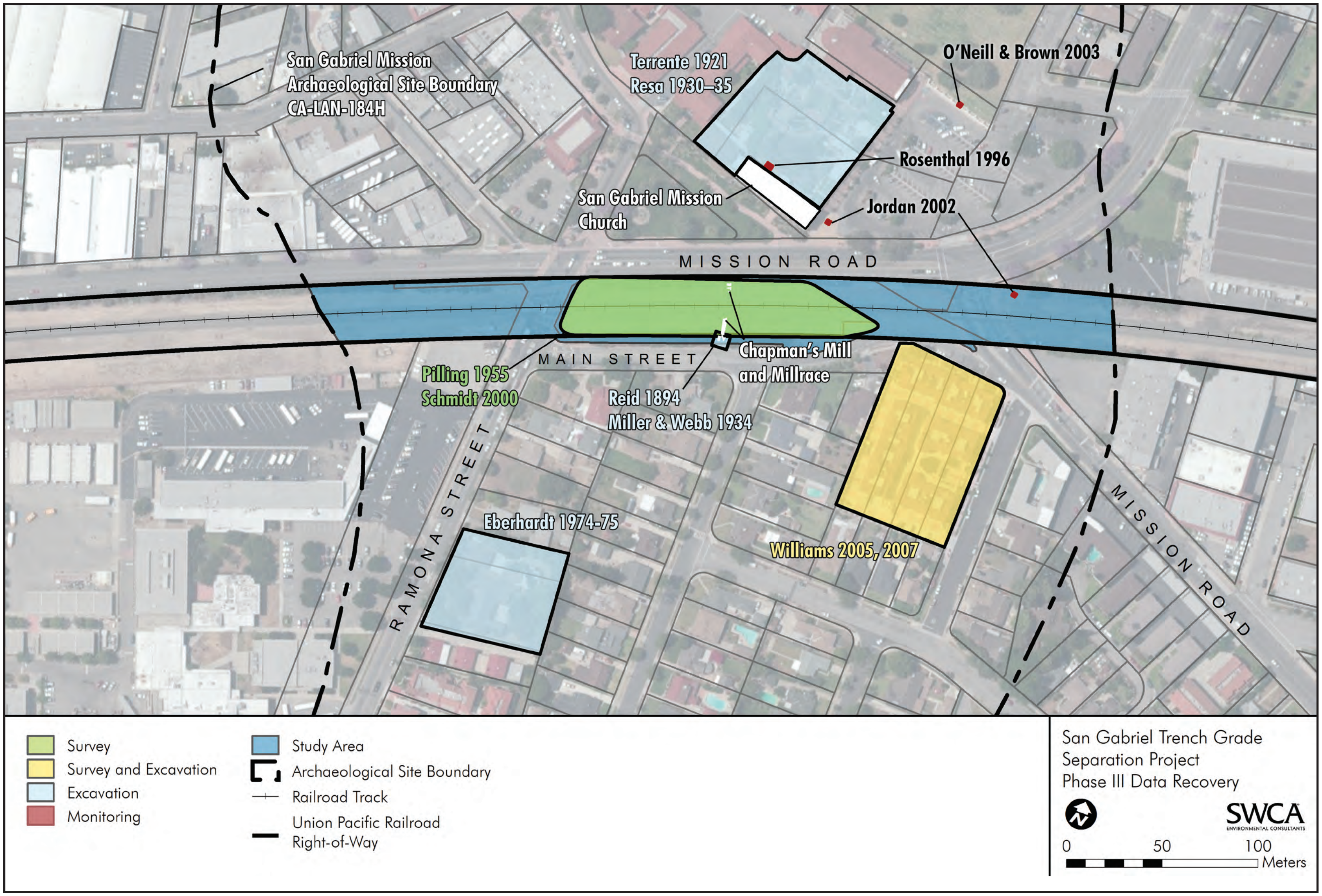

Figure 2.11. Previous research in the San Gabriel Mission archaeological site (locations approximate).

Figure 2.12. Chapman's Mill, ca. 1935. Image courtesy of San Gabriel Mission Museum.

Mid-twentieth-century newspaper articles hint at the fascinating role that community development plays in the erasing and rediscovery of history. As the city of San Gabriel grew, it seems to have forgotten how widespread the mission's built environment once was, only to be reminded of it every few years through accidental discoveries. Behind the San Gabriel City Hall (perhaps to the west), workers in 1939 discovered "rotting bones, sections of paving, and other mortar work including an irrigation flume" (Los Angeles Times, 20 May 1939), reminding them that the mission once extended beyond the primary quadrangle. The mortar and stone flume was reported to be about 20 inches wide and 20 inches deep, and was thought to have brought water to Chapman's Mill. It may have been a small zanja that connected to the larger millrace. Mission period bricks were discovered in front of the mission parochial school in 1946 (Los Angeles Times, 24 November 1946) and on the site of the newly constructed mission convent in 1950 (Los Angeles Times, 25 November 1950). Another water feature was discovered in 1950 in the Mission High School athletic field, consisting of a 2.5-inch-diameter pipeline made from handmade terracotta pipe segments, called *caños* (Los Angeles Times, 6 September 1950). The pipeline, encased in lime plaster, rested upon a bed of boulders and was capped with fragments of roof tiles, or *tejas*. It was thought to have conveyed water from El Molino Viejo to the mission tannery. A similar pipeline had been discovered a decade earlier between the mission cemetery and the mission church.

The San Gabriel Mission archaeological site was first formally recorded by Arnold R. Pilling (1955a, 1955b) of the University of California Archaeological Survey in 1955. It was given two site numbers: CA-LAN-184H and CA-LAN-185H. His decision to record the site components as separate site numbers appears to reflect a conceptual division between architectural elements, both standing and ruined, in the heart of the mission complex (CA-LAN-184H), and an artifact scatter observed in the Southern Pacific Railroad right of way to the south (CA-LAN-

185H). He conducted a surface collection at the latter site, which he associated with Native American occupation, noting the presence of olivella disk beads, glass beads, and numerous fragments of unglazed pottery, Mexican majolica, Chinese porcelain, painted European earthenware, and Mission period tile.

The most extensive formal archaeological research undertaken in the San Gabriel Mission area prior to the current research was not at the mission proper but rather at the Ortega Vigare Adobe (CA-LAN-1034H), a small farmstead located about 600 feet south of the mission church and immediately west of the mission garden. In 1974 and 1975, under the direction of Hal Eberhardt of California State University, Los Angeles, archaeological field schools excavated 41 test units using 6-inch levels and passing soils through ¼-inch screen mesh. The project yielded great quantities of ceramic, glass, metal, and other objects, as well as a large faunal assemblage. Native American influences on the farm's material culture was evidenced by the presence of Mission ware pottery (referred to as Tizon brown ware), three flaked stone artifacts, and 10 glass fragments that had been knapped. Ground stone finds, including three manos, four metates, and one pestle, may have been attributable to Mexican, rather than Native American, foodways. Sixty-five beads were recovered, all of which were glass. The absence of shell beads may be explained by the use of a relatively large screen size. The deposit's stratigraphy was badly mixed, and evidence for the Mission period was limited, with most materials post-dating 1850 (Marshall 1982).

At the turn of the twenty-first century, several small-scale studies at San Gabriel Mission were undertaken by cultural resource management professionals. Following the 1994 Northridge earthquake, archaeological monitoring of repairs to the mission rectory walkway within the quadrangle revealed building materials and mixed household refuse dating from 1835 to 1865 (Rosenthal 1996).

James J. Schmidt (2000:6) observed historic artifacts in the railroad right-of-way within the current study area, which he associated with Pilings' CA-LAN-185H, as well as mill- or millrace-related ruins consisting of parallel alignments of masonry and Mission period brick and tile. Schmidt interpreted the features as remnants of Chapman's Millrace, and recorded the resource under the designation P-19-187367. At the beginning of the current project, SWCA subsumed these two resource numbers under the lowest available site number, CA-LAN-184H, because it was clear they were elements of a continuous landscape of mission deposits.

In 2002, Mooney & Associates, under the direction of Stacey Jordan, conducted archaeological monitoring and test excavations at two locations. Immediately east of the mission church, excavations related to sidewalk repairs led to the discovery of masonry footings and numerous artifacts in trench fill dating from the Mission period through 1930. The construction of a storm drain southeast of the intersection of West Mission Road and Junipero Serra Drive and north of the Union Pacific Railroad tracks (within the current study area) revealed a large, dense archaeological deposit of building materials, including more than 40 gallons of brick and roof tile fragments, as well as ceramics, glass, metal, and bone. Artifact completeness and diagnostic attributes suggested a primary trash deposit dating to the 1880s (Jordan 2004).

The 2003 installation of a mausoleum wall on the south side of the mission's new cemetery, established in the 1880s, was monitored by archaeologists from SWCA. The excavation revealed a deposit of Mission period construction material, domestic cattle bone, and household and kitchen items dating from the 1880s to the 1930s, suggesting that the current mission parking lot overlies largely undisturbed deposits (O'Neil and Brown 2003).

One of the more expansive and well-documented archaeological studies in the San Gabriel Mission archaeological site took place immediately south of the current study area, in what was the northeast corner of the mission garden (Williams 2005, 2007). Before the development of the 400–412 Mission Boulevard property as a multi-unit residential complex, Jack Williams conducted extensive background research and undertook an archaeological testing program. This work included the excavation of 15 excavation units, the locations of which were selected using a stratified random sampling strategy intended to cover all available portions of Williams' study area. Extra effort was also invested in areas thought likely to contain remnants of the garden wall foundation.

Williams' team recovered nearly 4,000 artifacts, most related to the late-twentieth-century suburban occupation of the area. Of the total number, 615 were items that pre-date 1950, and these were dominated by ceramics, particularly tejas and *ladrillos* (Mission-style bricks/floor tiles), as well as small numbers of Mission ware and buff ware sherds, and Chinese and British import ceramics. Pieces of black glass, glass beads, shell beads, square nails, pistol shot, a single quartz flake, and faunal remains dominated by cattle bone, rounded out the assemblage. Williams (2007:75) concluded that the area he examined "represents a periphery, or low-intensity, use area within the larger context of the mission site. The sensitive materials become denser as one moves to the north and west." In Williams' view, Mission period artifacts were more numerous and the deposits were more intact in the area closest to the current study area. Williams suggested that the mission's garden wall, which was likely constructed of plaster-coated adobe and capped with tejas, once passed through his study area, and that footings may have been present in adjacent public rights-of-way (Williams 2007:75).

Summary

The study area is situated within what was once a well-watered and thickly vegetated area traditionally occupied by the Gabrielino. From the late 1700s through ca. 1834, the area was covered by a portion of San Gabriel Mission's lush formal garden. The garden was crossed by a network of ditches that brought water from multiple springs to the north. The same water powered an innovative gristmill designed by New Englander Joseph Chapman and completed ca. 1825. The mission fell into ruin following secularization in 1934, and few records exist regarding the use of the study area over the succeeding decades. The construction of the Southern Pacific Railroad Los Angeles Division in 1873 included the excavation of a trench across the study area, cutting into archaeological deposits and Chapman's Millrace. Ironically, this initially destructive act ultimately led to the preservation of the remaining deposits within the study area, because from that time forward the area became off limits to further construction or disturbance due to its proximity to the active rail line. Excavations in the area of the San Gabriel Mission archaeological site have been conducted sporadically from 1894 to the present. Early work consisted of excavations by avocational historians and local priests and focused on the mission's quadrangle and Chapman's Mill. Development in the late twentieth and early twenty-first centuries spurred small-scale professional archaeological work. Each of these projects offered tantalizing clues to the rich archaeological deposits that have survived, well out of the imagination of the public but only inches beneath their feet as they pass by during their daily travels.

CHAPTER 3: RESEARCH DESIGN

John Dietler and M. Colleen Hamilton

The data recovery research design discusses the research objectives of the study and the specific methods and techniques that were used to meet those objectives. The research strategies were designed to be flexible enough to be modified during fieldwork and post-field analyses, and contingencies were built into the research design to manage unanticipated discoveries and record unexpected feature types.

The research design was initially developed to structure the Phase II study (Dietler et al. 2009). Based on the results of that phase of research, we revised and expanded the research design in the Phase III treatment plan (Dietler and Harper 2010) and research design (Dietler and Hoffman 2011). The approach described here, written before fieldwork commenced, expands upon those earlier versions of the research design, adding an overarching theoretical and methodological orientation and new research directions that were informed by regional research issues.

This research design presents the basis for identifying, interpreting, and evaluating the archaeological materials and data recovered from the portion of the San Gabriel Mission archaeological site (CA-LAN-184H) that lies within the Union Pacific Railroad right-of-way and adjacent City of San Gabriel property where Phase III (data recovery) took place. For the purposes of this report, this area is termed the "study area."

Any number of detailed research issues may be addressed with data retrieved from subsurface excavations. The topics outlined below are based on the archaeological information available prior to data recovery.

Research Domains

Scientific or scholarly research domains are judged within the context of a research design that provides the framework for examining variability and change in the archaeological record, and creates a foundation for the interpretation of material evidence of past activities. A research design for historical archaeological resources can draw extensively from historical documentation outlining potential topics or questions that may be addressed given the availability of data associated with specific property types. The following section identifies historical themes and archaeological property types that were likely to be present in the study area, discusses key research topics that could be investigated with data from the site, and examines processes of archaeological site formation. Methods for identifying features that may contain significant data are presented below, as are techniques for acquiring and evaluating the significance of those data.

Site Formation Processes

To interpret archaeological data, it is critical to understand the processes by which natural and cultural strata form. These can be seen as deposition (the physical creation of an archaeological deposit), reuse of the deposits once they are in place, and damage (both naturally occurring and human-caused) to the deposits following their abandonment. It is particularly important to understand the events that created archaeological deposits in conjunction with the artifacts that they contain. Therefore, the archaeological data recovery process is a deconstruction of the archaeological formation process by means of recognizing and recording the accumulation of layers, features, and period interfaces.

Archaeological deposits represent periods of continuity as well as transitional events in site occupation or use. Continuous deposits constitute layers or living surfaces definable and identifiable by virtue of being buried between natural strata (e.g., silt, ash, or flood deposits) or cultural strata derived from site construction, maintenance, remodeling, and destruction. Such deposits can form quickly as a result of specific events, or over long periods of time. Transitional deposits, whether natural or cultural in origin, form a layered interface constituting a distinct archaeological deposit. Assemblages recovered from stratified, continuous archaeological layers can be used to study a variety of research issues within the matrix of time.

Transitional events often create strata representing a single depositional episode formed as a response to sudden changes in site occupation or land use. Transitional events are indicated by a new feature interface or the deposition of materials at an existing feature interface. These types of deposits maintain their integrity more readily than continuous deposits, and therefore possess greater visibility and clarity in the archaeological record. Such deposits can represent specific site components (e.g., an agricultural area, an earthen ditch, or footings for a residence) or events documented through historical research (e.g., construction of the Southern Pacific Railroad). Changes in occupancy (e.g., the construction of new mission buildings), responses to natural disasters (such as fires, floods, or earthquakes), and modification of building function (such as the addition or closure of privy vaults) often create transitional feature interfaces and the strata that represent them (Costello et al. 1996:49). Known historic events, then, can be used to date strata providing a *terminus ante quem* (TAQ)—the date *before* which a deposit must have formed—or a *teminus post quem* (TPQ), the date *after* which a deposit must have formed.

Such formation processes typically create two general categories of archaeological phenomena: primary and secondary deposits. Primary deposits and landscape features are those that are arranged horizontally (such as sheet refuse and structural remains) and are generated by past activities that result in the immediate creation and deposition of the fill. Sheet refuse accumulates on living surfaces and may be the product of either a single depositional sequence in a short period of time, accumulation over a long period of time, or a catastrophic event. Such a deposit may appear as either a relatively thin layer of debris at an archaeological layer interface or as a series of superimposed layers of substantial thickness. Sheet refuse accumulating over a long period of time tends to be relatively thick, reflecting its sequential formation. It often accumulates in low areas or results in the gradual raising of the local ground surface. Primary deposits of this type often contain data relating to the spatial organization of land use. Refuse deposits of this nature can yield temporal and functional diagnostic artifacts indicating what activities created the midden and when accumulation took place. Special care must be taken in recording the spatial relationships of artifacts and the stratigraphic relationship of layers because archaeological deposits are nonrenewable resources.

The remains of historical technologies compose another type of primary deposit. These might include building or structure footings and plumbing, as well as processing and activity areas. Industrial features may retain information on historical processes undocumented in the literature or specifically pertinent to a locally significant craft specialization. Differences in technologies over time and between different populations provide information on frontier adaptations, ethnic preferences, and economic necessities. Local innovations and individual attempts to exploit events in community history also may be recognized.

Secondary deposits are artifact assemblages and their matrices that are often arranged vertically. They are formed from land use, modification, and/or other daily activities generating refuse or fill that is collected and deposited elsewhere. Commonly, these include the filling of hollow features such as refuse pits, privies, wells, and cisterns, which might contain ceramics, glass, containers, food residue (i.e., bone and shell), and personal accoutrements. In many cases, the contexts and deposition dates of these discrete refuse caches can be accurately determined and assigned to historically documented households or commercial establishments. Features that have documented associations and a wide range and large quantity of artifacts are among the most important potential sources of material culture data, and can be used to study specific events, trends, historical themes, and archaeological research questions.

Massive secondary fill episodes, deposited over a short time, are considered distinct from sheet refuse. These deep fill deposits generally represent the intentional building up of the local land surface and provide information on the development and evolution of historic landscapes. The resulting modification may represent attempts to improve a grade above a flood stage, to bury or alter natural or cultural deficiencies in a landscape, or to otherwise modify a landscape in preparation for a new use. Artifacts in matrices of this nature can be assigned to (or be understood as predating) a recorded historical event and, for this reason, can contribute important interpretive data about land use and modification. However, such artifacts are re-deposited and once their temporal association is noted, additional important data may be exhausted by simple recordation. These massive secondary deposits may be created by human activity, or by natural processes, such as flooding. With the unprecedented landscape alterations brought about by the area's first agricultural endeavors, both intentional and unintentional flooding may have occurred at San Gabriel Mission.

It is important to consider post-depositional impacts to archaeological deposits, both natural and cultural, as these can greatly affect the distribution of cultural materials. Cultural processes (e.g., scavenging, borrowing, reusing, or reshaping a discarded tool from a midden) as well as natural processes (e.g., burrowing rodents, tree roots, wildfires, sedimentation, and erosion) have the potential to alter the character of an archaeological deposit. Artifacts can be moved horizontally or vertically out of their original depositional context, and differences between stratigraphic layers can be blurred. Because much of the information that can be learned from archaeological sites derives from the contextual relationships of artifacts to one another, and with the site as a whole, it is important to understand the extent to which these relationships have been altered by post-depositional impacts.

Site formation processes have been an important aspect of archaeological research since the early 1980s (Butzer 1982; Schiffer 1983, 1987). This realm of inquiry has become more sophisticated in succeeding years, now incorporating studies such as geomorphology, which closely examines a site's stratigraphic and sedimentologic context and post-depositional history in order to aid in dating and interpretation (Waters 1992:9). The role of bioturbation (animal- and plant-caused disturbance) has also been studied to discern its influence on archaeological deposits (e.g., Johnson and Watson-Stegner 1990; Schiffer 1987; Wood and Johnson 1978). The work of burrowing animals, particularly pocket gophers and ground squirrels in southern California, can result in widespread artifact displacement and stratigraphic blurring. Just as flooding has the potential to add massive secondary deposits to a site, it may also remove site deposits. When discussing a once fertile area of the current mission location, Hugo Reid wrote that "although now a washed waste of gravel and sand, nevertheless, at that time it rejoiced in a rich black soil" (Reid 1978 [1852]:263–264). Human-caused impacts—especially post-industrial earthmoving related to road and railroad construction and the installation of utilities—can remove, add, overturn, or mix entire strata. The San Gabriel Mission archaeological site is located in an urban area that has been impacted by the construction and maintenance of the Southern Pacific Railroad, numerous streets, and associated utilities.

Anticipated Archaeological Property Types

Archaeological property types are groups of features, artifacts, or other deposits that share significant physical characteristics and thematic associations. Identified archaeological features in the study area include the foundation remnants of Chapman's Mill and Millrace, the garden wall, and homogeneous historical fill/midden. Other feature types deemed likely to be encountered were construction trenches and occupational deposits, such as sheet middens, and possibly other refuse disposal units. Those generally found with Mission period sites tend to be sheet midden and fill accumulated in low or depressed areas such as shallow arroyos or abandoned river channels. The presence of prehistoric or protohistoric Native American features such as middens and lithic scatters was also possible and could reveal information about the transition from pre-Mission Native American lifeways and responses to mission life. Historical documentation suggested that tallow vats used to render animal fat into tallow and soap may be present. Railroad-related features and post–Mission period features related to the continued use of Chapman's Mill and the garden area were anticipated. These feature types and their data potential are considered further below. Research questions and hypotheses developed for Southern Pacific Railroad resources have been omitted from this chapter, because no such resources were documented during data recovery.

Architectural Remains

Architectural remains are the ruins or physical remains of once-standing buildings or structures. They can be represented by walls (at or below the ground surface), foundations, slab-on-grade floors, pads, piers, footings, worker's trenches, canals, or any other extant element of a building or structure that can be clearly identified. In a domestic context, structural remains may represent residences and domestic outbuildings such as barns, sheds, wash houses, tallow vats, and privies. In the study area, identified structural remains included foundation elements of the mill, millrace, and garden wall. These features were considered significant because they can be associated with events or persons of recognized historic importance; they can represent a type, period, or method of construction; or they can be of religious or cultural significance. In the case of mission-related architectural remains, importance was likely to be demonstrated by the impact the individual structure had on the mission landscape, the labor used in its construction, the construction methods, and the original function and historical significance of the structure. With regard to the railroad, the Southern Pacific Railroad line through San Gabriel and its depot were constructed in 1874, and it likely had support facilities and structures such as privies, wells, cisterns, workshops, car barns, towers, and switching mechanisms.

Hollow or Pit Features

Hollow or pit features potentially contain primary archaeological deposits directly associated with structural remains or site usage. Such features might include privies, wells, cisterns, workers' trenches, and other human-made features dug into the contemporary landscape. Workers' trenches, for example, were created as an element of construction; it was anticipated that these could be found intact and could contain structural remains. Other features may have a principal function related to site usage and might reveal activities that occurred onsite. Some privies may contain primary deposits related to their use; others might be filled when the site is left and could therefore contain secondary deposits that still relate to site function, usage, or change in ownership. The locations of cisterns and wells can reveal site-specific activity areas. They may also be filled when use of the site is discontinued. Tallow vats, although structures, may qualify as a hollow feature and contain primary deposits related to their industrial function. Although no pit features were encountered during Phase II testing, such features were considered likely to be present in the study area and to contain significant archaeological data.

Refuse Deposits

Hollow features, once abandoned, tend to be receptacles for the byproducts of everyday living—refuse. Within them are placed such items as broken and discarded ceramics, food scraps (bone, shell, or plant residue), personal items (beads, jewelry, or clothing articles), structural debris, and the like. In essence, they may contain any subsistence and consumer waste generated by food preparation and consumption, household or structural maintenance and repair, and the residues of agricultural or industrial processes. Hollow features with a defined primary function, such as ditches, aqueducts, construction trenches, or wells, may be filled by a secondary fill resulting from single- or multi-phase refuse disposal. Localized waste-disposal activities can result in the development of a sheet midden, accumulation of layers of fill, or isolated fill episodes. Generally, cast-off refuse is deposited in a discrete portion of a work or habitation site.

Fill Deposits

Another type of deposit is formed from the disposal of large quantities of refuse derived from the intentional importation of fill intended to correct irregularities in the local landscape. These deposits are characterized by accumulation of artifacts along a horizontal plane that can reach many feet in depth. The archaeological usefulness of this type of midden accumulation is similar to that of other refuse deposits because it contains sealed artifact assemblages and, if it has substantial depth, can have stratigraphic context and association. Fill deposits of this nature can provide evidence of change over time in ways that discrete caches—often the result of sudden, transitional change—cannot. Such deposits will reflect changes in the landscape to accommodate major construction and modification of landforms. For example, the channelizing of localized drainage to power Chapman's Mill likely created fill deposits. Fill formed from structural remains or mill waste could be encountered in the study area. Data from these contexts can be used to interpret site usage and the importance of agriculture in the operation and maintenance of the mission. Secondary only to conversion of the neophyte population, the mission's role was the production of agricultural products for the consumption of nearby ranchos, the pueblo of Los Angeles, and the local indigenous population.

Large-scale or Industrial Landscape Modifications

As with fill deposits, large-scale landscape modifications (e.g., construction of a railroad) often require advanced technology. Such changes represent the intentional building up or modification of the local terrain to raise or level a grade prior to a new use. The resulting altered landscape represents a deposit type that exemplifies the changing urban environment over time. The artifacts and fill constituents themselves are less likely to yield important information beyond the possible dating of landscape modification. Fill generally has been displaced from its original context and may even have been brought onto the site from outside sources. Artifacts in fill deposits often do not maintain a clear association with events outside the area or in the immediate vicinity. The importance of this type of deposit depends upon the integrity and focus of the fill effort and its relationship to larger research issues (Costello et al. 1996:52).

Based on Phase II test results, it was known that archaeological deposits associated with the mission were displaced and cast aside in the study area as a result of railroad construction. This fill material was of similar composition to intact Mission period deposits. It will be important to distinguish this re-deposited fill from the midden representing daily accumulation of refuse associated with the mill and garden area.

Research Questions

Site Function

Previous research indicated that the portion of the San Gabriel Mission archaeological site in the study area contained the remains of structures with relatively clear, historically documented functions: Chapman's Mill and Millrace were used for processing grain, and the San Gabriel Mission garden wall enclosed a formal garden and orchard. Numerous questions remained unanswered, however.

The unexpected orientation and irregular construction of the garden wall foundation suggested that this feature may differ from historical descriptions or that its preliminary identification as the garden wall may be incorrect. Historic images (e.g., Figures 2.2 and 2.3) suggested that Native American residences were located in the vicinity of the study area, but the stylized nature of the paintings and drawings and the lack of landmarks in historic photographs made their specific locations difficult to determine. Most of the cultural materials that had been recovered in previous phases of work at San Gabriel Mission were classified as construction materials or related to food activities (e.g., tableware and animal bone). However, a wide variety of other activity groups were also represented by artifacts, including personal adornments, furniture, garment elements, machine hardware, and munitions, suggesting that this portion of the site served other functions, as well. Historical documentation suggested that other activities occurred on this portion of the mission grounds. There was some indication that tallow vats, as well as other evidence of industry, may have been present near the mill (Reid 1895:41). Alternatively, the area may have served as a general refuse disposal for one or more of the mission's resident groups, including Native Americans, Hispanic people, or other people with nonnative backgrounds.

Research Questions

- Are additional archaeological features present within this portion of the San Gabriel Mission archaeological site? If so, what is the function of these features?
- Is there direct evidence for primary residential use by Native Americans?
- Aside from gardening and grain processing, what other activities took place within this portion of the site? Was other industry occurring near the mill, as suggested by historic documents?
- Are discrete, horizontal concentrations of artifacts or ecofacts present across the site? Do such concentrations reflect specific use areas? If so, do these concentrations reflect activity areas? Are there areas within the site that are devoid of artifacts?
- Can evidence of mission productivity such as ironwork, pottery production, and cloth-making be identified archaeologically?

Hypotheses

- Hypothesis Site Function-1 (SF-1): As a portion of the mission complex that did not have a single, fixed purpose over time (see Site Chronology, below), the study area will contain evidence of a wide variety of activities related to industry, habitation, transportation, and agriculture. In addition to features, changing artifact densities across the site will indicate the locations where these activities took place.
- Hypothesis SF-2: Evidence for primary residential use by Native Americans will be present in the form of dense concentrations of food remains, Mission ware pottery, fire-affected rock, and portable milling equipment.

Data Requirements

- Archaeological features (e.g., architectural remains, storage pits, trash deposits, and hearth features);
- Spatially discrete artifact or ecofact concentrations or associations;
- Stratigraphic integrity of soil layers and features;
- Identifiable historical associations dating to the Mission period; and
- Food refuse, botanical remains, and faunal remains associated with the most agriculturally productive years.

Site Chronology

Establishing a solid chronology is fundamental to any archaeological endeavor because documenting change (or stasis) is central to many of the research questions posed. The precision and accuracy of dates is critical because it forms the baseline for the other research topics. Obtainment of multiple dates through a variety of techniques increases the confidence with which the data can be interpreted. Although radiocarbon dating is commonly used for prehistoric sites, this technique has limited utility in nineteenth-century and later sites. Instead, historic sites are commonly dated through documentary information and artifact type frequencies, which can provide more precise date ranges than can radiocarbon dating. However, if deposits containing organic materials that may predate the founding of the mission are identified, radiocarbon dating may be useful in determining their age.

Prior to excavation, research at the San Gabriel Mission archaeological site demonstrated that the site has strong Mission period (1769–1834) and American period (1847–present) components. Aside from the historically documented construction date for Chapman's Mill (completed around 1825), research in the study area produced few discrete, datable deposits within these general time periods. It also remained unclear whether there were Initial Contact period (1542–1769) or Secularization period (1834–1847) components in the study area. To reconstruct the sequence of occupation in this portion of the site, it was deemed essential to attain precise dates for the construction of the garden wall and any other features or discrete strata that were encountered. Dating American period events at the site—including post–Mission period use of the mill, grading and trenching associated with the railroad, and the construction of surface streets—was expected to help reconstruct the site's history.

Research Questions

- Was this portion of the site used during the Initial Contact period or earlier? Is there evidence for the Gabrielino village of Shevaanga? When was this portion of the site first occupied?
- Can individual use episodes in the Mission period be detected? Are documented historic events visible in the archaeological record?
- Was this portion of the site used during the Secularization period? How long did mission-like lifeways continue after the end of the Mission period in 1834? What evidence, if any, is available for the transitions from the Mission period to the Secularization period to the American period?
- Can events within the American period (e.g., construction of the existing railroad trench, grading the railroad right-of-way) be precisely dated? When did the first direct evidence of American influence appear at the site? How was the site used (if at all) after the Secularization period and prior to the construction of the railroad (1848–1874)?
- Is there evidence of changing site use over time? For architectural elements (including Chapman's Mill and Millrace and the garden wall foundation), are construction, remodeling, and destruction episodes visible? Can these events be dated? If older features are identified, is there evidence of repairs related to the earthquake of 1812?
- How do archaeologically derived dates compare to those established through historical documents? Were all of the elements of Chapman's Mill and Millrace constructed prior to 1825? Were modifications made later?

Hypotheses

- Hypothesis Site Chronology-1 (SC-1): No evidence of pre-1775 occupation will be identified in the study area.
- Hypothesis SC-2: The construction of Chapman's Mill, which took place during a building boom orchestrated by Father Zalvidea, marked a turning point in the use of this portion of the mission site. The transformation from a pre-1821 agricultural and residential area to a post-1825 industrial and processing area will be clearly visible in dated contexts through changing assemblages of artifacts and ecofacts.
- Hypothesis SC-3: Given the presence of lush gardens and a much-touted gristmill that was only a decade old, the land in the study area continued to be used by Native Americans and others during the Secularization period. This use will be found to be most intensive immediately following secularization, and will show evidence of diminishing in the years leading up to the construction of the railroad (1834–1874).
- Hypothesis SC-4: The beginning of the American period will be clearly marked by a change in ceramics; Spanish Majolica and Mexican earthenware will disappear,

and American and British ceramics will increase.

- Hypothesis SC-5: Evidence of the use of the study area for activities other than transportation will cease after the installation of the Southern Pacific Railroad line. Materials dating after 1874 will be limited to railroad-related materials and casually discarded roadside refuse.

Data Requirements

- Additional documentary evidence (e.g., published accounts and photographs) for events that took place in the study area;
- Temporally discrete artifact or ecofact concentrations;
- Stratigraphic integrity of soil layers;
- Chronologically diagnostic artifacts, building materials, or building techniques in direct association with architectural remains or intact stratigraphic layers; and
- Organic material in sufficient quantities to date using radiocarbon dating methods, found in undisturbed stratigraphic contexts that apparently predate the nineteenth century.

Native American Health, Status, and Ethnicity

San Gabriel Mission, like many of Alta California's missions, was designed to be a self-sufficient agricultural community. Because of the fertile lands and labor provided by a large local Native American population, San Gabriel Mission was among the most successful missions in this regard. The population included both the Gabrielino inhabitants of the Los Angeles Basin, as well as people from surrounding areas, including the Serrano, the Vanyume Serrano, the western Cahuilla, and the Luiseño. The diverse population of San Gabriel Mission included both Christianized Native Americans (neophytes) and unconverted Native Americans (gentiles). At its peak, San Gabriel Mission housed more than 1,700 neophytes (Engelhardt 1927a:268). During the Phase II study at the San Gabriel Mission archaeological site, SWCA recovered Native American pottery that appeared to derive from the American Southwest, suggesting extra-local Native American influences, as well.

Although written records for San Gabriel Mission are substantial, they are far from comprehensive and were largely written by the missionaries and other Euro-Americans (e.g., Engelhardt 1927a). Archaeological studies can broaden our perspective on history by providing details about the lives of the mission's Native American residents and laborers. Very few such studies have been completed to date at San Gabriel Mission, although there have been numerous studies of this type in other California Mission contexts (e.g., Allen 1998; Greenwood 1976; Hoover and Costello 1985; Lightfoot 2005; Silliman 2001, 2006; Panich and Schneider 2014), as well as in contemporary contexts outside of mission settings, including ranchos and Native American villages.

Prior to excavation, the study area contained three archaeological elements of the San Gabriel Mission archaeological site: Chapman's Mill and Millrace, an artifact deposit, and what was thought to be a portion of the garden wall foundation. Mission facilities like gristmills and formal gardens, although designed and managed by Euro-Americans, were typically constructed and operated by Native Americans. The artifact deposit contained artifact classes that are strongly associated with Native American cultures, including shell and glass beads, indigenous (Mission ware) pottery, and flaked stone tools (Dietler et al. 2009). Historic images of San Gabriel Mission depict traditional Native American houses near the mission and in the study area (Figure 3.1; see also Figures 2.2 and 2.3). Consequently, it seemed likely that many of the artifacts and features identified at the San Gabriel Mission archaeological site were affiliated with Native American inhabitants.

Figure 3.1. Possible Native American residences adjacent to San Gabriel Mission. Courtesy of the Braun Research Library Collection, Autry National Center, Los Angeles; Photo P.1543.

Earlier phases of research clearly indicated that the San Gabriel Mission archaeological site contained datasets that would allow us to address research questions concerning Native American diet, health, status and role in the mission community, ethnicity, and responses to missionization (Dietler et al. 2009; Dietler and Harper 2010). Material assemblages (artifacts, food remains, and architectural features) from these contexts were expected to reflect the mixing of practices that occurred within this multiethnic community as social relationships and identities were continuously negotiated. This includes the influence of Gabrielino, non-local Native American, and Euro-American traditions on daily life at the mission. While it was clear from earlier phases of research that these multiple cultural influences would shape the material assemblage, interpretation of aspects of Native American life such as health, status and ethnicity hinges on identifying clear contexts that can be associated with the neophyte community and developing a more nuanced understanding of how relations of power structured daily activities in different spheres of the mission.

Research Questions

- Which contexts, features, artifacts, and food remains are most closely associated with Native Americans? Which site components can be associated exclusively with Native American residents, and which are associated with both Native American and Euro-American use? Is evidence of neophyte behavior visible in the archaeological record? What aspects of neophyte daily life can be reconstructed based on the archaeological evidence?

- What foods did Native Americans living at San Gabriel Mission consume? Previous research revealed a preponderance of domestic cow and sheep or goat bone in the site's faunal assemblages. Did the Native American diet focus on a particular range of body parts or meat cuts? What was the proportion of wild species to domesticated species in their diet? Does the faunal evidence suggest a healthy or unhealthy diet, in terms of quantity and variety? What non-food uses are evident in the faunal remains?

- What butchering techniques are visible in the archaeological record? Do they conform to other faunal assemblages recovered from California mission sites (e.g., San Fernando Mission)? Do butchering techniques vary by species?

- What plants were used by Native Americans at San Gabriel during the Mission period? Did plant use mirror animal use by focusing on a narrow range of domesticated species (e.g., corn and wheat)? What role did wild plant species play in Native American diet and material culture? Does the botanical evidence suggest a healthy or unhealthy diet, in terms of quantity and variety? Does the diet reflect gradual change over time (e.g., gradual reduction of wild plant use)?

- What roles did Native Americans have in the mission community? Does archaeological data from contexts associated with Native Americans reflect the variety of statuses or social positions that indigenous people held at San Gabriel Mission, as reflected in the historic record?

- What Native American responses to missionization are evident at San Gabriel Mission? Is there evidence of Native American persistence (sensu Panich 2013:107) within the colonial context, including the continuation of pre-Contact practices or acts of overt resistance to missionization? Is there evidence that mission neophytes used new raw materials to create familiar forms or used pre-Contact technologies to repurpose materials such as glass or ceramic? How do these data compare to contemporary Gabrielino assemblages at other sites?

- What Native American responses to secularization are evident at San Gabriel Mission? Is there evidence of cultural continuity with, or deviations from, Mission period practices? Is there evidence of resistance to Americanization?

- Do the site's features, artifacts, or ecofacts provide evidence for ways that native people maintained or created social relationships or trade networks? Are distinct Native American ethnicities or affiliations suggested through the presence of particular artifact types, cultural practices, or nonlocal raw materials? Is there any direct evidence that pottery was made locally, adopting technology rather than relying on continued direct exchange with offsite potters? Are other imported Native American craft goods present? If so, how do the suggested ethnic affiliations of these artifacts compare with documentary evidence such as baptism, marriage, and death registers?

Hypotheses

- Hypothesis Native American-1 (NA-1): Native Americans living near San Gabriel Mission were well supplied with domesticated animal food, particularly beef. Because San Gabriel Mission controlled an immense cattle empire that was valued for the hides and tallow rather than the meat it produced, few restrictions would have been placed on the distribution of beef. Native Americans had access to the same meat cuts that Euro-Americans had.

- Hypothesis NA-2: Because of the easy access to beef, Native American use of wild animal species to supplement their diet was minimal.

- Hypothesis NA-3: Native American access to non-native plant foods (e.g., corn and wheat) was more limited and was therefore supplemented with greater quantities of wild species of plant foods, including acorns.
- Hypothesis NA-4: Native Americans held relatively low statuses in the mission community, and occupied a variety of roles that were primarily associated with physical labor. Higher-status managerial roles were filled by Euro-Americans. These roles and statuses would have resulted in lesser access to valuable goods. Contexts dominated by Native American-affiliated materials will contain fewer valuable goods than will Euro-American contexts.
- Hypothesis NA-5: As a prosperous mission with a thriving hide and tallow export industry and documentary evidence for the presence of Native Americans from across southern California, imported Native American goods and raw materials will be relatively common. Materials from the south (San Diego region) and southeast (Colorado River region) will be more common than materials from the north and northeast.

Data Requirements

- Interpretable contexts, including temporally and spatially discrete features and strata;
- Features, artifacts, faunal remains, and botanical remains from contexts that can be strongly associated with Native Americans; and
- Features, artifacts, faunal remains, and botanical remains from contexts that can be strongly associated with Euro-Americans.

Engineering and Architecture

The San Gabriel Mission, being a multicultural frontier community, was built using a mixture of architectural styles. Europeans and Euro-Americans with a variety of backgrounds designed and directed the construction of buildings and other architectural features at the mission, while the labor force was primarily Native American (Engelhardt 1927a). Each of these cultures influenced the final design of the mission's built environment.

The mission's historic church that forms the centerpiece of the extant quadrangle evokes both Spanish and Moorish influences. The wall around the garden may have been similar to garden walls at other Spanish missions such as San Buenaventura Mission (Williams 2007:57), San Antonio de Padua Mission (Bertrando 1997), San Fernando Mission (Hamilton and Warren 2006), and elsewhere. The mission's first mill, El Molino Viejo, was constructed using a floor plan and architectural details in the Hispanic tradition. Chapman's Mill, in contrast, apparently resembled the mills of its principal architect's native New England (Webb 1952:82). This second gristmill at San Gabriel Mission was explicitly designed to resemble a mill constructed under Chapman's direction at Santa Inés Mission (Webb 1952:155). The ruins of that mill still exist and have been the subject of a detailed archaeological investigation (Hoover 1992).

The architectural remains at the San Gabriel Mission archaeological site could answer research questions about architectural styles and influences at the dynamic and multicultural edge of the Spanish empire.

Research Questions

- Are the design and construction of the architectural features at San Gabriel Mission similar to those found at other Alta California missions? How does Chapman's Mill at San Gabriel Mission compare to other mills affiliated with San Gabriel Mission (e.g., El Molino Viejo)? How does it compare to mills designed by Joseph Chapman elsewhere (i.e., at Santa Inés Mission)?
- Do the design, building materials, and basic measurements of architectural features at San Gabriel Mission reflect Spanish, Euro-American, or Native American architectural traditions, or some mixture of these?

- Does the landscape reflect engineering of the site for mill use?
- Was the mill modified over time for different uses?
- Does the mill's operation reflect a Native American workforce?
- How does the design of the garden wall compare to similar walls at other missions? What does its design tell us about the designer(s), builders, labor force, and intended use of this wall?
- Did the design, dimensions, materials, or layout of the garden wall change over time?
- Is evidence of other Mission period industry reflected in the archaeological record?

Hypotheses

- Hypothesis Engineering and Architecture-1 (EA-1): Chapman's Mill was commissioned by Spaniards, designed by an American, and built with Native American labor, and will reflect a mixture of architectural traditions from all three cultures.
- Hypothesis EA-2: The wall around the mission garden, a utilitarian construction, will reflect a basic Spanish design and the use of locally available materials.

Data Requirements

- Mission period architectural remains or built environment features that are datable;
- Detailed measurements of any architectural elements that are present, and comparable data from contemporary structures elsewhere; and
- Modified landscape elements associated with construction and use of the mill.

Environmental Reconstruction

The siting of each of the 21 missions was carefully considered by the mission fathers, and each had a specific purpose. San Gabriel Mission was the fourth mission to be built and was intended to provide agricultural products to the region. Fathers Pedro Benito Cambón and Josef Angel Fernandez de la Somera established the first mission site on the banks of the Rio de los Temblores, near the confluence of what are now called Rio Hondo and the San Gabriel River. Because that mission site (known as La Misión Vieja) flooded frequently, or perhaps due to insufficient agricultural yields, the mission was moved five miles northwest to its current site just four years after its founding (Engelhardt 1927a:4–28).

According to Hugo Reid's 1852 account (Reid 1978 [1852]:263–264; see Chapter 2), the study area was heavily vegetated prior to the establishment of San Gabriel Mission. Despite the necessity of clearing the site, the mission soon included a large church, priests' quarters, guest rooms, neophyte housing, workshops, a kitchen, a cemetery, and many other structures. The center of the mission complex initially consisted of a large open plaza. As the mission prospered, a quadrangle was established and storerooms were built. A tannery was added, as well as numerous granaries, a hospital, three water-powered mills, a hen house, a fountain, a girls' dormitory, and soldiers' barracks (Weber 1979:18–21).

Construction of Chapman's Mill began around 1820. Relying on native labor, Chapman completed the structure around 1825. It was powered by water pressure created by dams on Alhambra and Eaton Washes and via earthen ditches and a deep masonry flume, the millrace. Hiram Reid (1895:41) reports that Bishop Alemany was confirmed a portion of church property in 1875 by the Board of Land Commissioners. This restored land included "55 1/2 acres south of the church, where the Chapman Mill, and tallow works and other industries formerly stood, and now known as the 'Bishops orchard, or garden,' it having a fine orange grove on it, all fenced in."

Only masonry foundation remnants of the mill and millrace remained visible prior to the data recovery phase of work. Urban development and the construction of the Southern Pacific Railroad have obscured the network of aqueducts between Mission Lake, La Presa, and Chapman's Mill. As early as 1889, James Steele regretted the loss of the waterworks, especially the millrace, as it meandered across the landscape.

> Outside, across the road, and by me found by chance are the remains of a huge cement water-main. It is laid above ground entirely, and being some four feet wide and deep; conveyed a torrent. Perhaps nothing could recall so vividly the old and prosperous Saturnian days as to imagine this aqueduct brim-full through the midst of a shining valley. It seems indicative of the utter passing away of all these early blessings to see that the railroad, when it was built, cut it square across. (Steele 1889:60)

Much of this area was further altered when Hiram Reid excavated the millworks in 1894 and again when Edith Webb excavated the feature in 1934. Roadwork and construction of a subdivision in 1941 isolated the mill remnant and millrace on a narrow strip of ground south of the railroad. Data recovery was expected to offer the opportunity to further explore the mill and millrace and attempt a reconstruction of its environmental setting.

These remnants have the potential to answer questions about historic exploitation of the environment. Historical maps, paintings, and photographs can be used to reconstruct this early landscape and archaeological deposits and native sediments may provide insight into how the Chapman's Mill was engineered and powered. Geomorphological data can also be used to identify natural events such as the historic flood episodes of 1811 and 1815, and the earthquake of 1812 (Gumprecht 1999:131–171), providing key data for identification of archaeological features and dating of site stratigraphy.

Research Questions

- What did the environment look like prior to the first use of the area surrounding Chapman's Mill?
- Do these remnant structural remains have the potential to answer questions about historical exploitation of the local landscape?
- Can historical maps, paintings, and photographs be used to reconstruct the early landscape? Such a reconstruction would contribute to site interpretation.
- Can the water distribution system be reconstructed from historical documents and archaeological evidence?
- Will the archaeological excavations yield geomorphological data that can provide insight into how Chapman's Mill was engineered and powered?
- Does soil stratigraphy reflect natural events, such as the flood episodes of 1811 and 1815, and the earthquake of 1812?
- Were structures onsite damaged by these events? Is there evidence of the 1812 earthquake?
- Can such data aid in the interpretation of archaeological features and dating of site stratigraphy?

Hypotheses

- Hypothesis Environmental Reconstruction-1 (ER-1): Historical documentation in the form of early descriptions, paintings, photographs, and remnants of structural elements from the mission aqueduct system and waterworks are available for use in an environmental reconstruction of the study area. Archaeological and geomorphological data that contribute to an environmental reconstruction will be available, and these data will be useful in further interpreting the construction and use of Chapman's Mill and associated waterworks.
- Hypothesis ER-2: Assuming geomorphological and additional architectural data are gathered through excavation, evidence will be found that

contributes to an interpretation of changing land use over time.

- Hypothesis ER-3: Geomorphological data representing natural processes such as area floods (in 1811 and 1815) and the 1812 earthquake will be encountered. This information can then be used to date cultural deposits and evidence of change to specific time periods and events, aiding in the development and interpretation of site stratigraphy and change in land use.

Data Requirements

- Local landscape features that can be linked to historical documents, including maps, for use in environmental reconstruction;
- Strata datable to historically documented weather- and seismic-related events;
- Architectural remains that can be dated; and
- Identification of specific features or landscape modification episodes that can be dated.

Agriculture and Industry

Out of the thickly forested riparian area, the mission fathers directed the neophyte labor to clear land for orchards and gardens. As stated above, Bishop Alemany took more than 55 acres of the mission orchards and gardens in 1875. San Gabriel Mission was foremost an agricultural settlement. In addition to the gardens, vineyards lay northeast of the study area and grazing land extended in all directions. At the pinnacle of its production, the mission boasted vast productive yields of livestock, grain, and fruit, and other agricultural products. Among its industrial pursuits were tanning of hides and production of tallow and soap—key export products in the late eighteenth and early nineteenth centuries.

The collection of botanical samples from San Gabriel Mission was considered likely to yield data about mission agriculture and viticulture. Similar samples have been collected from other mission sites, and comparison with them could yield information on the type of products grown and the agricultural specialization of these missions. At San Fernando Mission, for example, a variety of cultigens were identified from archaeological contexts, including wheat, maize, peach, olive, strawberry, and grape (Abdo-Hintzman et al. 2010:Appendix C). Remnants of Chapman's Mill and the garden wall have already been revealed, and elements of the tallow vats would likely be found. Carbonized cultigens could be used to identify the products that had been ground at and distributed from the mill.

Research Questions

- Which grains were milled onsite?
- What products were grown in the garden? Did the garden, orchards, and vineyards extend into the study area? At the time data recovery was initiated, only the garden wall had been found. Is there other evidence of the garden and what was grown there?
- Was there other industry onsite? Is there evidence of tallow vats and baking ovens, as seen at other mission sites (e.g., San Fernando Mission) and suggested in historical documents?
- Was San Gabriel Mission in fact as productive as indicated in historical documents? How did it compare to other contemporary missions in the production and distribution of agricultural products (e.g., San Fernando and San Buenaventura Missions)?
- Were there other structures present in the study area that were related to the agricultural and industrial use of the site?

Hypotheses

It is anticipated that the study area will contain evidence of a variety of industries.

- Hypothesis Agriculture and Industry-1 (AI-1): Phase II testing demonstrated that remnants of Chapman's Mill are located on the site. This mill, like the earlier mill that Chapman built at Santa Inés Mission (Webb 1952:155), was designed to grind both wheat and corn, and archaeological evidence of these grains will be found in the vicinity of the mill.
- Hypothesis AI-2: Historical documents allude to other industries occurring at the mission. Some are said to have been near the mill, although others are known to be closer to the mission quadrangle. Such industries include tallow vats and ovens used for baking bread and making bricks and soap (Sugranes 1909:96). The earliest tallow vats are known to be at the mission, but Reid (1895) alludes to other vats at the mill. Clearly, structural remains have survived within the study area; it is hypothesized that additional structural remnants will be found representing these industries.
- Hypothesis AI-3: Elements of the garden wall have been tentatively identified in the study area. It is said that "large vineyards, apple and peach orchards, and some orange and fig trees" (Northrup 1944:17) were planted at the mission, and that brandy and wine were distilled. Archaeological evidence will reveal what cultigens were processed and consumed in the study area and how the variety compares with cultigens listed in historical documents or produced at other mission sites.

Data Requirements

- Identifiable cultigens, including agricultural products ground at the mill;
- Mission period industrial features representing tallow pits, earth ovens, and remnants of the mill and millrace;
- Additional intact elements of the garden wall that would convey the extent of the gardens;
- Structural remains for housing workers and storing tools and work products; and
- Refuse pits related to site usage that contain charred botanical remains.

Secularization Period

Events leading up to the secularization of the California missions spanned many years and much political upheaval, after which the Mexican Congress passed the Secularization Act in August 1833. Not only did the action divest the Franciscans of property, it also opened both Alta California and Baja California to colonization. The first 10 missions were secularized in 1834; San Gabriel Mission among them. An inventory of the mission's holdings was made in November of the same year. Mr. Wilkes, a member of an expedition sent by the government in 1842, reported what he encountered:

> Anarchy and confusion began to reign and the want of authority was everywhere felt. Some of the missions were deserted, the property which had been amassed in them was dissipated, and the Indians turned out to seek their native wilds. This act (he alluded to secularization) brought about the ruin of the missions and the property that was still left became a prey to the rapacity of the governor. (Sugranes 1909:76)

Historical documents suggest that what followed was a period of revolution and lawlessness. With a disruption in trade came an increase in the number of American interlopers. Political resistance erupted on every front as Californios vied for control of their ranchos against American intruders and Mexican authority. As mission landholdings passed into private hands, neophyte workers, who had become dependent on the missions, were left to fend for themselves. With no work at the mission, there was a far greater labor force in the region than could be employed. John Russell Bartlett, visiting Los Angeles and San Gabriel in 1852, reported the following:

> I saw more Indians about this place (Los Angeles) than in any part of California I had yet visited. They were chiefly mission Indians, i.e., those who had been connected with the mission and had derived their support from them until the suppression of those establishments. They are a miserable, squalid-looking set, squatting or lying about the corners of the streets, with no occupation. (Sugranes 1909:76)

Following enactment of secularization, the padres surrendered control of San Gabriel Mission, removing its properties from ecclesiastical control and secularizing its lands. With the threat of an American takeover, the Mexican government issued large numbers of land grants aimed at privatizing mission lands. More than 600 grants were issued between 1833 and 1846 in this region of California. Californios also scrambled to secure land. Trade in the region changed. British and American trade displaced supply ships from Mexico, and, in 1841, the first party of American immigrants arrived at the pueblo of Los Angeles.

Historical records for this period are full of descriptions similar to those provided above, often in contradiction with each other, having been generated by displaced missionaries, struggling Californios, and intruding American traders. Alta California was in revolt, and without proper oversight the mission grounds were said to have quickly fallen into disrepair. By 1846, San Gabriel Mission property officially passed into the hands of Hugo Reid and William Workman. What occurred onsite during the interim period is not fully known. It is possible that Chapman's Mill continued to operate; that mission neophytes remained in the general area and tended crops at least to a subsistence level, and that industry was carried on by those who stayed. If the mission fathers remained in residence, work in the fields and garden may have continued, albeit at a much reduced level. Phase III data recovery was expected to offer the opportunity to explore what did occur, to supplement or challenge the historical record, and to reveal if land use in the area continued. Such information can be used to critically examine historical documents, and it is possible that archaeological data can temper these accounts and lead to a reconsideration of the period of Hispanic-to-American transition.

Research Questions

- What physical evidence exists of post-1834 use of mission structures, fields, and other industry? Did the use of the land adjacent to Chapman's Mill continue as before, or was the mill immediately abandoned?
- What evidence remains of Native American site use post-1834? How did this use change over time?
- Is the transition between mission control and secularization as stark as historical documents portray?
- Is the transition from Hispanic use of the site to American use visible in the archaeological record?
- If these activities are visible archaeologically, can deposits be associated with specific population groups, ethnicities, and industries?
- Does archaeological evidence reflect previously undocumented uses of mission grounds?

Hypotheses

- Hypothesis Secularization-1 (S-1): Clearly the secularization of San Gabriel Mission changed the way of life for the missionaries and the neophytes in their charge. Historical documents paint this time as a period of decline. Sugranes (1909) titles his Chapter 17 "Gloomy Days in San Gabriel Mission." Assuming the study area was occupied between 1834 and 1848, archaeological evidence will reveal that this was a period of decline, rather than prosperity or total abandonment.
- Hypothesis S-2: Historical documents suggest that decline was immediate following inventory of mission property and relinquishing of lands in November 1834. Other sources indicate that a resident priest remained and that some neophytes lingered to work in the gardens and field.

The archaeological evidence will provide data with which to assess continued industry through the years of secularization. No evidence for industry beyond that consistent with subsistence and private ranching activities will be found.

- Hypothesis S-3: Phase II testing revealed a variety of artifact classes in the study area, including structural remnants, food remains, domestic wares, and personal items. The variety in ceramics indicates multiple activities occurring onsite, possibly even habitation. The artifact assemblage will reflect the actual land use over time.
- Hypothesis S-4: The variety in ceramics suggests a change in consumption of trade goods during Secularization. Mission wares are abundant, as are Mexican Majolica and unrefined earthenware. Chinese porcelain and British ceramics are present, suggesting a range of production from the late 1700s through the 1830s, possibly as late as the 1840s. The artifact assemblage will reflect the transition between the prosperous mission years and the declining years of secularization into the later years of the American period and stabilization of the frontier.

Data Requirements

- Temporally discrete components securely dated to the period between 1834 and 1862;
- Stratigraphic integrity of soil layers and features dating to this period of use;
- Discrete archaeological features or sufficient quantities of artifacts to allow for analysis and interpretation of post-secularization site use;
- Extant structural remains altered for post–Mission period site use; and
- Food refuse, botanical remains, and faunal remains reflecting American period site use versus Hispanic or Native American use.

CHAPTER 4: METHODS

Laura E. Hoffman, Kim Owens, and John Dietler

The purpose of archaeological data recovery is to provide information on human and natural processes at sites that can be interpreted in an anthropological framework. Archaeological methods employed in data recovery are designed to collect data that are relevant to the specific questions posed in the archaeological research design (see Chapter 3: Research Design) and that reveal the nature of the archaeological resource.

This chapter presents the methods and procedures used for field excavations, general laboratory analysis, and public outreach for the San Gabriel Trench Archaeological Project. The chapter also discusses the steps taken to ensure the long-term preservation of Chapman's Millrace through its relocation and restoration. Specific methods used for certain features are described in the feature description section of this report (Chapter 6). Methods for particular analyses, such as those for ceramics or faunal remains, are presented in specific analytical chapters (Chapters 7–10).

Field Methods

This section outlines the techniques used in the field for organizing incoming data, preparing the site for excavation, remote sensing, site mapping, surface collecting, monitoring, excavating, backfilling, geoarchaeology, aerial photography, laser scanning, and collecting special samples. It also describes the coordination between archaeologists and Native American monitors. The methods employed during data recovery fieldwork were designed to identify and document the natural processes and disturbances that have contributed to site formation; the spatial relationships (horizontal and vertical) among artifacts, natural features, cultural features, and disturbances; and, ultimately, the cultural activities that took place at the site.

Provenience Designation System

To effectively record the complex suite of information, particularly the spatial relationships among site elements that are disrupted during the process of archaeological excavation, SWCA used a provenience designation (PD) system that synthesizes spatial data recorded in the field into a series of consecutive numbers. This comprehensive, sequential numbering system integrates all spatial units and recovery activities for the site.

SWCA assigned a unique PD number to every unit of space associated with the excavation, including hand excavation units, features, profiles, datums, mechanical excavations, point-provenienced artifacts, and surface collections. The SWCA team maintained a provenience log of the basic characteristics of all spatial data. The PD numbers followed their respective data throughout the project, acting as an inventory tool and integrating with the project database.

Each PD number was assigned two descriptors: a provenience type and a retrieval method. Provenience type indicates the type of space the data occupied, such as excavation units, features, point-provenienced artifacts, and datums (Table 4.1). Retrieval method refers to the way in which the particular spatial unit was processed, including dry screened, mapped with a total station, or mapped with a global positioning system (GPS) unit (Table 4.2).

SWCA implemented the PD system at the start of Phase III excavations, beginning with PD 1001 and increasing in value. The SWCA team assigned additional, sequential numbers to excavation units, augers, datums, and features in the field. We assigned excavation unit numbers sequentially beginning with 101, augers beginning with 1, datums beginning with 1, and features beginning with 1, all increasing in value from the first number. For data recovered during earlier phases (Phase I, Extended Phase I, and Phase II), we retroactively assigned PD numbers sequentially beginning with 1. For the sake of expediency, only proveniences from Phase I, Extended Phase I, and Phase II that yielded artifacts were assigned a PD number.

Site Preparation

In the initial field stage of the Phase III study, the SWCA team prepared the portion of the study area south of the Union Pacific Railroad for data recovery excavations by clearing vegetation, including a hedge of oleander bushes, coast live oak trees, and palm trees, and removing disturbed strata. The vegetation was cut to grade level with roots left in place in order to leave any underlying archaeological deposits undisturbed. Earlier phases of the project indicated that the upper 50–80 cm of the site contains a mixture of Mission period and later materials (Dietler et al. 2009:64–66; Ramirez et al. 2009:23–25), likely as a result of the creation

Table 4.1. Provenience Types

Provenience Type Code	Provenience Type Name	Description
AUG	Auger	A unit excavated by hand with an auger.
DATUM	Datum	A site, unit, or other type of datum or sub-datum.
EU	Excavation unit	An arbitrarily defined unit excavated in natural or arbitrary levels used to explore cultural and natural deposits and control artifact samples.
FEAT	Feature	A natural or human-made modification of the landscape, usually with discrete and discernible limits. This provenience type is used in two ways: 1) when the unit of excavation is defined by the natural boundaries of the feature, and 2) when originating a feature.
HTR	Hand trench	A long, arbitrarily defined, hand-excavated unit.
MSU	Mechanical stripping unit	A mechanically excavated unit used to strip large areas.
MTR	Mechanical trench	A long, arbitrarily defined and mechanically excavated unit.
OTH	Other	Any unit that does not fit into another category.
PP	Point provenience	A point-located artifact, sample, or observation; the associated retrieval method should be method used to map the location of the artifact: GPS, MTP, or MTS (see Table 4.2).
SITE	Site	This provenience type is used in two ways: 1) to define the site as a whole and to define artifacts that cannot be point-located or attributed to a specific feature or arbitrary unit, and 2) to record the site boundaries.
STP	Shovel test pit	A small unit excavated with a shovel used to define subsurface deposits, often without precise depth control and with approximate dimensions.
UNH	Undefined hand excavation	A hand-excavated unit with poorly defined, often irregular boundaries.
UNM	Undefined mechanical excavation	A mechanically excavated unit with poorly defined, often irregular boundaries.

and maintenance of the railroad grade. To maximize the efficient, controlled recovery of undisturbed Mission period deposits and to provide a level surface for remote sensing (see the Remote Sensing section below), the SWCA team removed the top 50 cm of sediment with a mechanical excavator (Figure 4.1). To prevent damage to two known features, the mechanical site clearance avoided the westernmost portion of the study area, which contained what was then identified as the mission garden wall and later defined as Area 1 (see Chapter 5: Site Overview), as well as a 5-m buffer around the known and anticipated locations of Chapman's Mill and Millrace, later defined as Area 2. The team also created ramps for equipment to enter the site and installed the viewing platform and pole-mounted webcam for the public outreach program. SWCA archaeologists monitored all ground-disturbing activities during site preparation, and identified one previously unidentified feature, Feature 5.

Remote Sensing

A remote sensing study was conducted after the site was cleared and before full-scale excavations began. The intent of the remote sensing was to identify unknown subsurface archaeological features and buried components of known features identified through surface expressions (e.g., the millrace) and previous excavation (e.g., cobble wall foundations).

Table 4.2. Retrieval Methods

Retrieval Method Code	Retrieval Method Name	Description
ALL	All	The entire excavated space was collected and returned to the laboratory.
BOUND	Boundary	The number assigned to a site or locus boundary.
DS4	Dry-screened through ¼-inch screen	Sediment from the provenience was passed through ¼-inch wire mesh to separate out artifacts larger than ¼ inch.
DS8	Dry-screened through 1/8-inch screen	Sediment from the provenience was dry-screened through 1/8-inch wire mesh to separate out artifacts larger than 1/8 inch.
DS16	Dry-screened through 1/16-inch screen	Sediment from the provenience was passed through 1/16-inch wire mesh to separate out artifacts larger than 1/16 inch.
FEATO	Feature origination	The initial number that was given to a newly discovered feature.
FLT	Flotation	Sediment was collected to be processed by flotation to capture artifacts and ecofacts of extremely small size for special analysis.
GPS	Mapped with GPS	The provenience locations were mapped with a mapping-grade, hand-held GPS unit.
MTP	Mapped with tape	The provenience locations were mapped by hand with a measuring tape.
MTS	Mapped with total station	The provenience locations were mapped with a total station.
NPP	Non–point provenienced	A given space from which materials were recovered without their locations formally mapped; the associated provenience type should be the type of unit from which the materials were collected: for example, HTR, MSU, MTR, or SITE.
PROF	Profile	The sidewall of an excavated area showing stratigraphy.
UNITO	Unit origination	The initial number that was given to any newly initiated excavation area, including EUs, STPs, HTRs, MSUs, and AUG (see Table 4.1).
XNS	Excavated, no sample recovered	No attempt was made to make artifact or sample collections from the provenience via screening or any other method.

Caltrans offered the services of remote sensing specialist Billy Silva, who conducted a geophysical survey through the use of ground-penetrating radar (GPR). Magnetic data collection was attempted but quickly abandoned because of external interference from surrounding structures.

GPR uses radar pulses to detect variations in a subsurface structure. The raw data signal returned by the machine is processed and displayed in ways that allow the operator to identify anomalies that may represent areas of potential interest to archaeological investigation, such as those containing buried features or disturbances. The particular methods used for data capture and signal processing produced a continuous profile and plan view image of the radar signal. The result was a composite color image of variations in subsurface properties at a range of depths.

The GPR survey area included survey grids across an area measuring 2,825 m² (Figure 4.2). Two grids were located within the study area on the south side of the Union Pacific Railroad tracks. These grids were placed adjacent to one another and form a continuous east-west-trending irregular rectangular area measuring approximately 104 m long and 5–8 m wide, with a total area of 467 m². Survey transects within the southernmost portions of the study area were excluded from the remote sensing study due to excessive slope. Additional grids were surveyed within the Plaza Park in front of the San Gabriel Mission to look for additional segments of the millrace and to look for an area suitable to receive the relocated millrace segment from the study area (see Millrace Relocation section below).

The results of the GPR survey within the Union Pacific Railroad right-of-way were used to assist in the selection of specific targets for excavation within the data recovery area. The GPR data collected within the Plaza Park were used to look for additional segments of Chapman's Millrace and to identify areas in the park where the millrace segment from

Figure 4.1. Removal of upper sediment with mechanical excavator, view facing east.

the study area could be relocated without impacting other archaeological features. Additional details about to the methods and results of the remote sensing study are found in Appendix A: Geophysical Survey Report for the San Gabriel Mission.

Mapping

Two- and three-dimensional spatial information was collected from multiple sources, including those from previous phases of work, project-provided survey data, and archaeological data recovery.

Prior to excavation, a Trimble® GeoXT™ GPS unit (installed with Esri® ArcPad™ version 10.1 integrated with the Trimble® GPScorrect™ extension used for post-processing differential allowing for sub-meter accuracy) was used to record the locations of surface artifacts and non-

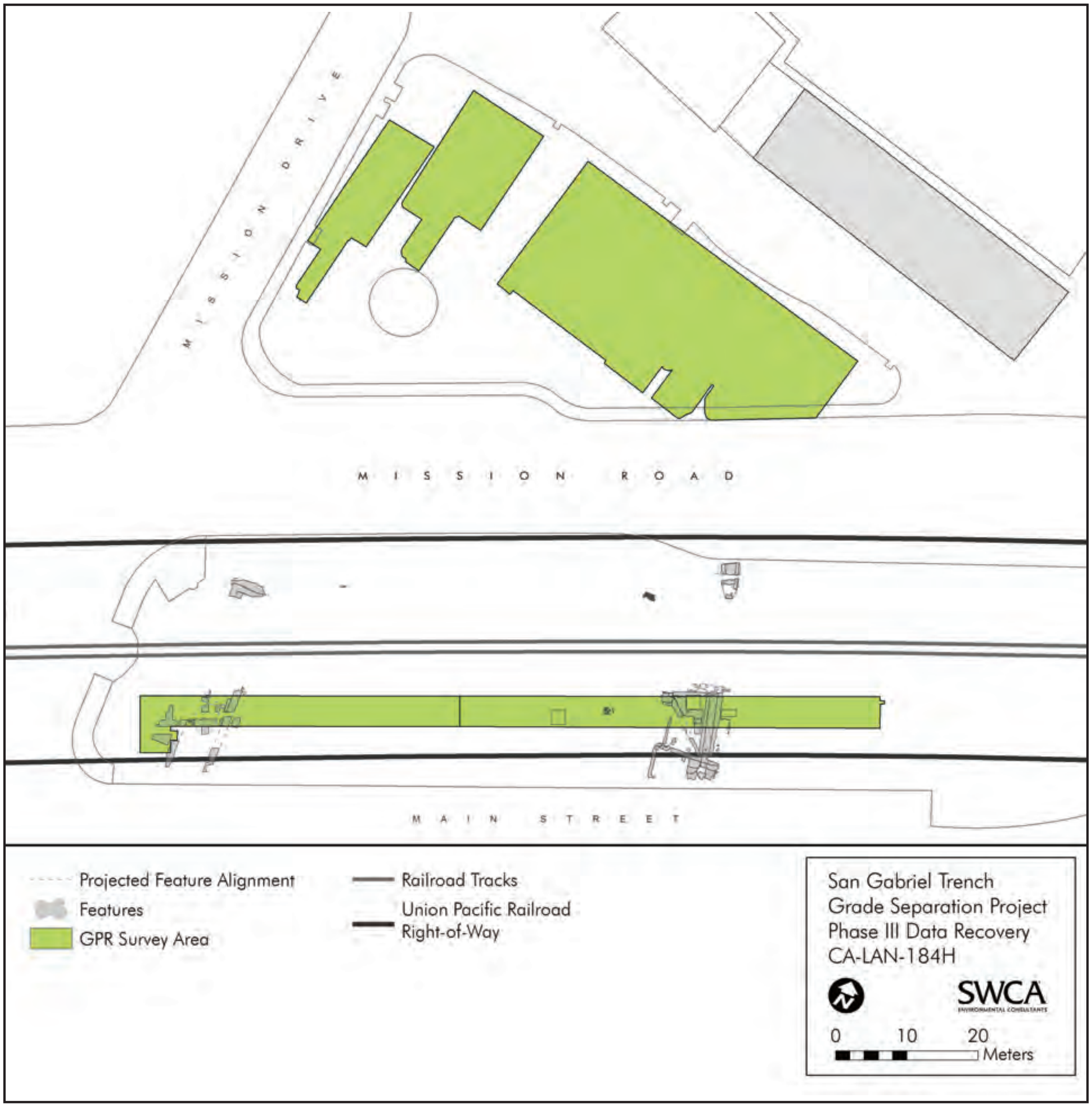

Figure 4.2. Ground-penetrating radar survey areas.

archaeological features. A Leica Geosystems® TC407 Electronic total station was the primary instrument used for recording spatial data during archaeological excavations. The total station was fitted with a Spectra Precision Recon® 400X data collector installed with the Tripod Data Systems® Survey Pro TSX v4.6.0.

Spatial information from all sources was brought into a geographic information system (GIS) for processing, analysis, and mapping. Esri®'s ArcGIS™ version 10.0 and 10.1 software package was the primary GIS platform used for data management, analysis, and map production. After post-processing, the GPS data were projected according to the Universal Transverse Mercator (UTM) coordinate system referenced to the North American Datum of 1983 (NAD83) (Zone 11).

For the Phase III data recovery SWCA established a geographic coordinate system that included a series of mapping datums for defining the provenience of individual artifacts and excavation units. A new primary mapping datum (Datum 2) was established east of Area 2 on the south side of the Union Pacific Railroad tracks, replacing Datum 1, which had been used during previous phases. Datum 2 was assigned the arbitrary coordinates 1000 North, 1000 East, and the new grid was aligned with the streets and railroad tracks. The grid's north orientation with respect to the UTM coordinate system measures 111.298 degrees west of north. The total station was then used to establish elevation control points and additional datums across the site (Table 4.3). A laser level was set up at each datum to maintain vertical control during hand excavations.

Surface Collection and Monitoring

During the Phase I and Extended Phase I studies, SWCA conducted systematic surface collections (Ramirez and Dietler 2009; Ramirez et al. 2009). SWCA resurveyed the surface of the locations of major Phase III excavations after site clearing and before removal of the top 50 cm of sediment. For each artifact found during this survey, its type and location were recorded.

SWCA monitored ground disturbances associated with the preparation of the site for the Phase III data recovery and the public outreach program. This included installation of infrastructure such as fencing, viewing platform and handicap access ramp; and mechanical excavations such as stripping and grading. These activities took place in areas of the site with less archaeological sensitivity, based upon Extended Phase I and Phase

Table 4.3. Datum Point Proveniences

Point	PD Number	Grid Northing	Grid Easting	UTM Northing*	UTM Easting*	Elevation (m above mean sea level)
Datum 1	7577	1017.86	979.74	3773370.91	397876.38	130.13
Datum 2	7578	1000.00	1000.00	3773361.63	397901.75	129.76
Datum 3	7579	992.15	996.72	3773355.72	397895.63	130.23
Datum 6	7580	924.10	997.44	3773331.63	397831.98	130.31
Datum 7	7581	996.77	1018.53	3773377.71	397892.00	130.22
Datum 8	7582	986.97	1012.83	3773368.86	397884.88	130.24
Datum 9	7583	929.31	1012.90	3773347.93	397831.21	130.23
Datum 10	7584	950.72	1013.03	3773355.84	397851.10	130.23
Datum 11	7585	944.17	1013.03	3773353.46	397845.00	130.23
Datum 12	7586	957.08	995.82	3773342.12	397863.29	129.78
Datum 20	7582	998.96	1004.50	3773360.59	397906.31	128.35

* NAD 83, Zone 11N

II results. In addition, an archaeological monitor was present for all post-data recovery backfilling and compaction work. Monitors observed all such non-archaeological excavation and earth-moving activities, halting work when potentially significant archaeological materials were observed and conducting further investigation through controlled excavation, if warranted.

Excavation

After preparing the site, conducting remote sensing, and establishing the grid, the SWCA team employed hand and mechanical excavation to expose archaeological features and recover artifacts. In general, mechanical excavation was used to investigate large areas of the site to expediently identify and partially expose archaeological features. Features and a sample of the midden were hand excavated to gather data from controlled contexts with precise provenience information. During Phase II, the portion of the study area south of the Union Pacific Railroad tracks, east of Ramona Street, and west of Mission Drive was identified as the richest and most intact portion, and this area is referred to as the site core (Figure 4.3). The excavation target established in the data recovery proposal (Dietler and Hoffman 2011:58) was a 5 percent sample of the site core. This total sample size was chosen to generate a defensible and adequately sized sample of the richest and most intact part of the site in the project area, based on available information.

The team excavated 278.3 m² of the 3,009-m² site core in the course of Extended Phase I, Phase II, and Phase III. The 5-percent excavation target established in the project data recovery proposal was exceeded through hand excavation alone, which represented 6 percent of the site core. When mechanical excavation is included, 9.2 percent of the site core was excavated. Across the study area, a total of 210.9 m^2 of hand excavation was conducted in the course of Extend Phase I, Phase II, and Phase III, and 159.9 m^2 of mechanical excavation was conducted as part of Phase III. The amount of effort devoted to the various types of excavation within the study area is listed in Table 4.4.

The areas selected for excavation initially focused on Area 1 and Area 2 within the site core (see Figures 1.4 and 4.3), which contained known architectural features. As the excavation progressed, SWCA found that each of these areas contained many interconnected features, both architectural and non-architectural, and a considerable amount of excavation was conducted to expose enough of these features to characterize them. Because one of the goals of the project was to remove the southernmost segment of Chapman's Millrace, located in the center of Area 2, from the path of construction to facilitate its long-term preservation, that feature was completely exposed with hand-excavated units. To explore the large portion of the study area between Area 1 and Area 2, SWCA excavated long mechanical trenches both north and south of the tracks. These trenches exposed additional features, which were excavated by hand.

Table 4.4. Excavation Totals for All Phases

Phase and Excavation Type	Count	Square Meters
Extended Phase I		2.4
Hand trench	*1*	*0.7*
Shovel test pit	*23*	*1.6*
Phase II		42.0
Excavation unit	*8*	*7.9*
Hand trench	*2*	*33.3*
Shovel test pit	*11*	*0.8*
Phase III		326.5
Column sample	*9*	*0.4*
*Excavation unit**	*169*	*142.7*
Hand trench	*12*	*17.6*
Mechanical stripping unit	*2*	*25.6*
Mechanical trench segments	*19*	*134.3*
Undefined hand excavation	*2*	*6.0*
Total		**370.9**

* Four column samples were taken from within excavation units and are excluded in those surface area totals in this row to avoid double counting.

The team documented all excavations using digital photography and on standard archaeological field forms, including unit level, feature, photograph, column sample, auger, and monitoring records, as well as the PD log, a field bag inventory, and a non-collected artifact inventory.

Hand Excavation

The SWCA team used four approaches to hand excavations: 1) excavation units oriented to the grid, 2) hand trenches, 3) auger holes, and 4) undefined hand excavations. Shovels, trowels, breaker bars, picks, and other hand tools were used. Most units were dug in arbitrary 10-cm levels except where it was possible to dig stratigraphically. If the upper sediment was determined to be a disturbed context, the upper 20 cm was removed as one level.

With a few notable exceptions, all hand-excavated sediment was dry-screened through 1/8-inch mesh. After recovering an unusually dense concentration of beads from Excavation Unit (EU) 151, SWCA screened sediments from two levels each from EU 151 and adjacent EU 152 through 1/16-inch mesh. In addition, SWCA screened 32 levels from 12 1 × 1–m excavation units through ¼-inch mesh, five levels from two 1 × 0.50–m excavation units, one aggregate level from six 1 × 1–m excavation units, and seven levels from six hand trenches of various sizes. The larger screen size was selected in these cases because either the upper sediment had been identified as a disturbed context or a representative sample of sediment had already been screened through 1/8-inch mesh and later data recovery efforts were concentrated on exposing features.

Excavation Units

The SWCA team placed excavation units to 1) expose archaeological features, 2) maximize the recovery of Mission period artifacts from areas likely to yield the greatest subsurface artifact density with the least post-depositional disturbance, and 3) recover data from all accessible portions of the site. In general, excavations took place in 2 × 2–m excavation blocks divided into 1 × 1–m units. Initially, the 2 × 2–m blocks were positioned adjacent to the most productive and intact excavation units from the Phase II study,

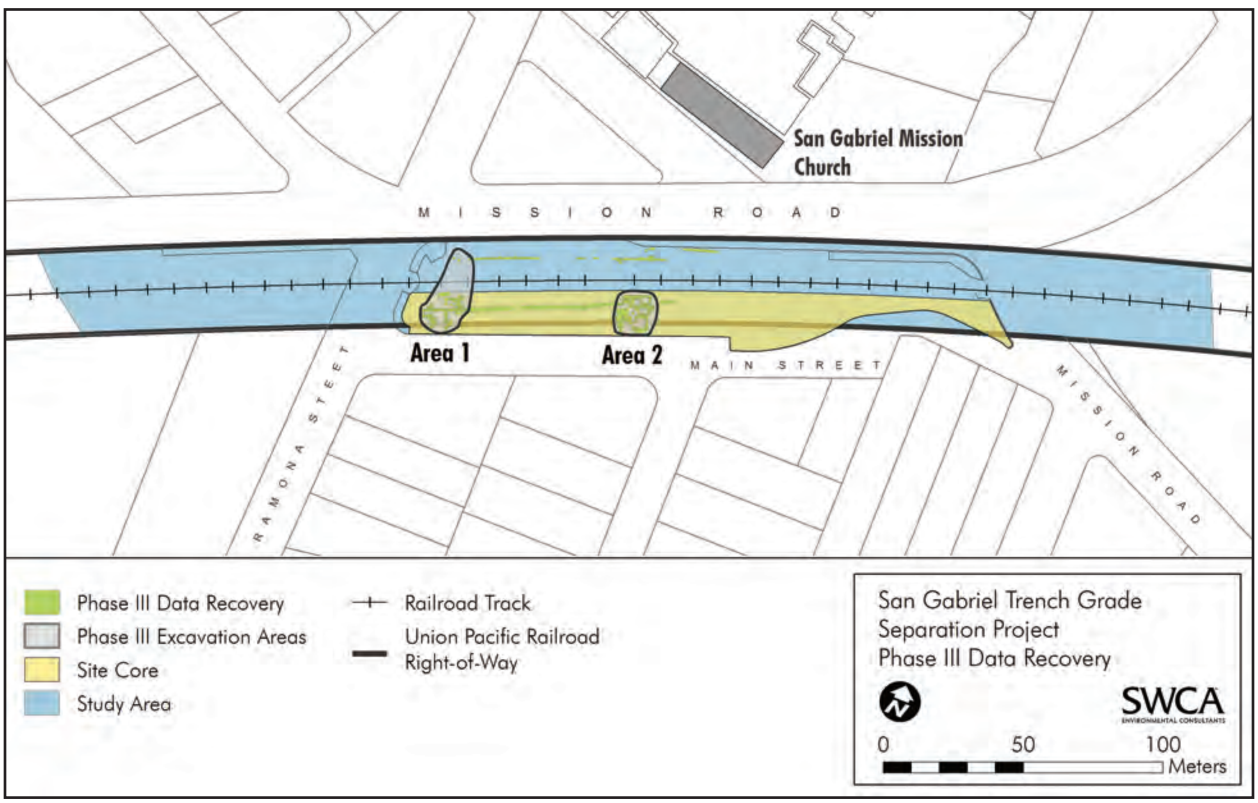

Figure 4.3. Site core in relation to study area.

at the location of Chapman's Millrace (Area 2), at the location of what had been previously identified as the garden wall (Area 1), and at the location of potential features identified during site preparation. As data recovery progressed, additional 2 × 2–m blocks were added and appended to existing blocks with additional 1 × 1–m units or other types of hand excavation units as necessary to expose features and reveal meaningful artifact groupings to address the research questions posed in Chapter 3.

Hand Trenches, Auger Holes, and Undefined Hand Excavations

In addition to excavation units, SWCA used hand trenches, auger holes, and undefined hand excavations. Hand trenches varied in size but were longer than they were wide, and were most often used to expose the limits of architectural features, including Features 1, 2, 20, 21, and 31. To investigate the possibility of deeply buried cultural deposits, auger holes were excavated in a sample of excavation units after culturally sterile sediment had been reached. Undefined hand excavations were used to identify intrusive infrastructure such as utility lines, but they were also occasionally used to identify the horizontal limits of a feature, including Features 2 and 3.

Mechanical Excavation

Mechanical excavation was used to expose, identify, and evaluate subsurface cultural materials in some portions of the site, and to examine site stratigraphy. A mini-excavator with a 24-inch-wide bucket dug several trenches and areas that were labelled as undefined mechanical excavations (UNMs). Two long trenches paralleling the Union Pacific Railroad tracks on the north and south were excavated to expose a complete stratigraphic cross section of the site. SWCA archaeologists directed the mechanical excavations, collected diagnostic artifacts, and demarcated potential features for later investigation by hand.

Collection Protocols

Because a focus of data recovery was the identification and assessment of intact Mission period contexts, SWCA followed a policy of limited artifact collection for surface collection and monitoring of disturbed deposits. The following items were collected during surface collection and monitoring: Mission period and Secularization period pottery, diagnostic glass, ground stone, and uncommon artifacts such as coins, jewelry, tools, beads, and projectile points. SWCA did not collect ubiquitous and American period artifacts, including faunal bone, building materials such as bricks and tiles, non-diagnostic glass and metal, and twentieth-century or twenty-first-century refuse.

In the field, SWCA sorted artifacts and ecofacts into four basic categories: 1) fauna, which consisted of bone and shell; 2) charcoal; 3) other, which consisted of all other artifact types, including all ceramic, glass, and metal; and 4) building materials, which consisted of *ladrillos* (bricks), *tejas* (roof tiles), *caños* (pipe segments), miscellaneous other tiles, unidentifiable earthen building materials, rocks, concrete, mortar, and asphaltum. A qualified osteologist or faunal analyst inspected all bone on site to ensure that it was faunal bone and not human.

Identifiable Mission period building materials were sorted in the field by type (teja, caño, or ladrillo) and weighed. Because of their limited data potential and the expense of long-term curation, nearly all building materials were stockpiled on site for potential donation to educational institutions and were listed as "discarded" in the database to indicate they were never transferred to the laboratory. SWCA collected examples of select complete or nearly complete building materials, including ladrillos, tejas, and caños, as well as samples of other building materials such as asphaltum. Modern materials clearly less than 50 years old—for example, coins, plastic, and aluminum—were similarly noted in the catalog and discarded.

Collected artifacts were placed in 2-mil reclosable plastic bags and labeled in permanent marker with the provenience designation number, date, excavator initials, unit, and depth. A field bag inventory was kept daily by the screening crew. Artifacts were transported daily to the SWCA laboratory.

Geoarchaeology

At the conclusion of major excavation efforts, SWCA geoarchaeologist Mary Ann Vicari described the site stratigraphy. These investigations focused on the three mechanical trenches, MTR1, MTR2, and MTR3 (Figures 4.4 and 4.5). The sidewalls of each trench were visually examined for stratigraphy in order to gain an overall understanding of subsurface deposits. Much of the site had been subjected to considerable modern and historical disturbance of native soils, which were observed to be intact only in discrete locations of the site. Portions of the trenches containing intact stratigraphy or historic features, or both, were selected for profiling of subsurface deposits: MTR 1 section 1, MTR 1 section 2, MTR 1 section 3, and MTR 3 sections 1 and 2 (see Figures 4.4 and 4.5).

Trench walls were cleaned using trowels to create a planar surface and sprayed with water to highlight stratigraphic changes. An arbitrary datum line was created using a laser level in each profile location to establish vertical control over site stratigraphy. This datum height was then correlated with elevations above mean sea level using the known site datum. Profiling consisted of the mapping of all observable depositional and soil stratigraphy, all historical artifacts and features, and any natural inclusions. Profiles were accompanied by descriptions of individual strata following Natural Resources Conservation Service guidelines (Schoeneberger et al. 2002), which included notes on soil color, texture, structure, presence of inclusions, redoximorphic features, organics, bedding, boundaries, and soil horizon designations. Individual strata designations were assigned on the basis of geologic, pedogenic, and cultural characteristics. Descriptions also included field interpretations of site depositional settings, facies changes, soils indicators, and anthropogenic disturbances. Profiled areas were photographed in shade.

Aerial Photographs

After excavation, SWCA engaged Southland Aerial Photography to document site features using low-elevation aerial photography. The team mounted a digital camera beneath a 5-foot-diameter helium balloon and directed it to locations several hundred feet above the site using guide ropes. Using an infrared remote control, the ground-based camera operator took vertical and oblique photographs of the site's major architectural features.

Laser Scans

Laser scanning was conducted by the Mollenhauer Group to provide millimeter-accurate mapping of key areas. The three-dimensional (3D) laser scanner is a semi-automated machine mounted on a tripod that generates a raw point cloud—a series of points with defined x, y, and z coordinates and their optical red, green, and blue (RGB) color values. The operator chooses a series of locations surrounding the area selected for scanning. Several locations surrounding the mapping area are required in order to ensure that all surfaces have been recorded, and to reduce the number of data "shadows" that would result in blank areas on a map. SWCA selected four excavation blocks for scanning based on the presence of significant features: Area 1, Area 2, the cobble wall (Feature 36), and the northern millrace segment and cobble wall (Feature 34). Once the 3D laser scanning was completed, the Mollenhauer Group processed the raw point cloud in order to provide SWCA with geo-referenced polygons and polylines used in analysis and map production.

Special Sample Collection

SWCA collected samples from several contexts for special analysis following the methodology provided by the Paleo Research Institute (Cummings 2000, 2007). To identify macrofloral remains and small artifacts, SWCA collected 13 column samples from the sidewalls of excavation units. Each column sample measured 20 × 20 cm horizontally and contained multiple levels,

Figure 4.4. Area 1 excavation overview.

Figure 4.5. Area 2 excavation overview.

including unit levels and stratigraphic levels, with breaks every 10 cm or less. Therefore, if a stratigraphic break occurred within an arbitrary 10-cm level, a separate sample was taken within the level for each stratum.

Samples of feature fill, or "grab samples," were collected for flotation. Grab samples were non-uniform in size and were collected to ensure that at least a portion of a given feature was collected for flotation, in case it was not possible to collect feature fill from a column sample after the unit was terminated. In addition, several ground stone and flaked stone artifacts were collected from in situ contexts with associated sediment samples for residue analysis, as were several samples for pollen analysis. Samples for residue and pollen analysis were collected using a clean trowel rinsed with distilled water and were immediately placed in reclosable bags. Two control samples were collected for comparison during pollen analysis.

Native American Coordination and Human Remains Treatment

Gabrieleno/Tongva Tribal Consultants provided monitoring services for all archaeological fieldwork. The firm is affiliated with the Gabrieleno/Tongva Tribal Council of San Gabriel (also known as the Gabrieleno/Tongva Band of Mission Indians), which was designated in the memorandum of agreement as the project's preferred source of Native American monitors. SWCA coordinated with Tribal Chairman Anthony Morales throughout the data recovery excavations. Mr. Morales provided valuable input regarding the identification and treatment of Native American materials.

SWCA developed a project-specific protocol for any unanticipated discoveries of human remains made during the course of the project in compliance with state law (Section 7050.5 of the California Health and Safety Code and Section 5097.98 of the Public Resources Code) and in accordance with the project's treatment plan. This protocol was developed in consultation with the Alameda Corridor–East Construction Authority (ACE), Caltrans, the Los Angeles County Department of Coroner, the California Native American Heritage Commission (NAHC), the NAHC-designated Most Likely Descendant (MLD) for the project, and the San Gabriel Mission Parish.

The SWCA team discovered isolated human remains on two occasions. At the time of the first discovery, SWCA notified the Los Angeles County Department of Coroner. Forensic Anthropologist Dr. Elizabeth Miller came to the site and made a positive identification, assigning it case number 2012-01655. Dr. Miller concurred with the determination made by SWCA's human osteologist and found the bone to be not modern and "most likely of Native American origin" (Los Angeles County Department of Coroner 2012). Following this determination, the NAHC designated the Gabrieleno/Tongva Band of Mission Indians as the MLD for the project. At the direction of the MLD, SWCA held the recovered human remains, including the second isolated discovery, in a secure location at SWCA's Pasadena, California, office until reburial could take place. SWCA osteologist Sam Murray took standard osteological measurements of the bones using digital calipers and made nonmetric observations.

After coordinating with all relevant parties, and after following the steps outlined in the treatment plan and human remains protocol, SWCA continued with planned excavations at the locations of the two discoveries. In both cases, the human remains were discovered in a secondary context in a layer of disturbed construction fill that was unlikely to contain additional remains or associated burial objects. To ensure that any additional small bone fragments would be recovered, the archaeologists switched from using a ¼-inch dry screen to a ⅛-inch dry screen.

At the direction of the MLD, and with the permission and participation of the San Gabriel Mission Parish, both of the human bones were reburied in April 2012 in the San Gabriel Mission Church Cemetery (established ca. 1803). This ceremony, marked by traditional Gabrielino and Catholic blessings, represented the first burial of Native Americans in this cemetery in more than 60 years.

Laboratory Methods

The laboratory methods presented below were designed to clean, sort, catalog, and analyze materials recovered during excavation so the data they contain could be used to address the questions posed in the research design (see Chapter 3). The methods also outline strategies to organize and prepare the collected data and specimens for curation.

Laboratory analysis was conducted from December 2011 through December 2013 in SWCA's Pasadena, California, laboratory facility. The facility is climate controlled and has an appropriate set-up for processing and storing collections. Laboratory conditions were monitored daily to ensure the optimal environment for the collection. Prior to excavation, laboratory policies and procedures were put into place to establish efficient and safe protocols for artifact processing. The laboratory work focused on creating a basic analysis of all artifacts encountered at the site, a detailed analysis of a sample of artifacts, and preparation of artifacts for curation. Under the supervision of Collections Manager Kim Owens, laboratory technicians and interns cleaned, sorted, and cataloged the collections.

Incoming artifacts were checked against the field inventory and stabilized by opening the field bags to prevent damage from increased relative humidity and mold growth. Diagnostic or fragile items were given priority for immediate cleaning and cataloging. This "fast track" method allowed easy tracking for artifacts significant to dating stratum and immediate stabilization for delicate artifacts, thus preventing additional deterioration caused by environmental changes.

Cleaning

Prior to cleaning, laboratory technicians emptied the bags of artifacts over 1/8-inch mesh to remove loose sediment that fell off artifacts during the course of drying. From the screen, the artifacts were then sorted onto plastic trays by material type. Cleaning strategies were modeled on those developed by the Society for Historical Archaeology (2007). Procedures for most collected materials included cleaning in dry and wet environments. Instruments used included soft-bristled paintbrushes, soft toothbrushes, wire brushes, wood picks, and metal dental picks. Items that were determined to be too vulnerable to damage were not cleaned.

High-fired glazed ceramic, glass, ground stone, and lithic artifacts were washed in tap water and lightly brushed with a soft-bristled toothbrush to remove sediment. Laboratory technicians examined each fragment before cleaning to identify and avoid damaging fragile elements (e.g., applied color labels, decals, or residue). Lithic and ground stone artifacts selected for special analysis, such as protein residue analysis, phytolith analysis, and Fourier Transform Infrared Spectroscopy (FTIR), were not cleaned because cleaning may have destroyed the residue needed for analysis.

Bone, metal, plastic (e.g., Bakelite), leather, and soft, unglazed, or low-fired pottery were lightly brushed with a soft-bristled paintbrush or medium-bristled toothbrush. Special care was taken in identifying weak points to avoid damage to the artifacts. A wire brush was used in cases of heavy corrosion on metal artifacts.

Fiber, charcoal, shell, wood, slag, coal, and botanical samples were not cleaned due to their fragile nature and potential for future analysis. Objects collected in foil packages, such as charcoal, were kept in their original packaging.

Identification and Cataloging

SWCA developed a customized database for the data recovery with a Microsoft Access front end and a PostgreSQL back end server to catalog artifacts and associated provenience data. Prior to entering artifact data, provenience and stratigraphic information was entered into the provenience table. This information was then linked to incoming artifact data via PD numbers. Data recorded in the provenience table includes PD number, provenience type, unit, feature, retrieval method, excavation date, beginning and ending depths below surface or datum, map datum, unit dimensions, coordinates and their location, and comments.

Basic Analysis

Cataloged items were assigned unique identifiers consisting of an accession number that was assigned by the Fowler Museum of Cultural History at the University of California, Los Angeles (UCLA), followed by the site trinomial and a sequential catalog number. All collected artifacts and ecofacts were cataloged as individual items or in lots (e.g., non-diagnostic glass of the same color and vessel form from the same provenience). The assigned catalog numbers represent data recorded at the basic analysis level. Data recorded at this level include provenience designation number, material, subtype, condition, color, description, count, and weight.

Categories of materials recovered from the study area include ceramics, glass, metal, fauna, botanical specimens, lithics, ground stone, earthenware building materials, other historic artifacts made of material such as fiber, leather, plastic, wood, and charcoal, and sediment samples. For artifact types that were determined to require detailed analysis, the database generated a sub-catalog number based on the quantity of fragments entered. Artifacts were then analyzed by sub-catalog number. Bulk lots of materials that were not subjected to additional analysis (e.g., non-diagnostic glass) were assigned the sub-catalog number regardless of quantity (Table 4.5).

Detailed Analysis

While a basic analysis was completed on all materials collected from data recovery, a detailed analysis was completed for certain analytical categories and for the complete contents of 15 excavation units thought to be representative of major site activity areas (Table 4.6). The areas represented are in the westernmost portion of the study area (Area 1), the area surrounding Chapman's Mill (Area 2), and general midden deposits located north and south of the railroad tracks that divide the site (see Figures 4.4 and 4.5 and Chapter 5: Site Overview). The units selected for detailed analysis contained roughly 20 percent (by count) of material recovered, and all artifacts and ecofacts from these selected units were analyzed (Figure 4.6).

Additionally, all lithic artifacts, beads, samples of building materials, complete bottles, and marine shells were subjected to detailed analysis, regardless of which unit they were collected from. These were selected for their high research value, and in some cases, small relative sample size.

For the purposes of dating features that were not included in the full detailed analysis sample, a detailed analysis of only the nonnative ceramics was completed for EUs 251, 252, 270, 271, and 283. All other items in these units with the exception of artifact types listed above were subjected to basic analysis.

Curation

Significant or diagnostic artifacts were prepared for eventual curation in accordance with Title 36 of the Code of Federal Regulations, Part 79, "Curation of Federally Owned and Administered Archeological Collections." All collected artifacts were indirectly labeled with tags printed on a Lexmark Forms printer and on acid-free cardstock. The labels and artifacts were housed in archival-quality, polyethylene, 4-mil, zip-top bags. Artifacts were organized by material type and catalog number. Small artifacts were housed in acid- and lignin-free storage trays inside acid-free boxes. Delicate artifacts were cushioned with a piece of volara foam cut to fit the size of the bag or box. Delicate artifacts particularly susceptible to rapid changes in temperature and relative humidity were monitored using humidicator tape. Oversized artifacts were housed in appropriately sized, acid-free boxes. Artifacts too large for a box or bag (e.g., complete caños) were indirectly labeled using cotton tying tape to tie the label securely on the artifact. SWCA has a curation agreement with the Fowler Museum of Cultural History at UCLA for this project, which will curate all significant and diagnostic artifacts. Not all collected materials will be curated at the Fowler Museum; see the Distribution of Cultural Materials section below.

Table 4.5. Analysis Categories and Cataloging Methods by Material Type

Material Type	Type	Cataloged in Lots	Cataloged by Item	Analysis
Ceramic	Nonnative	X		Basic*
	Native American	X		Basic*
Earthenware building material	Caño, sample	X		Detailed
	Caño, bulk	X		Basic
	Teja, sample	X		Detailed
	Teja, bulk	X		Basic
	Ladrillo, sample	X		Detailed
	Ladrillo, bulk	X		Basic
	Earthenware building material	X		Basic
Fauna	Faunal bone	X		Basic*
	Bone artifact		X	Basic*
	Shell	X		Detailed
	Shell artifact		X	Detailed
Glass	Diagnostic glass	X		Basic*
	Complete bottle	X		Detailed
	Glass bead	X		Detailed
	Bulk glass	X		Basic
Metal	Diagnostic metal	X		Basic*
	Can	X		Basic*
	Bulk metal	X		Basic
Non-artifact	Non-artifact	X		Basic
Other historic artifact	Other historic artifact	X		Basic*
	Mortar	X		Basic
Other precontact artifact	Other precontact artifact	X		Basic*
Stone	Battered stone		X	Detailed
	Chipped stone tool		X	Detailed
	Core		X	Detailed
	Debitage	X		Detailed
	Fire affected rock, sample	X		Basic
	Fire affected rock, bulk	X		Detailed
	Ground stone		X	Detailed
	Gun flint		X	Detailed
	Projectile point		X	Detailed
Unidentifiable	Unidentifiable	X		Basic

*A sample was subjected to detailed analysis.

Table 4.6. Units Selected for Detailed Analysis

Site Area	Feature Number	Units Selected for Detailed Analysis	Non-Native Ceramic Analysis Only	Macrofloral Analysis	Pollen Analysis
Area 1: Inside building		255 (North Room) 243 (South Room)		292*, 263*	
Area 1: Outside building	9, 13	165, 166 (West Floor) 121, 135 (East Floor)			164, 165 (under West Floor) 121, 247 (under East Floor)
Area 1: Refuse pit	14	149		258*	
Area 2: Below millrace		206			
Area 2: Brick feature fill	11	108		145*	
Area 2: Brick reservoir			251, 252		
Area 2: East of millrace	15	105			
Area 2: Stone reservoir fill	12, 31	137		104*	137 (under floor)
North Midden		269		291*	
South Midden		118, 273, 282			
Unidentified foundation	34		270, 271, 283		
Total		**15**	**5**	**6**	**5**

* Column sample unit

Public Outreach

SWCA and ACE implemented a public outreach program with several components to inform members of the public about the project and to educate interested parties on the significance of the cultural resources in the study area. These public outreach components included the following:

- The ACE website;
- Tours via the San Gabriel Trench Grade Separation Project Archaeological Excavation Guided Viewing Program;
- An informational brochure and sign at the excavation site;
- Media outreach;
- A symposium of scholarly papers presented at the Society for American Archaeology conference in April 2013;
- Distribution of cultural materials; and
- The relocation and display of Chapman's Millrace.

Website

The ACE website (http://www.theaceproject.org/sangabrieltrench.htm) was the primary source of information to the public during the project, and included a description of the railroad project and its impacts, as well as construction alerts. A wide-angle, low-resolution webcam focused on the excavations allowed the public to view the excavation project via the ACE website.

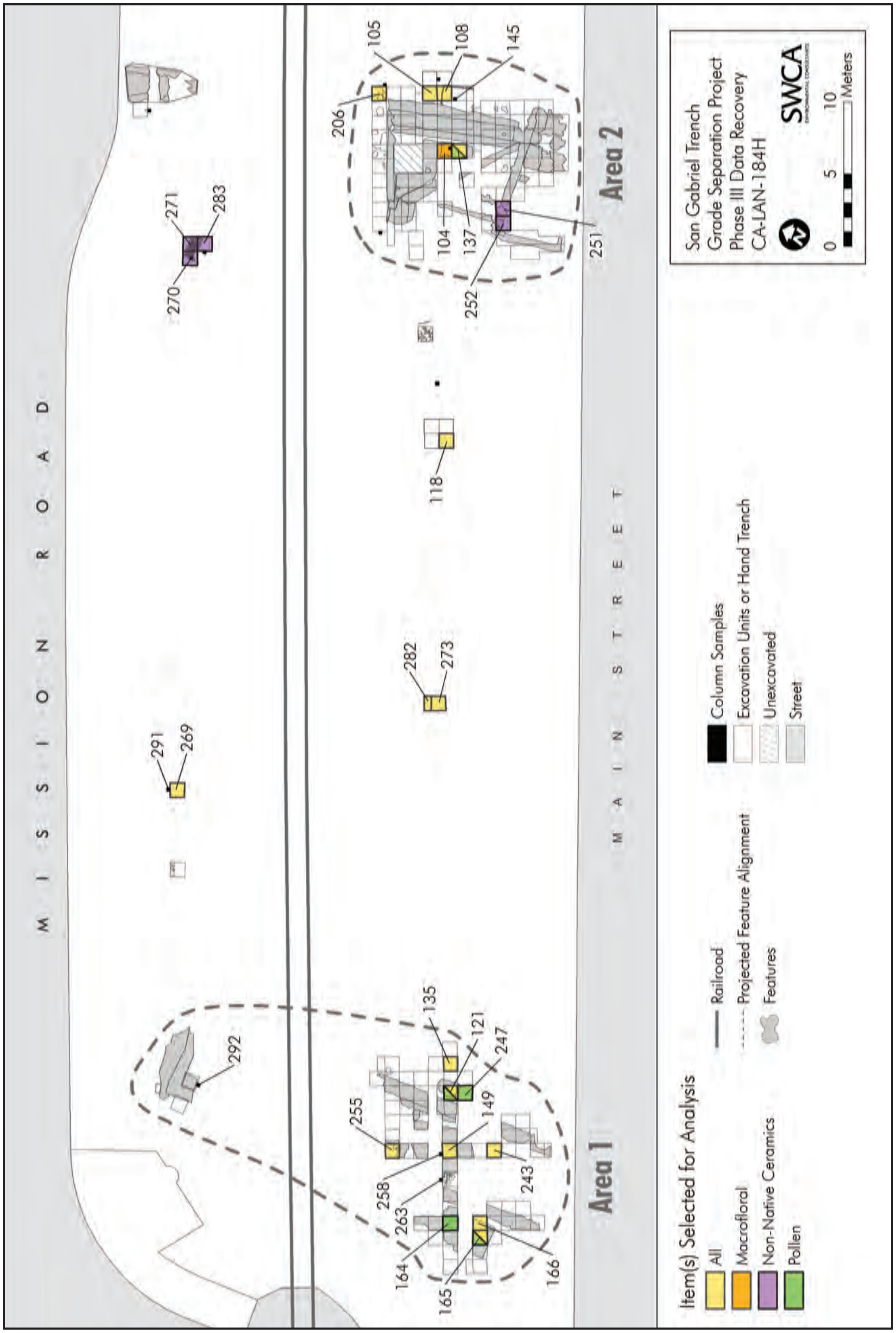

Figure 4.6. Units selected for detailed analysis.

The webcam footage could be replayed as a sequence of still images dating back to the start of the data recovery. The website also featured a page dedicated to the San Gabriel Trench Grade Separation Project Archaeological Excavation Guided Viewing Program, describing the program and providing contact information for interested parties such as school teachers. All information listed on the ACE website was available in English, Spanish, and Chinese.

Tours

The San Gabriel Trench Grade Separation Project Archaeological Excavation Guided Viewing Program was designed primarily for school children to view the archaeological excavation and learn about the site's history. The program consisted of an educational presentation provided on a viewing platform located in the Union Pacific Railroad right-of-way immediately adjacent to the excavation (Figure 4.7). Sylvia Novoa, an ACE representative, presented age-appropriate materials prepared by SWCA, and SWCA archaeologists were available to talk about the site and answer questions at the conclusion of the presentation. A show-and-tell box contained samples of artifacts found from the site, and visitors were able to view and handle ladrillos and tejas, cow bones, glass, ceramic artifacts, beads, and lithic artifacts. Andy Morales of the Gabrieleno/Tongva Band of Mission Indians of San Gabriel also participated in tours. More than 2,200 students visited the site over the course of three months. The tour was also opened to stakeholders and other interested parties, and more than 700 people, including Boy Scouts of America, members of the media, archaeologists, members of local Native American bands, members of historical societies, and representatives from city and state governments and agencies attended the tours.

Informational Brochure and Sign

A tri-fold brochure was made available for visitors to take home (Figure 4.8). The brochure gave a brief history of San Gabriel Mission, explained the science of archaeology, and featured the stories of three individuals who helped shape the history of the mission and who represent different perspectives of the mission system: Joseph Chapman, Father Zalvidea, and Toypurina (see Chapter 2: Site Context for more on these individuals). A digital copy of the brochure was available for download on the ACE website (http://www.theaceproject.org/sangabrieltrench.htm).

For members of the public unable to attend the guided viewing program, ACE and SWCA prepared an informational sign that was displayed on the fence surrounding the excavation (Figure 4.9). The sign briefly summarized the railroad project, explained the archaeological component of the project, and described the cultural resources present. The sign contained text in English, Spanish, and Chinese to reach as many members of the diverse community of the City of San Gabriel as possible.

Media Outreach

ACE acted as point of contact to local media outlets for project information. With the assistance of SWCA, ACE composed a press release that was distributed shortly after the initial cultural resources work had commenced. SWCA participated in a press conference and media day organized by ACE to help inform the public of the cultural resources work being done. The on-site media day, held February 2, 2012, was heavily attended by the local media. Segments of John Dietler's presentation were aired on KABC-TV 7 and University of Southern California's Annenberg TV News stations. The ACE project and SWCA's excavation were featured in 11 newspaper articles by the Los Angeles Times, KPCC-FM, NBC Los Angeles, Pasadena Star-News, San Gabriel Valley Tribune, and EFE news network. ACE and SWCA collaborated with the media by providing interviews, photograph opportunities, and in some cases, artifact photographs.

SWCA also participated in a televised interview by the local Charter Cable channel. Brad Pomerance hosted a half-hour, in-studio interview with Dr. Dietler and City of San Gabriel Councilmember David Gutierrez, and asked questions about the site, artifacts, and the ACE project.

Figure 4.7. SWCA archaeologist Ryan Glenn talking with students.

Figure 4.8. Informational brochure for the San Gabriel Mission Archaeological Excavation.

Figure 4.9. Informational sign displayed at the excavation site.

Presentations and Publications

Presentation of research results has included papers at state and national professional societies. For example, SWCA hosted a symposium at the Society for American Archaeology's 78th Annual Meeting in April 2013. The symposium, titled "The Archaeology of California's Mission Period: A View from the Los Angeles Area," featured six presentations discussing the findings from the excavations. Topics covered included Mission period archaeology, water use and management at San Gabriel Mission, public outreach, and analysis of faunal remains and ceramics from the site. SWCA made public presentations at local universities, historical societies, and elementary schools. Additionally, the magazine American Archaeology ran a two-page story on the project in the Spring 2012 edition (Neely 2012).

Distribution of Cultural Materials

At the close of the project, most cultural materials will be curated at the Fowler Museum of Cultural History at UCLA (see the Curation section above for more details). A large section of Chapman's Millrace was relocated to a nearby location for permanent display along with an interpretative sign explaining the history of the mill and its association with San Gabriel Mission (see the Chapman's Millrace Relocation section below).

Surplus examples of non-diagnostic artifacts (e.g., unmarked pottery and glass and unidentified metal artifacts) or bulky items (e.g., bricks and other building materials)—particularly those that date to the American period (1848–present)—have been offered to other entities such as local museums, schools, and other select interested parties, for public education purposes. Materials were offered to the Union Pacific Railroad Museum, the San Gabriel Arcángel Mission Museum, the San Gabriel Historical Association Museum, and the Ramona Museum. The San Gabriel Arcángel Mission Museum and the San Gabriel Historical Association Museum accepted donations of building materials, ceramic, metal, and glass artifacts. In addition, because of their excessive bulk and weight, their limited data potential, and the expense of long-term curation, surplus examples of building materials were offered to the institutions mentioned above, and unclaimed samples were deaccessioned.

Chapman's Millrace Relocation

The relocation of a portion of Chapman's Millrace was a large effort led by a multidisciplinary team of experts that included structural engineers, historic architects, architectural historians, and archaeologists, who worked in conjunction with heavy-moving professionals with experience relocating and rehabilitating unique historic structures.

The team began by preparing a feasibility analysis to determine whether the structure could be moved from its original location (the donor site) without irreparable damage and to identify a suitable place for its relocation, called the receiver site. The feasibility analysis concluded that a 20-foot segment of the structure could be relocated and that a location in Plaza Park about 300 feet northwest of the millrace segment's original location was the most ideal receiver site. The selected receiver site is directly in front of San Gabriel Mission Church and atop the millrace's historical alignment, making it historically compatible with its original location, sufficiently protected from potential vandalism, and visible and accessible to the public (SWCA 2012). The project team prepared preliminary design schematics showing how the millrace segment would look following restoration, with water running through the original channel set in an area landscaped with native plants and surrounded by a decomposed granite pathway.

Following approval of the selected relocation site by stakeholders, including ACE, the City of San Gabriel, and the San Gabriel Mission Church, work began to prepare the millrace for relocation. ICF International and SWCA prepared a Historic American Engineering Record (HAER) package for submittal to the Library of Congress (Appendix E). This package contains large-format photographs, artistic renderings of the mill and millrace, and scale drawings of the mill and millrace foundations based on the laser scans described above. SWCA archaeologists, accompanied by Native American monitors, used the GPR survey results and controlled excavation to ensure avoidance of significant archaeological features at the receiver site. The results of this monitoring will be reported in the forthcoming monitoring report for the project.

Mechanical excavation occurred at the donor site to fully expose the segment that was to be relocated, and at the receiver site to prepare for installation of the millrace. This work was monitored by archaeologists and Native American monitors. Construction and heavy-moving professionals excavated small, horizontal tunnels beneath the millrace structure and inserted steel beams for support. Once the steel beams were in place, the remaining soil under the structure was removed, leaving the millrace to be supported by the beams. Movers then used rock saws, hammers, and picks to separate the millrace segment from the mill foundation. They carefully lifted the structure with the beams, moved it laterally to avoid the intact mill foundations, attached wheels and axels to the underside, and drove it across the street to the receiver site. The millrace foundation, still supported by the steel beams, was placed into an excavated pit at Plaza Park and embedded in reinforced concrete.

Receiver site improvements included the restoration of the millrace walls to recreate the original historic height of the structure using salvaged stones from the data recovery excavation. Two concrete tanks, capped with flat bench lids, were constructed at the ends of the linear feature to house a simple plumbing system that runs water through the original channel. The water conveyance system was designed to be shallow and operate without chemicals, covering the channel with natural algae and recreating its historical appearance. The structure was landscaped with native plants and a decomposed granite pathway. A commemorative plaque, a small interpretive plaque, and a large interpretive sign were installed around the millrace to provide visitors with information about the history and significance of the feature (Figure 4.10).

Figure 4.10. A portion of Chapman's Millrace after relocation.

CHAPTER 5: SITE STRATIGRAPHY

Benjamin Vargas and Mary Ann Vicari

Introduction

This chapter presents the stratigraphy of the study area in order to document relative chronological sequencing within the site, identify site formation processes, and assess the origin, integrity, and stability of the deposits that compose the site. The chapter begins with a discussion of the site's natural stratigraphy followed by a discussion of the cultural stratigraphy. Stratigraphic interpretations are presented to provide context for the results of the data recovery excavation efforts and the analytical studies that follow in later chapters of this report.

Geology and Soils

The Los Angeles Basin formed during Miocene and Pliocene epochs due to subsidence caused by seismic activity (Fuis et al. 2001; Wright 1991; Yerkes et al. 1965). During much of the middle Miocene, a northwest-trending marine embayment covered the basin. Rivers that drained the highlands to the north and east deposited huge volumes of coarse-grained sandstone and sandy cobble-boulder conglomerate into the embayment. Deposition continued until the end of the Pliocene, when the rapidly rising Puente Hills, Santa Ana Mountains, and eastern Santa Monica Mountains caused the shoreline to retreat southward and westward (Yerkes et al. 1965).

The deposition of non-marine sediments occurred during the Quaternary period, and the study area is immediately underlain by relatively older and younger alluvium (Tan 1997). The older alluvium is Pleistocene in age (1.8 million years ago [Ma] to 10,000 years ago) and is composed of undivided and moderately to well-consolidated alluvial and fluvial deposits locally dominated by sand and gravel. Younger alluvium is Holocene in age (less than 10,000 years before present [B.P.] to recent) and is composed of undivided and unconsolidated gravel, sand, silt, and clay deposited in modern stream channels and fluvial slope wash. Within the project vicinity, the younger alluvium is predominantly composed of sand and is distinguished from older alluvium by its relatively poor consolidation and less weathered appearance (Tan 1997; Yerkes et al. 1965). The surficial alluvial and fluvial sediments that make up the San Gabriel Valley floor are derived from alluvial fan and floodplain deposits of the numerous local streams and rivers. These valley deposits may reach as much as 200 feet in thickness (Yerkes et al. 1965). Due to this alluvial and fluvial action, it is possible there are buried archaeological deposits within the study area.

Soils within the study area are mapped as San Gabriel gravelly loam, which is a dark-brown loam containing angular gravels ranging from the size of peas to 3.6 cm (1.5 inches) in diameter. The soil is at least 1.8 m (6 feet) in depth and is well drained (Holmes 1901).

A nearby *cienega*—a marshy area where ground water percolates to the surface—is visible in historical photographs (Figure 5.1). Early paintings and illustrations depict water courses near San Gabriel Mission that may have been natural or channelized through human labor (Figure 5.2). It is likely that these water features were precursors to Chapman's Millrace, bringing water to the padres' gardens and orchards. Detailed stratigraphic profiles recorded during our excavations show many small and larger channels that are likely both natural and man-made. We will discuss these features in more detail below.

Figure 5.1. Historical photograph (ca. 1885) of a wetland area northeast of the San Gabriel Mission grounds. Image courtesy of Security Pacific National Bank Collection, Los Angeles Public Library.

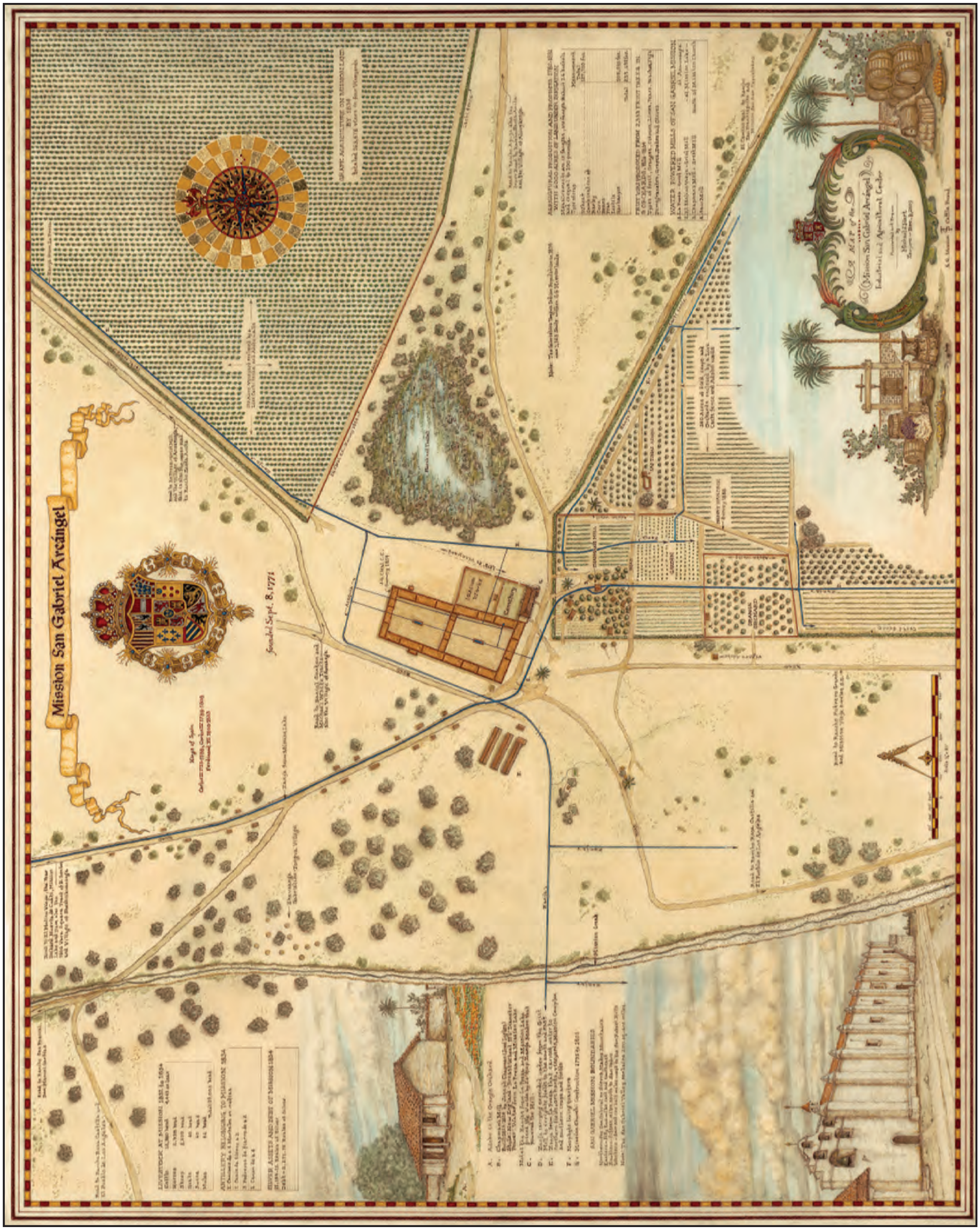

Figure 5.2. An artist's reconstruction of the grounds of San Gabriel Mission. Image reprinted with permission from Mike Hart, www.michaeljhart.com.

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Natural Stratigraphy

SWCA archaeologists recorded stratigraphic information from multiple excavation units and mechanically excavated trenches. The following section presents and interprets stratigraphic profiles from nine sections of four mechanical trenches and 11 excavation units that best represent site-wide soil stratigraphy. Site stratigraphy is described in terms of the soil/sediment morphology and type of deposit: artificial fill (modern and historical), anthropogenic soils/feature fill, and natural alluvial deposits. In trenches that were very long, detailed stratigraphic profiles were created for smaller representative segments. More than 175 excavation units were hand excavated at the site (see Chapter 4: Methods), and a representative sample of these units were selected for detailed stratigraphic profiling and to aid in defining the cultural stratigraphy of the site (Figure 5.3).

Site Stratigraphy

The profiles selected for analysis and discussion are:

- Mechanical Trench (MTR) 1, Sections 1, 2, 3, and 4;
- MTR 2, Section 1;
- MTR 3, Sections 1, 2, and 3;
- MTR 9; and
- Excavation Units (EUs) 105, 118, 147–152, 206, 269, and 282.

Examination of trench and excavation unit walls resulted in the identification of five distinct soil units, or facies (Table 5.1):

1. Modern Fill;
2. Historical Fill (unstratified historical fill deposits);
3. Historic-Period Occupation Deposits (Strata Ia–Ic; includes A horizon or surface soil, B horizon or subsoil, and Ab horizons or buried surface soil);
4. Historical Alluvium (alluvial deposits Strata IIa–IIe; C Horizon or parent material); and
5. Holocene Alluvium (Stratum IIIa; B horizon) and Pleistocene Alluvium (Stratum IIIb; B2 horizon).

The majority of cultural materials are found in the Historical Fill, Historical Alluvium, and Holocene Alluvium, with the exception of some intrusive materials found in the Pleistocene Alluvium and redeposited materials in Modern Fill and Historical Fill. The largest area of modern disturbance was noted in the northern portion of the study area, in MTR 3, and in the southwestern portion of the study area, in MTR 2 (see Figure 5.3). Elsewhere, site stratigraphy remains mostly intact, with the most complex stratigraphy preserved in the eastern end of MTR 1, in Area 1, near the millrace complex (see Figure 5.3). In general, stratigraphic integrity diminishes as one travels from the southern end of the study area to the northern end towards the modern railroad grade.

Table 5.1. Facies and Stratum Designations at CA-LAN-184H

Facies Name	Stratum / Strata Designation(s)	Soil Horizon	Cultural Materials Present?
Modern Fill	Modern Fill	Modern Fill	Yes – redeposited
Unstratified Historical Fill	Historical Fill	Historical Fill	Yes – redeposited
Historic-Period Occupation	Ia	A horizon	Yes – intact
	Ib	B horizon	Yes – intact
	Ic	Ab horizon	Yes – intact
Historical Alluvium	IIa–IIe	C horizons	Yes – intact
Holocene/Pleistocene Alluvium	IIIa	B horizon	Yes – intact
	IIIb	B2 horizon	Yes – intrusive

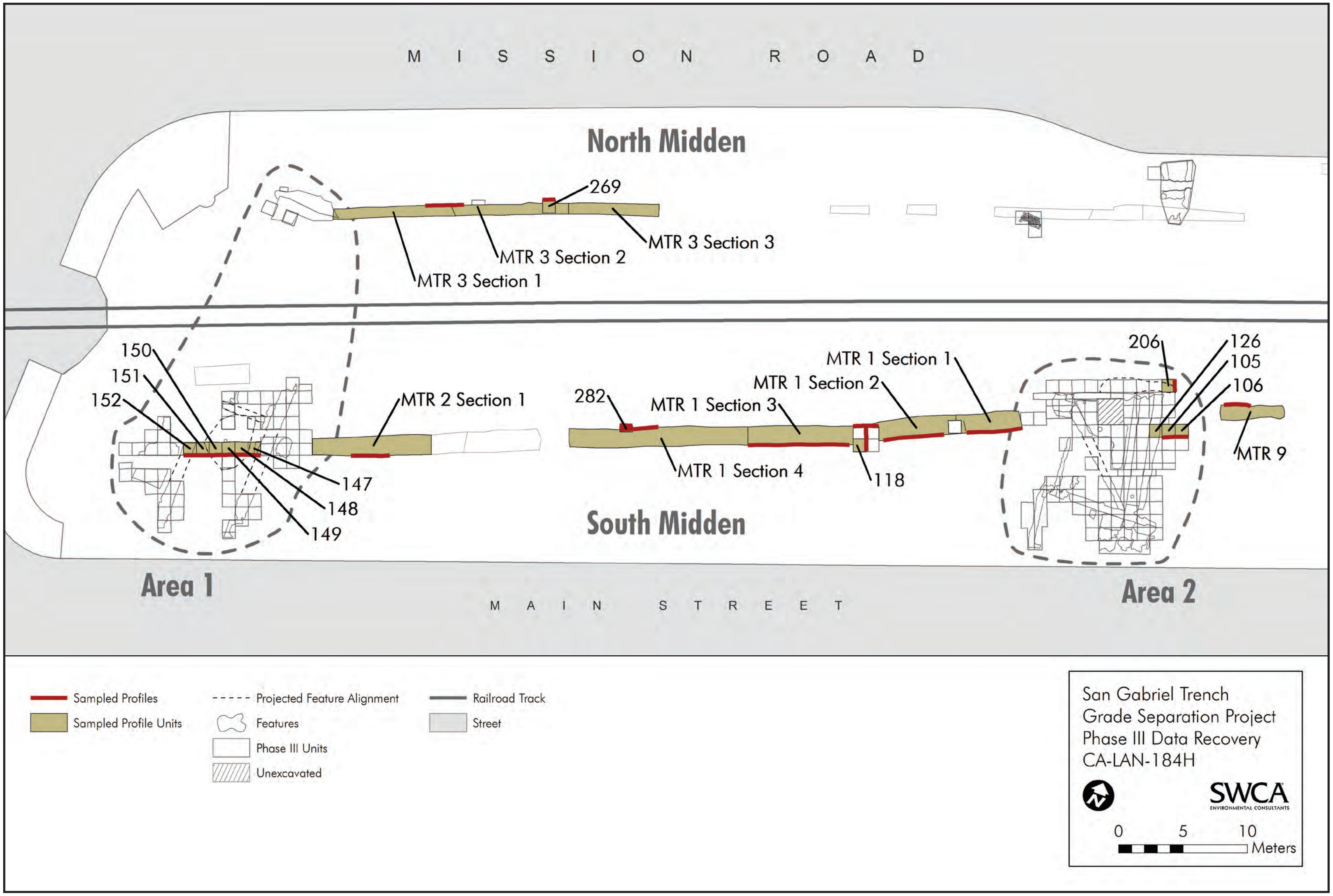

Figure 5.3. Map showing study area with trenches and units selected for stratigraphic analysis.

The area encompassing the modern railroad grade to the northern end of Mission Road is highly disturbed due to many factors, including infrastructure such as the railroad grade, water pipelines, conduit for various utilities, and roads. Although there are pockets of intact deposits containing archaeological materials, much of this area has been affected by modern and late Historic-period activities.

Natural disturbance—in the form of bioturbation from animal and plant activity—is evidenced in almost all strata at the site. Some stratigraphic mixing has surely taken place as a result of bioturbation, and this form of disturbance is especially evident in the upper (younger) deposits from the presence of numerous rodent burrows, plant and tree roots, and root casts. As will be discussed below, the modern fill stratum is entirely a disturbed context consisting of a mix of railroad debris, redeposited Mission-period materials, and other modern disturbance and debris relating to the placement of infrastructure such as pipelines and roads.

Strata Descriptions

Modern Fill: Modern Fill

Modern fill is seen in all locations at the site. The thickness of these deposits varies, but ranges from only a few centimeters to approximately 50 cm or more. In many areas of the site, we removed obvious deposits of modern fill to expose intact deposits containing historic archaeological materials (see Chapter 4: Methods). Because of this removal, most of the stratigraphic profiles presented in this chapter do not depict this stratum. Modern fill is the result of recent dumping activities associated with the construction of the nearby railroad grade, road construction, and other activities that led to secondary deposition of soils and associated cultural materials.

Unstratified Historical Fill: Historical Fill

In many areas of the site, unstratified deposits were identified overlying native soils that have a mixed, homogenized character and contain a high density of historical material, including metal cans, railroad ties, ceramics, glass, earthenware building materials, and mortar. This stratum was identified especially in portions of MTR 2.

Intact Historical Deposits

The Historic-period land surface is preserved at the contact between native soil and overlying historical fill, which accumulated during multiple phases of intensive anthropogenic use of the area over the past several centuries. These strata represent the ground surface prior to the accumulation of the modern fill described above. Historical deposits represent the combined effects of various industrial and occupational activities, which contributed to the aggradation of construction detritus and occupational midden. The diversity of historical activities conducted at the site, in combination with natural site formation processes, manifest in the variable historical fills present. Historical strata are distinguished by the presence of earthenware, adobe bricks, and adobe melt derived from weathered structural remains, charcoal lenses and diffuse charcoal inclusions, refuse concentrations, and organically rich midden soils. Stratigraphic variability is further complicated by the alteration of historical sediments through natural processes of soil formation. Soil stratigraphy is most pronounced in the eastern portion of MTR 1 adjacent to the eastern millrace excavations, where four distinct historical horizons can be observed.

Historic-Period Occupation: Strata Ia, Ib, and Ic (A, B, and Ab Horizons)

Historic-period occupation deposits were observed in both the northern and southern portions of the study area. The deposit (Stratum I), generally can be divided into a series of three substrata (Strata Ia, Ib, and Ic) representing an A–B–Ab soil sequence.

Stratum I contains the remnants of an historical pavement feature, indicating that the deposits date to the period of millrace construction and use. Parent materials likely derive from human activities ranging from construction episodes, waste disposal, and infilling of sediment for land surface elevation and leveling. The effects of anthropogenic activity are also manifest in the development of soils in this area, which tend to be weakly expressed due to the rapid rate of fill episodes and overall landscape instability during the Historic period. Soils also tend to be laterally delimited due to the highly variable sedimentary and organic inputs and localized burial of underlying sediment.

The lowermost Historic-period occupation horizon (Stratum Ic) is organically enriched relative to surrounding sediments and exhibits a truncated contact with the overlying horizon, both characteristics of a buried A horizon. The presence of intact charcoal lenses, abundant charcoal flecking, and frequent brick and mortar inclusions suggests this may be a midden deposit that accumulated during a period of intensified human use of the site. The midden deposit, which is most visually prominent in Section 2 of MTR 1, is not laterally extensive, and may represent a specialized use area of concentrated thermal activity and/or waste disposal. Overlying the midden is another historical deposit, containing a lower B horizon component (Stratum Ib) and an upper A horizon component (Stratum Ia). Both horizons contain abundant charcoal flecking, brick, and mortar inclusions; Stratum Ib also contains several intact charcoal lenses. The degree of pedogenic development and the lack of abrupt stratigraphic boundaries indicates that these soils formed as a result of continual deposition, rather than episodic infilling. This suggests that Strata Ia and Ib represent the gradual accumulation of construction and habitation debris rather than a single landscape fill episode. Stratum Ib has a higher potential to contain in-situ historical features than Stratum Ia, which is a highly bioturbated context containing a mixture of historical and modern materials.

Historic-period occupation deposits were also observed in Sections 1 and 2 of MTR 3 in the northern portion of the study area. Historical fill in this area of the site contains frequent gravel lenses representing shallow, braided stream courses, which suggests that this area of the site was periodically flooded during storm events. Stratum Ib contains numerous charcoal lenses, many of which are concentrated at the deposit's contact with the underlying native soil, indicating preservation of an Historic-period occupational surface. Overlying this stratum is a thin, highly oxidized deposit containing a high concentration of brick and mortar conglomerates (Stratum Ia). This stratum, which consists of highly weathered adobe materials (adobe melt), is only exposed at the western terminus of MTR 3. With the exception of intact stratigraphy observed in Sections 1 and 2 at the western end, subsurface sediments in MTR 3 have been significantly disturbed as a result of trenching and drilling for modern cable installation.

Historical Alluvium: Strata IIa–IIe (C Horizon)

Stratum II, observed in Section 1 of MTR 1, is a high-energy alluvial deposit that exhibits an erosional unconformity with the underlying native soil. Based on textural, structural, and morphological characteristics, these deposits represent ephemeral stream channels activated during flash floods or other punctuated flow events. The deepest and best-developed portion of this channel was observed in profile at the eastern edge of MTR 1, which suggests that the primary trunk of a channel had a roughly north–south orientation. Channel deposits underlay an historical pavement surface (Feature 10), suggesting the channel pre-dates construction of Chapman's Millrace; however, the presence of imbricated in-situ historical debris indicates that the channel formed simultaneously with an earlier period of Historic-period site occupation. This channel veers to the east, eventually intersecting the alignment of the millrace at a perpendicular angle.

The channel's depositional origins can be alternately explained as a function of 1) natural alluvial processes; 2) intentional human design; or 3) unintended consequences of historical anthropogenic activity. The channel may have formed naturally as the result of periodic seasonal flooding, representing one of many shallowly-incised channels within a larger braided stream network characteristic of a dissected fan surface. However, several indicators suggest that the channel may be anthropogenic in origin, including: 1) the fact that channel formation dates to the Historic period; 2) its textural and structural dissimilarity from stream deposits observed in older, pre-occupation alluvium present on the site; and 3) its orientation in relation to an historical reservoir (one segment aligned in parallel, then perpendicular and intersecting). In particular, the latter factor suggests the channel may have been constructed as a feeder channel for the historical reservoir (Features 10, 12, 20, 21, 31, and 39).

Individual fining-upward sequences within the channel deposit are indicative of multiple discrete flood pulses, which demonstrate regular, repetitive use of a maintained channel. However, certain characteristics of the channel are inconsistent with this scenario; namely, at only 80 cm below datum (cmbd; Datum 12) the channel is lacking the deeply incised morphology that would be expected of an artificial diversion canal. A third possibility is that the channel formed due to accelerated erosional processes resulting from intensified de-vegetation and overall alteration of the landscape associated with historical land clearance activities and grazing. This origin aligns with historical accounts of severe flood events, some of which were reportedly powerful enough to strip away topsoil and expose underlying sediment (Gumprecht 2001).

Holocene and Pleistocene Alluvium: Strata IIIa (B Horizon) and IIIb (B2 Horizon)

The oldest historical deposits are found in alluvium deposited during the early Holocene (Stratum IIIa) and the late Pleistocene (Stratum IIIb). Both strata were not always distinguishable, and they were only seen in the few locations that had deep excavations. Where they were not distinguishable from one another, they were called Stratum III. Stratum IIIa soils—like the underlying Stratum IIIb soils—consist of moderately consolidated silt and sand, with less gravels. This native soil can be seen in most trenches and excavation units that were excavated deeply, such as MTR 1, MTR 2, and EU 282. Cultural materials were identified in this stratum, and in some cases (such as in EU 282) dumping features appear to be intrusive. Stratum IIIa represents a very early Holocene or late Pleistocene soil horizon.

As depicted on a geologic map of the Los Angeles quadrangle (Tan 1997), the site sits on surface deposits dating to the late Pleistocene (Qof), consisting of slightly to moderately consolidated silt, sand, and gravel. In general, Qof deposits are dissected by variably incised drainages and show moderately to well-developed pedogenic soils (Yerkes and Campbell 2005). Qof deposits underlie much of the site, and they were observed in both the southern (MTR 1 and MTR 2), and northern areas of the site (western end of MTR 3). This facies, which represents native soil, consists of loam and sandy loam alluvial sediments deposited during sheetwash and channel alluviation on the Pleistocene fan surface. Native soils display minimal to moderate degrees of pedogenic development, indicating that the fan surface experienced a long period of landscape stability prior to burial. With the exception of a few intrusive artifacts in the upper portion of the stratum, no historical or prehistoric components were identified in native soil deposits, indicating that they predate historical occupation of the site and the construction of the millrace. Native soils do not appear to contain debris associated with prehistoric occupation of this locale.

Cultural Stratigraphy

To examine the correlation between the depositional history and human occupation of the study area, we plotted the elevations of excavated features and analyzed the density of cultural materials recovered from a sample of excavation units relative to the natural stratigraphic horizons. Artifact types included in the analyses included Native American brown ware ceramics, shell beads, flaked stone tools and debitage, imported ceramics, glass artifacts, faunal bone and shell, earthenware construction materials (bricks, tiles, and pipes), and some metal artifacts. Various artifact types were viewed stratigraphically in terms of their relative densities within the overall matrix of excavation units.

For the sake of analysis, the study area was divided horizontally into three distinct areas (see Figures 4.4 and 4.5). Area 1, in the western portion of the study area, includes a large building foundation and associated features. Area 2, in the center of the study area, is dominated by Chapman's Mill and Millrace and associated features. Between these areas is an expanse of midden without identified architectural features. This is labeled the North Midden and South Midden, with the Union Pacific Railroad tracks arbitrarily dividing these central portions of the study area.

Area 2

In the following section, we discuss stratigraphic interpretations for major trenches and a sample of excavation units in this area.

MTR 1 Sections 1 and 2

The excavation of MTR 1 served two purposes: 1) to acquire a stratigraphic profile in the central portion of the study area along its main axis and perpendicular to the millrace and associated feature complex; and 2) to identify subsurface archaeological features. The excavation of the trench was successful for both purposes. Interestingly, while complexes of features were identified at both the eastern and western ends of the trench, the central portion was nearly devoid of features except for one artifact concentration. All of the site facies and strata described above were noted in these two sections of MTR 1, although there is some lateral variation represented (Figures 5.4 and 5.5).

The general sequence seen in these two sections of MTR 1 is identifiable in most of the excavations undertaken at the site: Modern Fill and re-deposited cultural materials overlie a sequence of anthropogenically-altered stable soil horizons (Strata Ia, Ib, Ic) that in turn overlie early Holocene Alluvium (Stratum IIIa) and late Pleistocene Alluvium (Stratum IIIb).

Figure 5.4. Photographic detail of channel features in MTR 1 (approximately 1-m section), view facing north.

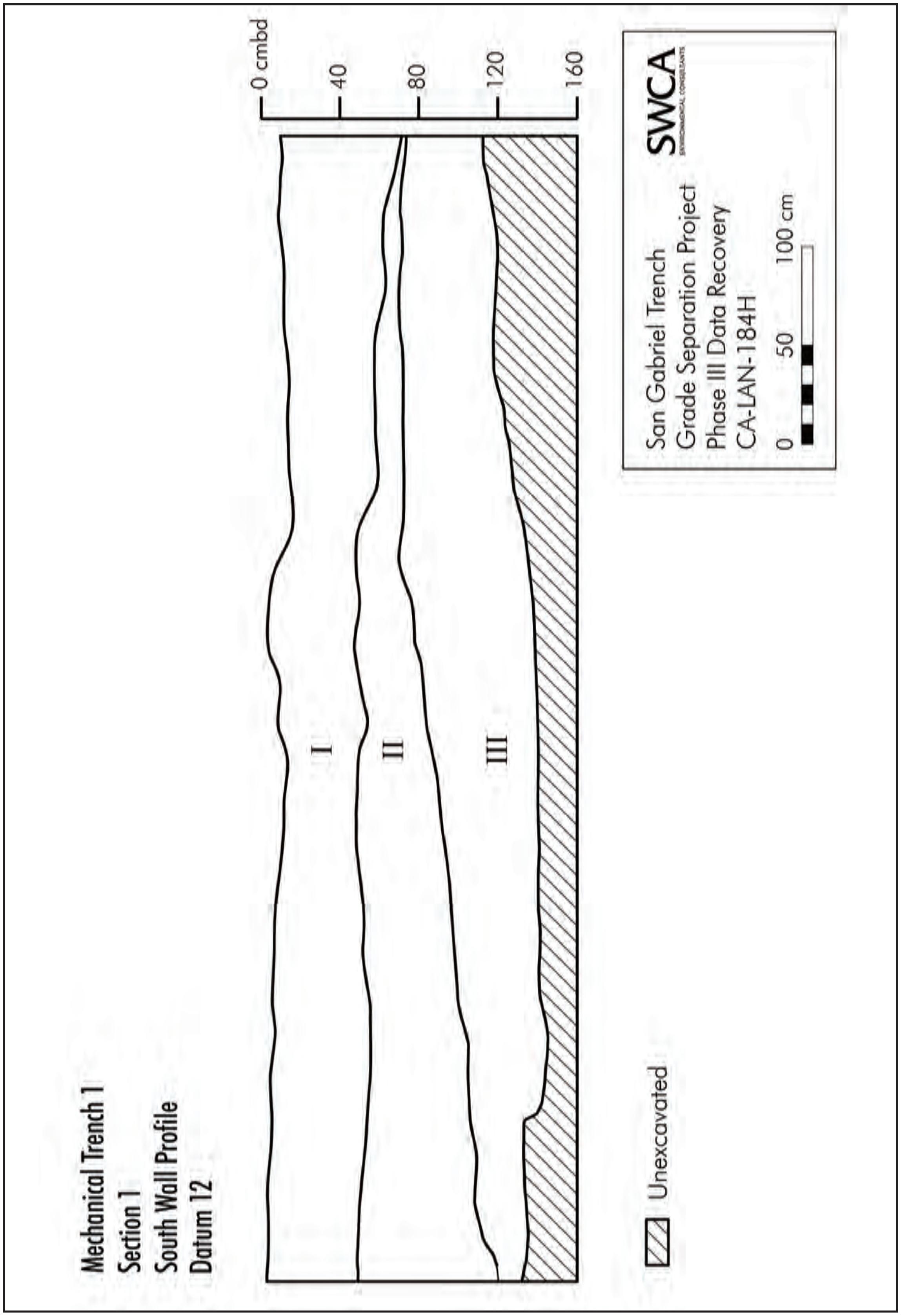

Figure 5.5. Generalized stratigraphic profile of south wall of MTR 1, Sections 1 and 2.

Stratum I is intersected by high-energy alluvial deposits that are derived from the remnants of a channel (Strata IIa–IIe). It is unclear whether this channel is completely natural in origin or whether it has been altered or maintained by human activities (see above discussion of Strata IIa–IIe). This channel feature appears to have run in a roughly northwest–southeast direction towards the millrace. Like the overlying alluvial deposits, these strata contain abundant cultural materials in very high densities. Importantly, this channel feature appears to predate all of the architectural features in the millrace feature complex, because it has clearly been truncated on its eastern end by Feature 52 (Chapman's Millrace) and it underlies Feature 10 (the triangular reservoir floor). When a section of the millrace feature was removed for display near San Gabriel Mission, SWCA archaeologists had the opportunity to view the sediments underlying the millrace and reservoir feature complex. The coarse sands that comprise Strata IIa–IIe were identified underlying the millrace feature complex, indicating that at least the lower portions of this channel feature predates construction of the triangular reservoir and millrace complex (Figure 5.6).

Figure 5.7 details Section 1 of MTR 1, located near its eastern terminus. The entire stratigraphic sequence is represented in this profile. In this area, modern fill was largely removed during site preparation, leaving Stratum Ia as the uppermost stratum identified in the trench. Stratum Ia is a heavily bioturbated, incipient A horizon soil containing numerous fragments of construction debris such as earthenware bricks, lenses of adobe melt, cobbles, tiles, fragments of plaster, and other modern, Historic-period, and Mission-period artifacts. Stratum Ia has also been disturbed by modern and historical activities such as railroad construction. Stratum Ib is a B horizon soil that is also heavily bioturbated, and contains a similar makeup of cultural materials. However, it appears to contain less modern debris and more Mission-period materials, as seen in the relative artifact densities recorded in EU 105 (see below). Stratum Ib appears to have more integrity, and lenses of ash and charcoal were identified within this stratum. These ash and charcoal lens features may represent cleanouts of hearths or other cooking features. Stratum Ic is a buried A horizon (Ab) soil. Stratum Ic appears to be much less affected by bioturbation than Strata Ia and Ib in this area, and it also contains ash and charcoal lenses as well as more dense concentrations of Mission-period materials. This thin, buried A horizon is indicative of surface stability, and it may represent Mission-period midden development.

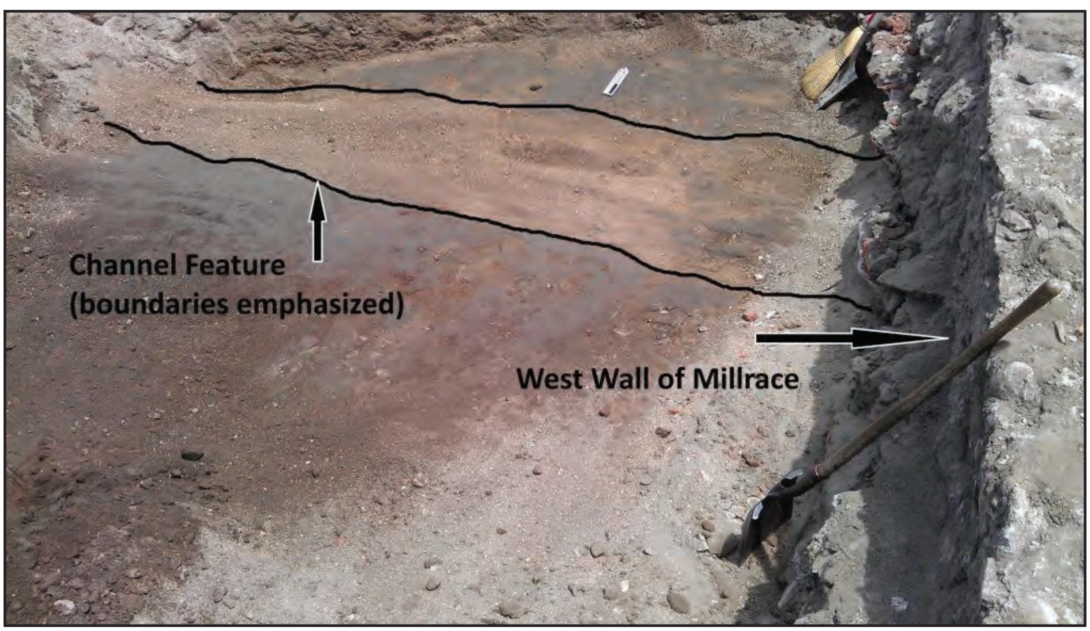

Figure 5.6. Photograph showing the intersection of the earthen channel and millrace after heavy equipment removal of the triangular reservoir; view facing north.

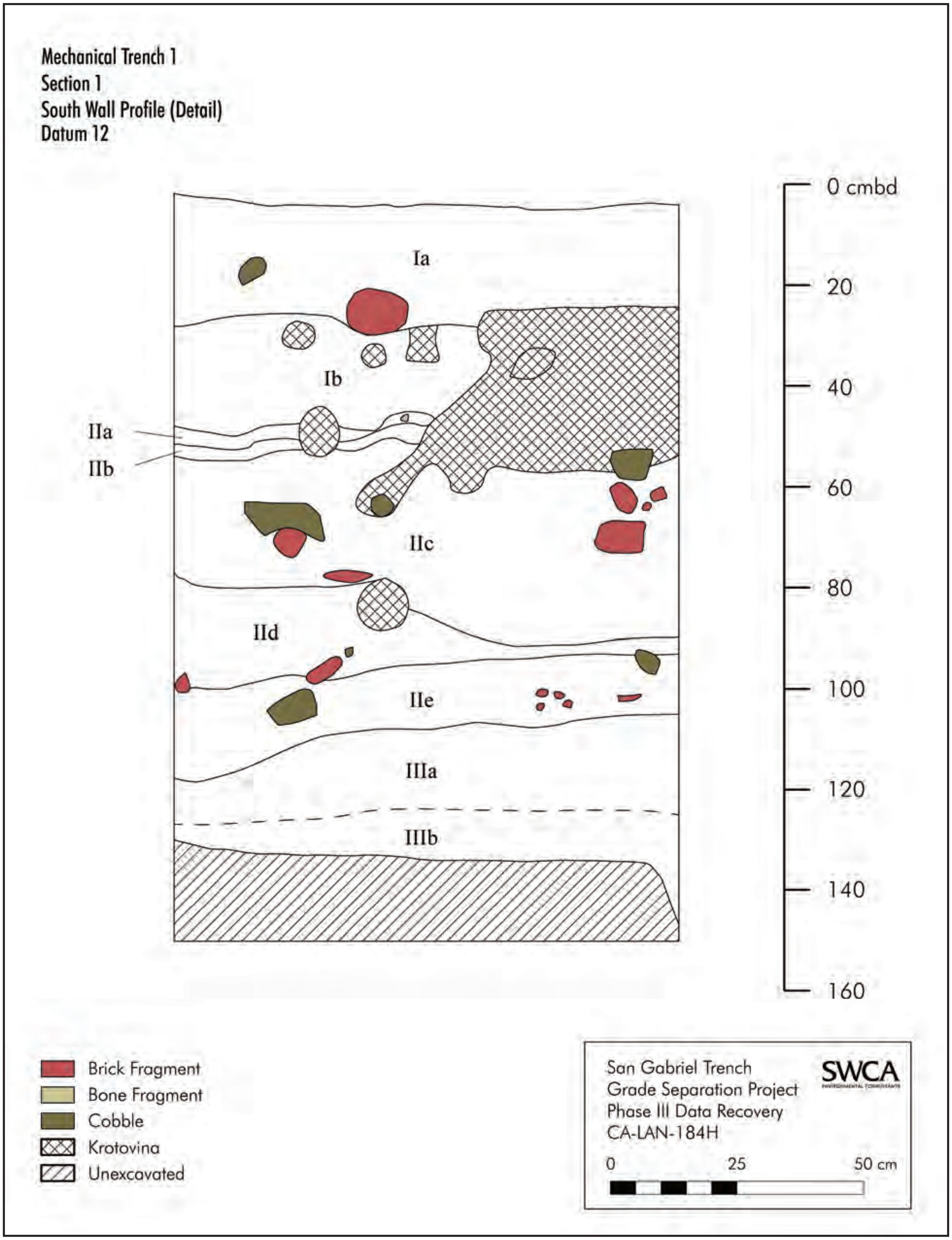

Figure 5.7. Detailed stratigraphic profile of MTR 1 Section 1, south wall.

Strata IIa–IIe represent high-energy alluvial deposits with well-incorporated Historic- and Mission-period cultural materials. These interbedded layers of sands vary in coarseness and grain size as well as thickness, and contain varying sizes of gravels and other inclusions. These lenses contain abundant cultural materials such as earthenware bricks, tiles, and pipe fragments, large faunal bones, ceramics, and other artifacts. These strata are thickest at the eastern edge of Area 2, and then become thinner to the west as documented in Section 4 of MTR 1. Stratum III underlies Stratum II, and is an alluvial deposit (B horizon) that contains sparse amounts of cultural materials. Stratum IIIa is the upper portion of Stratum III, and contains a fair amount of cultural material. It is likely that the materials encountered in this stratum represent some of the earliest Mission-period deposits on the site. Stratum IIIb is thought to be Pleistocene in age, and while it is shown to have some cultural material, it is likely that these materials are intrusive, carried down by the action of bioturbation.

MTR 9

MTR 9 was excavated as an eastern extension of MTR 1. The stratigraphic sequence is nearly identical to the profile of MTR 1, with some minor, but important variation. The sequence noted in MTR 1: Ia–Ib–II–III, is also present in MTR 9. However, Stratum II diffuses to the east, indicating that the channel identified in MTR 1 underlying the millrace feature complex is no longer present in this area. The thin pockets of coarse sands visible in MTR 9 may represent overbank deposits relating to the channel identified as Stratum II in MTR 1 (Figure 5.8). Similar to MTR 1, these lenses of Stratum II sands contained abundant cultural materials such as large mammal bones, fragments of earthenware building materials, and other construction debris. These thin sand lenses were identified at the upper boundary between Strata Ia and Ib as lenses of melted adobe. At this location, the upper boundary of the Stratum Ib deposit may represent a relic surface, likely dating to the later Mission period, as indicated by the presence of numerous fragments of earthenware tiles, bricks, large mammal bones, chunks of mortar, and ceramics in the sidewall of the trench. Lower in the profile, charcoal lenses and lenses of melted adobe were also visible, which is consistent with Stratum Ib in MTR 1. Stratum Ib overlies Stratum III, which is nearly devoid of cultural materials.

EU 105

EU 105 was located on the eastern side of Area 2. This unit was extremely dense with cultural materials, and shared essentially the same stratigraphic sequence as Sections 1 and 2 of MTR 1 (Figure 5.9). The stratigraphy of EU 105 was fairly complex due to the sporadic nature of Stratum II and the effects of bioturbation. Additionally, the effects of the millrace construction are poorly understood here, but may have altered the stratigraphic sequence somewhat. Regardless, the same sequence that was noted and described for MTR 1 Sections 1 and 2 above was identified in EU 105. This excavation unit was selected as a control unit for overall site analysis, and thus serves as a useful proxy for the cultural contents of the various strata described above.

Cultural materials analyzed from EU 105 indicate some interesting patterns (Table 5.2 and Figure 5.10). In the upper portion of the unit, in Stratum Ia from the surface to a depth of approximately 90 cmbd (Datum 3), the deposit appears to be relatively homogenous in terms of the diversity and relative densities of artifacts. Large amounts of clear glass, some metal, construction debris such as earthenware bricks, tiles, and pipe fragments, and relatively equal amounts of Native and nonnative ceramics are indicative of mixing in the deposit and are likely related to the significant amount of bioturbation that was recorded in these levels. Faunal bone was observed in relatively low numbers, but the density increases with depth. Due to safety concerns, the EU was terminated at 180 cmbd (Datum 3), so it is unknown how artifact densities changed below this depth.

This pattern seems to continue in Stratum Ib to a depth of approximately 110 cmbd (Datum 3). At this point, the bedded sands of Stratum II begin to interfinger with Stratum Ib, and the previous homogeneity noted begins to change with depth.

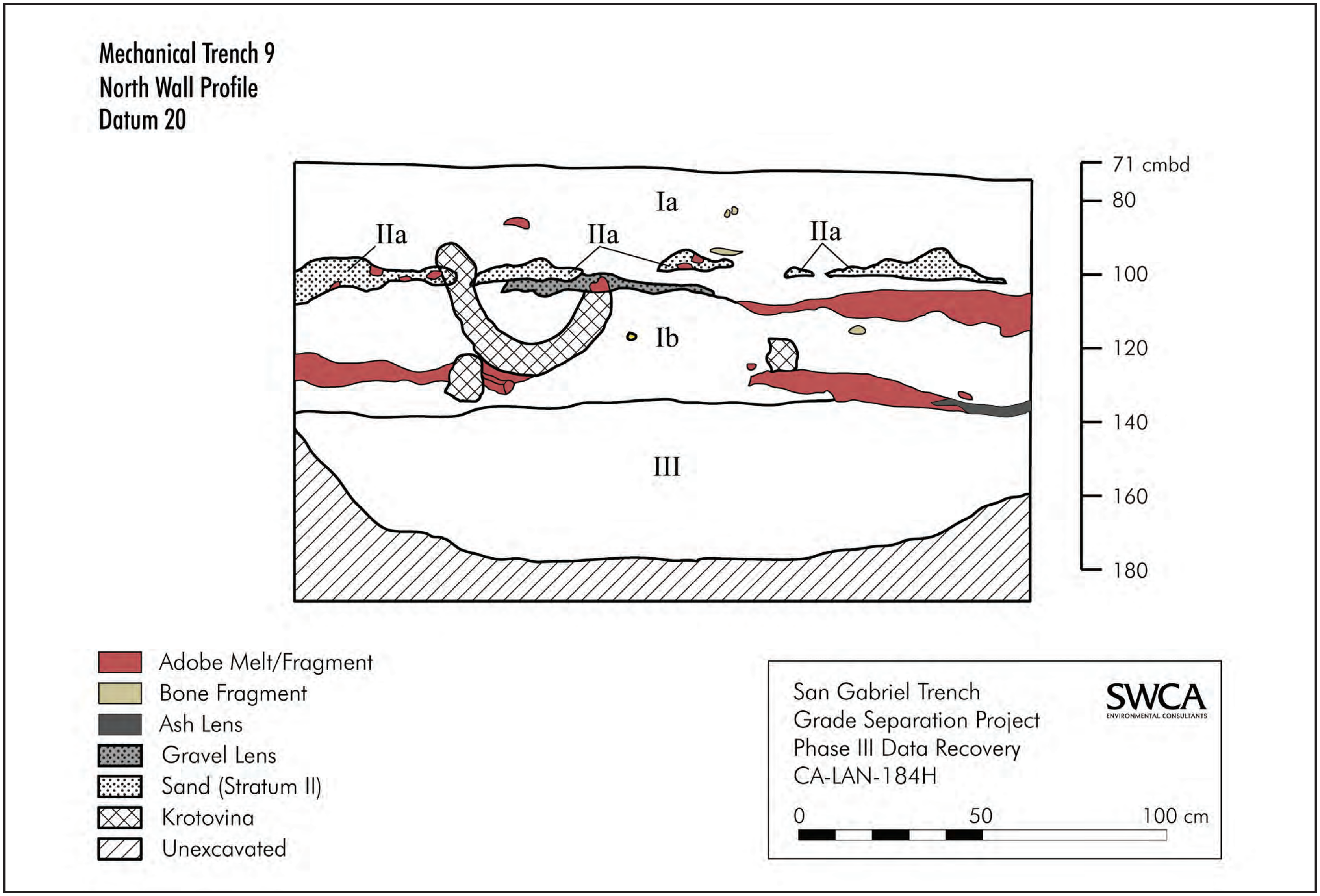

Figure 5.8. Stratigraphic profile of a section of MTR 9, north wall.

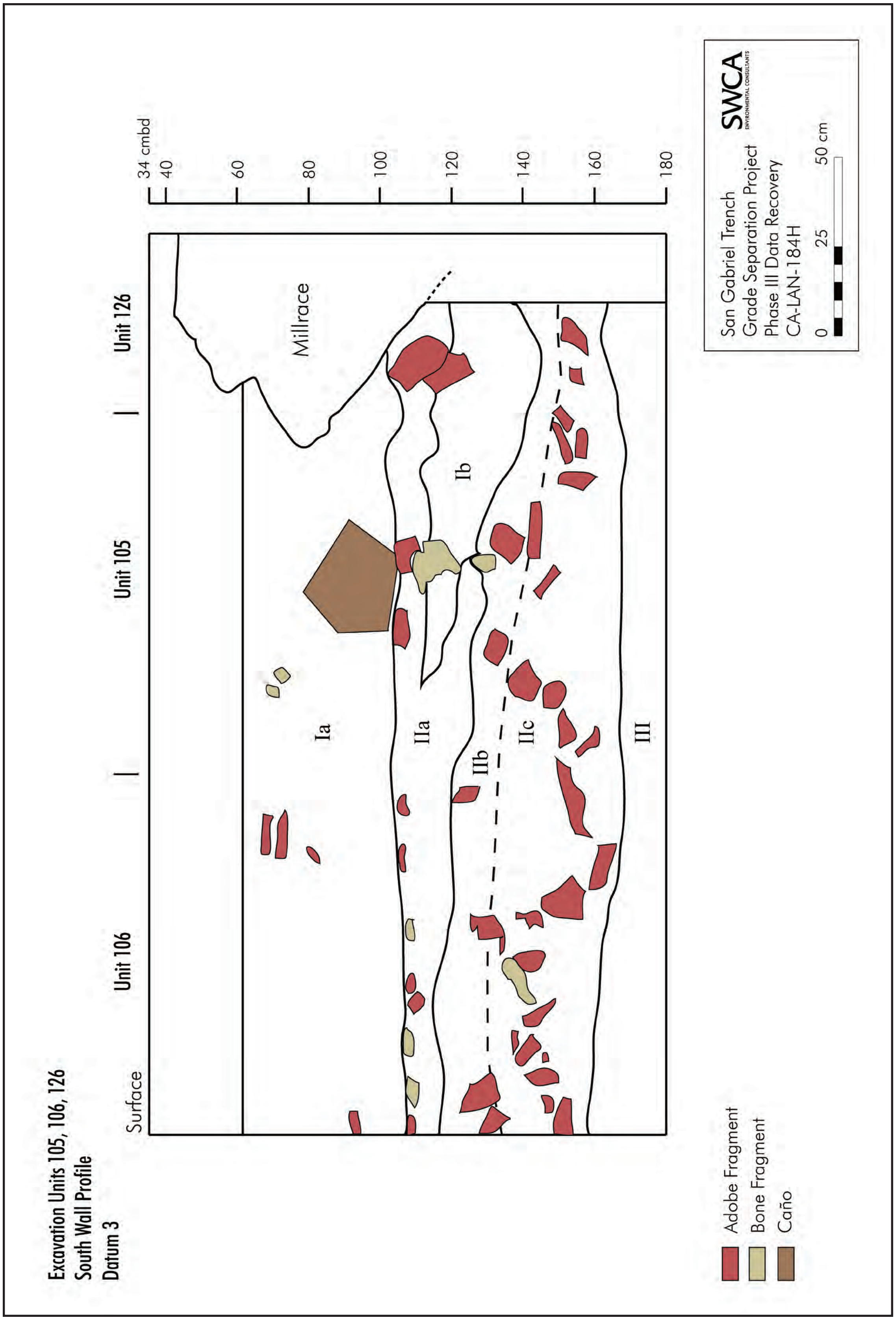

Figure 5.9. Stratigraphic profile of south wall of EUs 105, 106, and 126.

Table 5.2. Relative Densities of Cultural Materials from EU 105

Stratum / Level (cmbd [Datum 3])	Bone*	Stone Tool	Lithic Debitage	Earthenware Building** Materials	Glass-Colorless	Glass-Olive	Metal	Native American Ceramics	Shell	Imported Ceramics	Totals
	Density Per Cubic Meter										
Ia	976.74			2,965.41	1,152.86	102.73	63.37	675.11	8.70	298.30	**6,243.22**
30–40	26.44			116.09	620.69	11.49		22.99		80.46	**878.16**
40–50	49.23			255.34	423.08	53.85	53.85	76.92		69.23	**981.49**
50–60	208.70			1,537.48	69.57	17.39		130.43	8.70	69.57	**2,041.83**
60–70	95.00			522.00	30.00			150.00		40.00	**837.00**
70–80	272.38			389.81	9.52		9.52	104.76		19.05	**805.05**
80– 90	325.00			144.69		20.00		190.00		20.00	**699.69**
Ib	1,194.30		18.18	1,006.88			78.72	2,113.09	28.57	42.36	**4,482.11**
90–100	352.22			139.97			11.11	177.78		11.11	**692.19**
114–120	385.71			584.97				114.29	28.57		**1,113.54**
120–130	456.36		18.18	281.95			36.36	727.27			**1,520.13**
130–140							31.25	1,093.75		31.25	**1,156.25**
Ib/IIa	362.86			5,716.88				142.86	9.52	19.05	**6,251.16**
100–110	362.86			5,716.88				142.86	9.52	19.05	**6,251.16**
IIa	576.67			1,862.42	33.33			177.78	11.11	55.56	**2,716.87**
110–120	576.67			1,862.42	33.33			177.78	11.11	55.56	**2,716.87**
IIc	2,546.88	26.32		6,493.33				657.89	26.32	210.53	**9,961.26**
114–130	528.95			2,410.11				447.37		157.89	**3,544.32**
130–140	2,017.93	26.32		4,083.23				210.53	26.32	52.63	**6,416.94**
IIe			26.32				210.53	1,733.08		76.44	**2,046.37**
140–150							131.58	263.16		26.32	**421.05**
150–160			26.32				78.95	1,184.21		26.32	**1,315.79**
160–170								285.71		23.81	**309.52**
IIIa	2,139.64			10,016.18	22.73		286.62	3,329.55	194.44	133.84	**16,123.00**
140–150	989.47			5181.49	22.73		22.73	1454.55		22.73	**7693.69**

Table 5.2. Relative Densities of Cultural Materials from EU 105

Stratum / Level (cmbd [Datum 3])	Bone*	Stone Tool	Lithic Debitage	Earthenware Building** Materials	Glass-Colorless	Glass-Olive	Metal	Native American Ceramics	Shell	Imported Ceramics	Totals
150–160	1033.70			4665.79				1833.33	166.67	111.11	**7810.60**
160–170	112.30			168.90			55.56	41.67			**378.43**
170–180	4.17						208.33		27.78		**240.28**
Totals	**7,797.08**	**26.32**	**44.50**	**28,061.11**	**1,208.92**	**102.73**	**639.24**	**8,829.35**	**278.66**	**836.07**	**47,823.98**

*Faunal bone is divided by a factor of 10 to be comparable to other artifact densities.

**Earthenware building materials are divided by a factor of 100 to be comparable to other artifact densities.

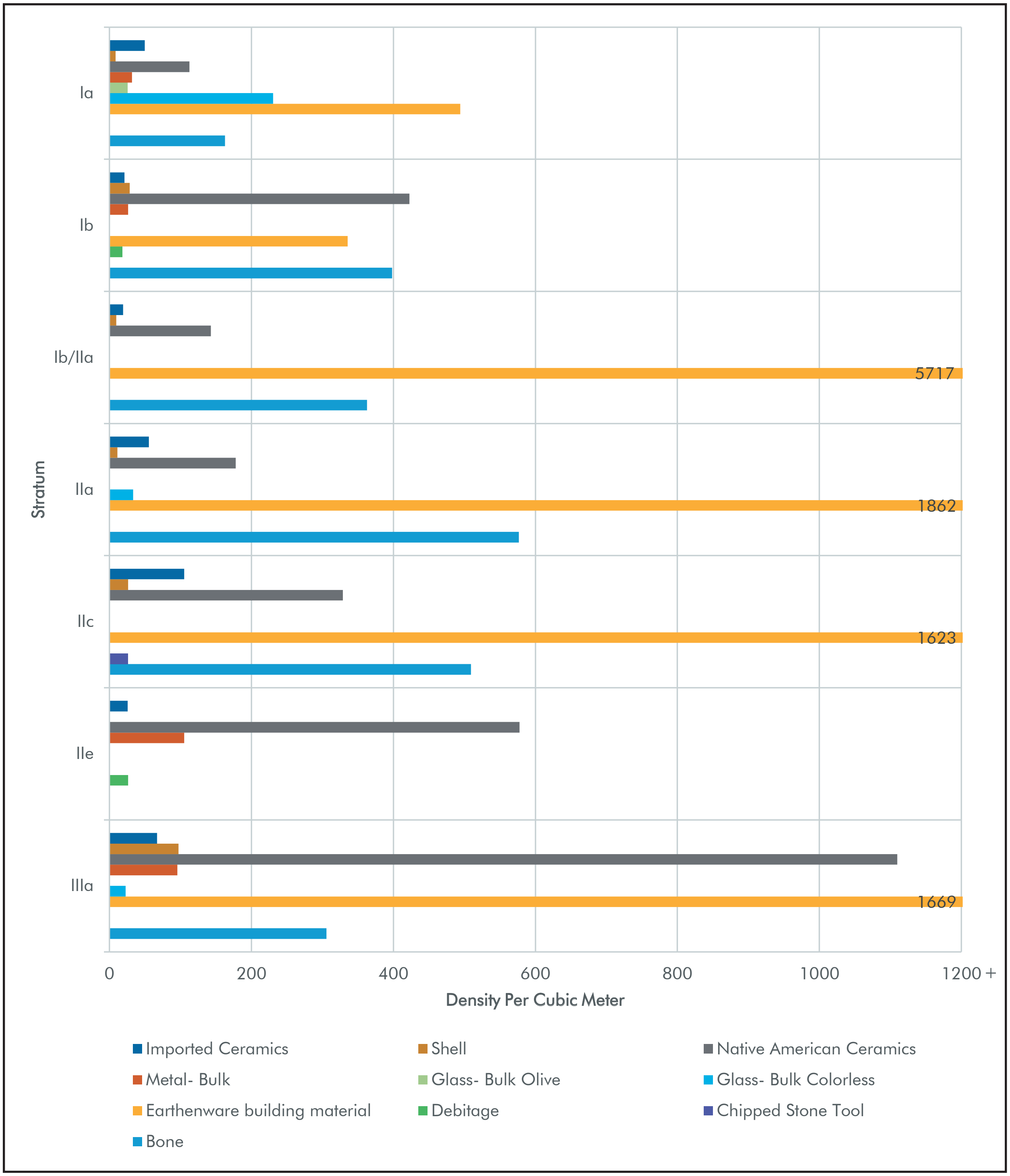

Figure 5.10. Relative densities of cultural materials recovered from EU 105.

There are marked increases in Native American ceramics relative to nonnative ceramics in the lower levels of Stratum Ib, and relatively fewer glass and metal artifacts, which were likely less available in the early Mission period. Within Stratum II, Native American ceramics gradually increase in density with depth. The density of materials such as shell and chipped stone artifacts increase in the lower levels of Stratum II as well, although these materials are found in very small quantities overall. At approximately 140 cmbd (Datum 3), Stratum IIIa and Stratum IIe begin to interfinger. Both of these strata have the highest densities of Native American ceramics and shell seen in the EU 105. Interestingly, nonnative materials such as metal, clear glass, and nonnative ceramics show a slight increase lowest levels of EU 105, a pattern that is not well understood, but may point to disturbance.

EU 206

EU 206 was located on the northeastern corner of Area 2. This unit was selected for analysis because of its location and because field observations noted numerous ash and charcoal lenses in this area that were thought to be indicative of dumping along the northern wall of the millrace feature complex. While EU 206 was just over 3 meters north of EU 105 described above, the stratigraphic profile is quite different (Table 5.3 and Figures 5.11 and 5.12). Similar to EU 105, Strata Ia and Ib in EU 206 were heavily bioturbated with relatively homogenous deposits of Native American and nonnative ceramics, as well as glass, faunal bone, and a small amount of metal. Earthenware construction debris were relatively sparse in the upper level of Stratum Ia, but increased dramatically in the lower levels.

In EU 206, Stratum Ib overlay Stratum Ic, which (similar to MTR 1) contained several ash and charcoal lenses. These lenses were identified as part of Feature 29, and where possible were excavated stratigraphically to isolate this feature and recover a sample of materials specifically from this context. In Table 5.3, this lens of material is identified as feature fill. In general, the feature fill displays quite a diversity of materials, including very high relative densities of Native American ceramics, faunal bone, and earthenware building materials such as adobe brick and tile fragments. Additionally, faunal shell and debitage was found in this feature, while the densities of nonnative ceramics, glass, and metal are low relative to artifacts considered to be of Native American origin. The densities of Native American ceramics in these lenses and in Stratum Ic are some of the highest at the entire site. The diversity of artifact types and high densities in these relatively thin lenses suggest that this feature was a product of refuse disposal rather than related to cooking activities or hearth cleanouts. Stratum Ic and the ash lens feature overlies Stratum IIIa. The amount of cultural materials of all categories dramatically drops off in this stratum.

EU 118

EU 118 was located near the boundary of Sections 2 and 3 of MTR 1 in the eastern portion of the study area. This unit was excavated as part of a block of excavation units placed to acquire a sample of cultural materials away from Area 2. Strata Ia and Ib were represented in the upper levels of EU 118, and the densities of cultural materials were relatively homogenous (Table 5.4 and Figure 5.13). Here, Stratum Ia had much higher amounts of metal and glass than seen in lower levels, which points to a post-Mission-period component in these upper levels. The amount of bone was low in the upper levels, with an increasing trend with depth. In the transitional Strata Ia–Ib, the amounts of Native American ceramics increased substantially and peaked at 90–100 cmbd (Datum 3), while nonnative ceramic densities remained consistently low. Glass and meal were still present in these levels, but dropped off slightly. Relatively high densities of Native American ceramics and shell were seen in the transitional strata of Strata Ic and Ic–III. Higher amounts of bone and earthenware building materials were also present in these strata.

Table 5.3. Relative Densities of Cultural Materials from EU 206

Stratum / Level (cmbd [Datum 3])	Faunal Bone	Lithic Debitage	Earthenware Building Materials*	Glass-Colorless	Glass-Olive	Imported Ceramics	Metal	Native American Ceramics	Shell	Totals
Density Per Cubic Meter										
Disturbed Ia	250.00		68.60	500.00		500.00				**1,318.60**
60–70	250.00		68.60	500.00		500.00				**1,318.60**
Ia / Ib	2,534.62		12,896.20	684.62	17.31	137.50	43.27	94.23	25.00	**16,432.74**
70–80	150.00		7,189.20	425.00	12.50	75.00		12.50	25.00	**7,889.20**
80–100	2,384.62		5,707.00	259.62	4.81	62.50	43.27	81.73		**8,543.54**
Feature Fill	4,562.75	7.81	6,527.90	111.74		185.08	6.45	1,204.89	12.90	**12,619.53**
100–110	2,304.69	7.81	3,846.20	85.94		62.50		398.44		**6,705.58**
110–120	2,258.06		2,681.70	25.81		122.58	6.45	806.45	12.90	**5,913.96**
Mixed Ic / IIIa	1,365.59	7.17	1,739.20	3.58		86.02		956.99	3.58	**4,162.14**
120–140	1,365.59	7.17	1,739.20	3.58		86.02		956.99	3.58	**4,162.14**
IIIa	65.07		122.20			10.27		20.55		**218.09**
140–160	65.07		122.20			10.27		20.55		**218.09**
Totals	**8,778.03**	**14.98**	**21,354.10**	**1,299.94**	**17.31**	**918.88**	**49.72**	**2,276.66**	**41.49**	**34,751.10**

*Earthenware building materials are divided by a factor of 10 to be comparable to other artifact densities.

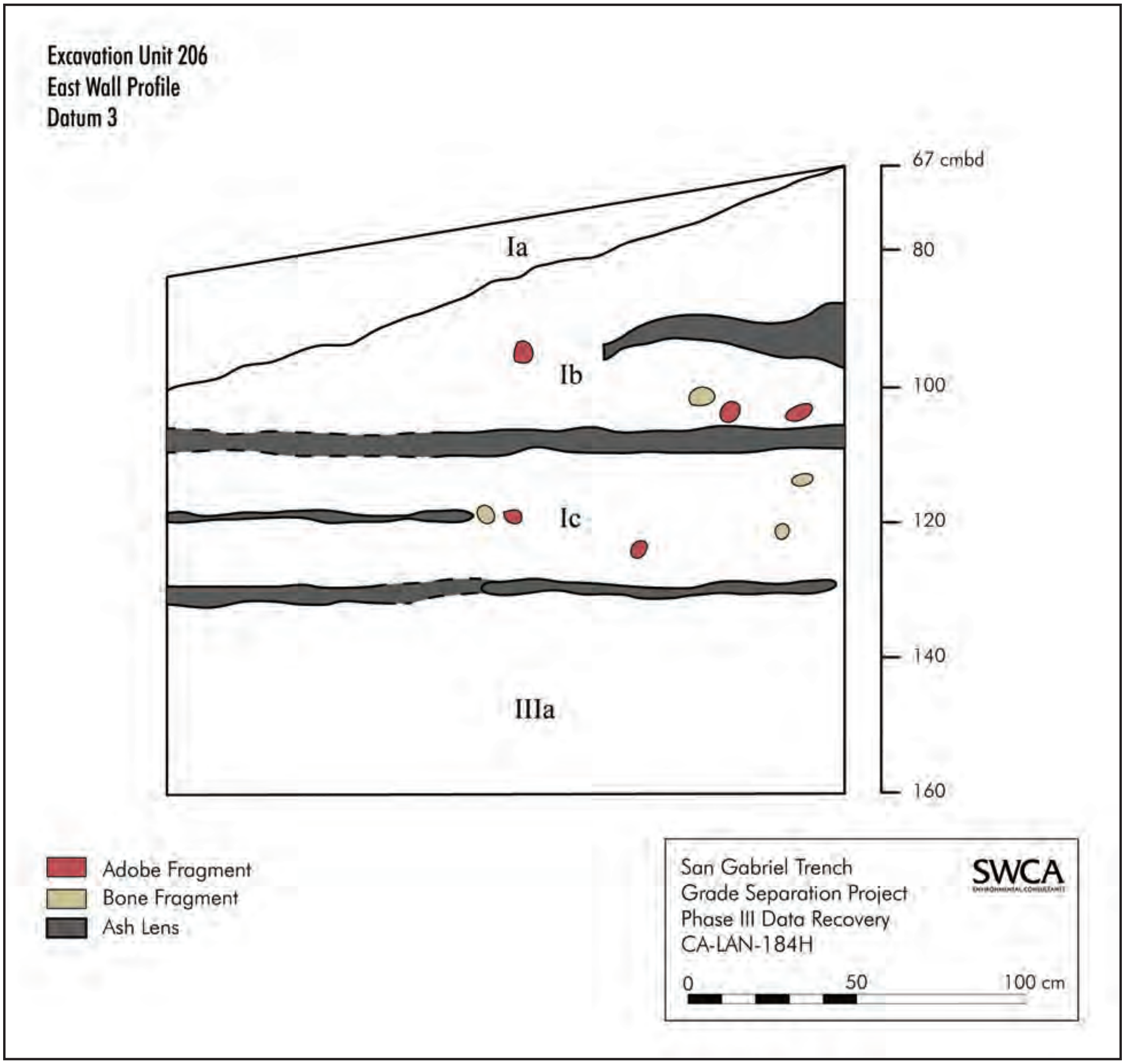

Figure 5.11. Stratigraphic profile of east wall of EU 206.

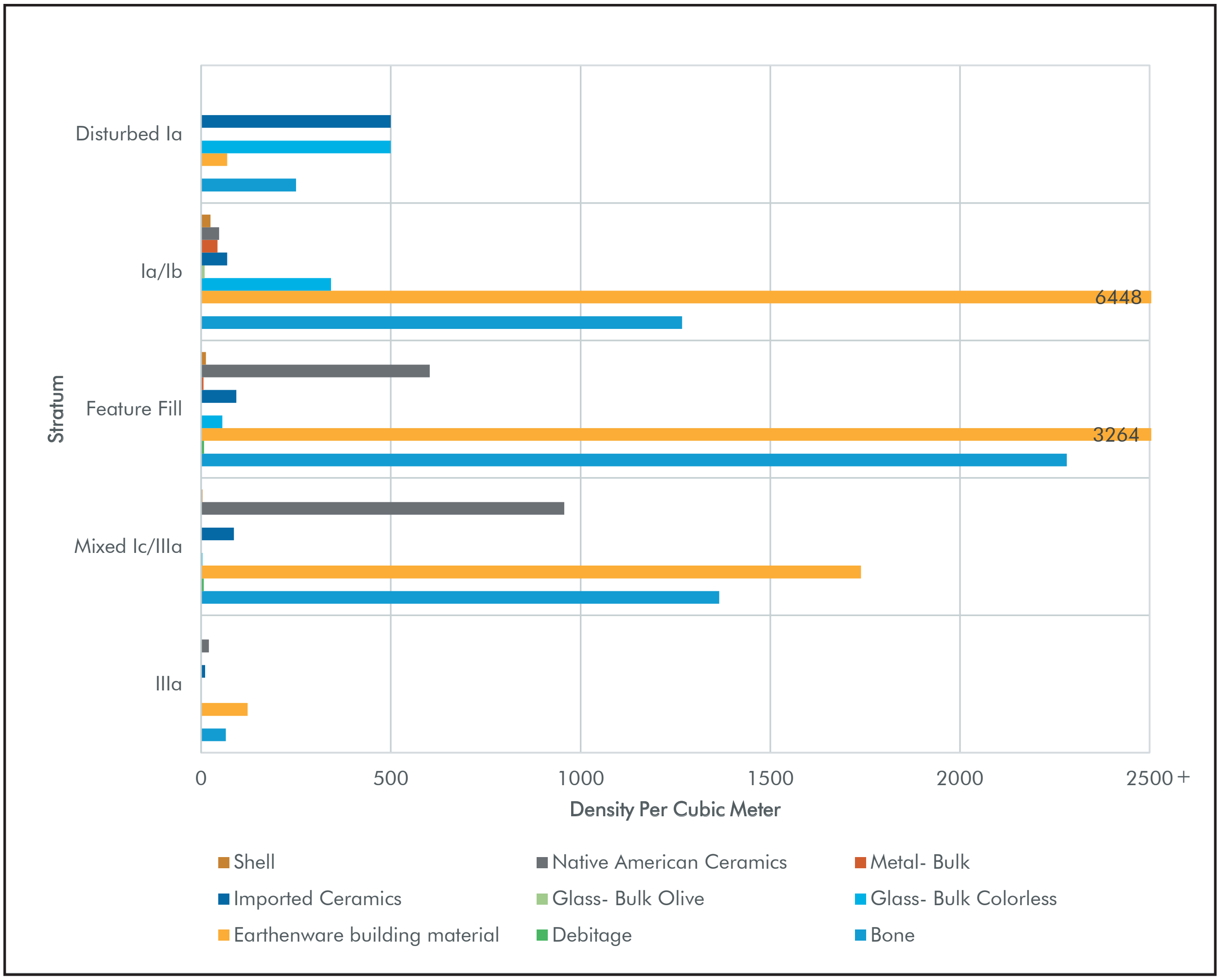

Figure 5.12. Relative densities of cultural materials recovered from EU 206.

Table 5.4. Relative Densities of Cultural Materials from EU 118

Stratum / Level (cmbd [Datum 3])	Faunal Bone*	Earthenware Building Material**	Glass-Colorless	Glass- Olive	Imported Ceramics	Metal	Native American Ceramics	Shell	Totals
Ia	83.50	290.08	50.00	25.00	53.57	436.90	28.57		**967.63**
72–83	41.30	168.77	50.00	25.00	25.00	75.00			**385.07**
83–90	42.20	121.31			28.57	361.90	28.57		**582.56**
Ia / Ib	111.80	186.88	27.78	22.22	22.22	22.22	105.56	5.56	**504.23**
90–100	111.80	186.88	27.78	22.22	22.22	22.22	105.56	5.56	**504.23**
Ib	91.40	103.11	8.06		24.19	64.52	32.26		**323.55**
100–110	91.40	103.11	8.06		24.19	64.52	32.26		**323.55**
Ib / Ic	153.50	96.86			35.71		47.62		**333.69**
110–120	153.50	96.86			35.71		47.62		**333.69**
Ic	473.90	168.78			25.00	25.00	66.67		**759.35**
120–130	473.90	168.78			25.00	25.00	66.67		**759.35**
Ic / II	60.00	44.07	24.39				73.17	12.20	**213.83**
130–136	60.00	44.07	24.39				73.17	12.20	**213.83**
Feature (8) Fill	52.80	62.00			60.00		40.00		**214.80**
130–136	52.80	62.00			60.00		40.00		**214.80**
III	423.20	332.72					9.26		**765.18**
136–146	269.80	317.00							**586.80**
146–150	20.00	1.97							**21.97**
150–160	90.00	0.24							**90.24**
160–170	43.40	2.70					9.26		**55.36**
170–180		10.81							**10.81**
Totals	**1,450.10**	**1,284.51**	**110.23**	**47.22**	**220.70**	**548.64**	**403.10**	**17.75**	**4,082.26**

Note: *Faunal Bone divided by a factor of 10 to be comparable to other artifact densities. **Earthenware building materials divided by a factor of 100 to be comparable to other artifact densities.

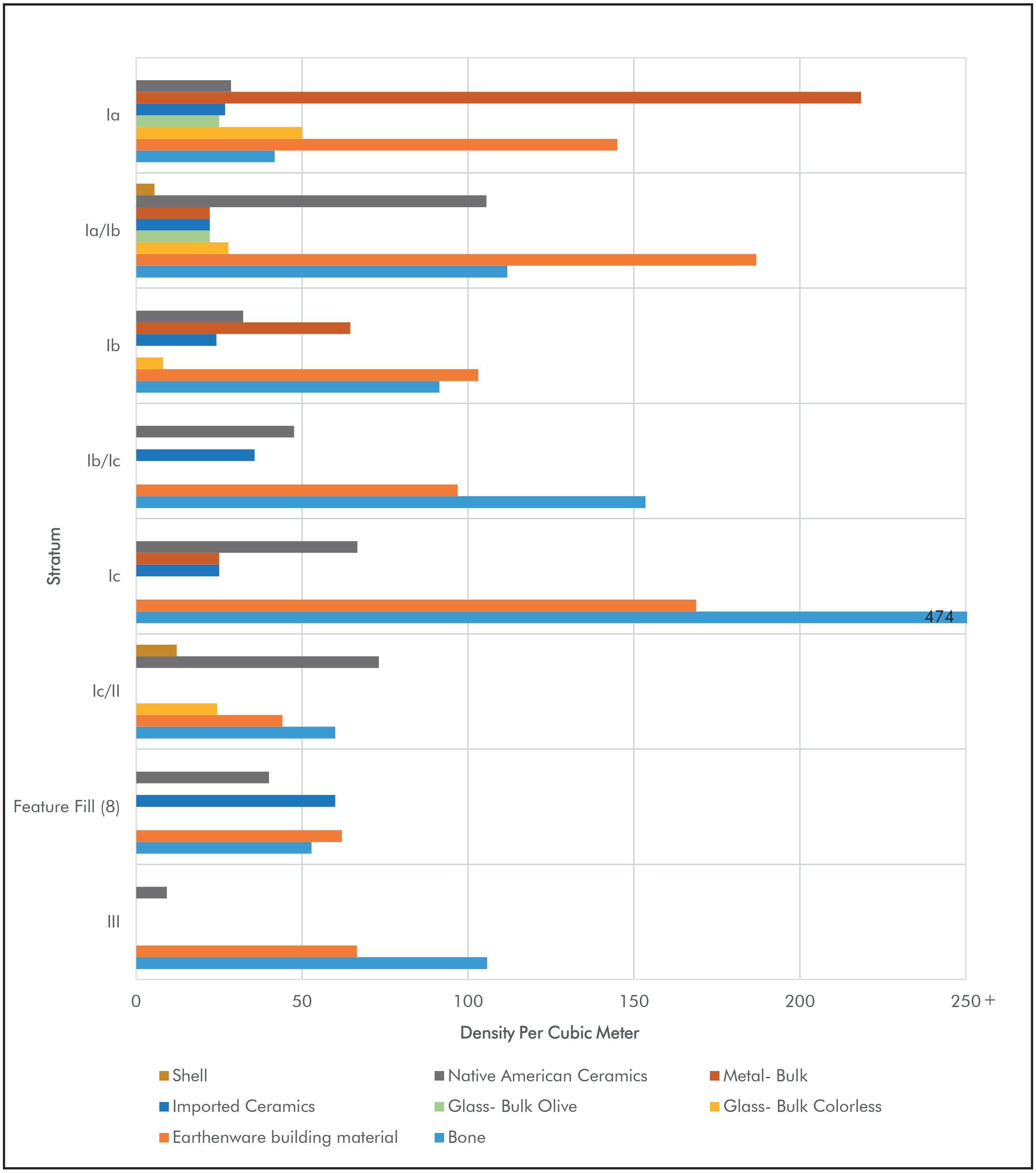

Figure 5.13. Relative densities of cultural materials recovered from EU 118.

An anomalous lens of darker, more compacted soil with higher clay content was identified at the interface between Stratum Ic and Stratum III. During fieldwork, it was posited that this lens may represent an anthropogenic surface. The lens was designated Feature 8, and soils were excavated stratigraphically to isolate materials from it. In general, artifact densities were lower in this stratum than those seen in strata overlying and underlying it. Furthermore, there was a marked drop in both faunal bone and earthenware construction materials (generally larger artifact types). A lack of larger-sized artifacts and lower densities of artifacts are characteristics that might point to maintenance of an activity area by cleaning. A well-maintained earthen house floor, for example, is typically kept free from large objects by regular sweeping. Additionally, the upper portion of this lens was highly compacted, which is another characteristic of house floors. Alternatively, this lens may simply represent an unused portion of the site where larger refuse items had not accumulated, as was observed in other areas of the site. The densities of bone and earthenware building materials increased slightly in the underlying layer (Stratum III) while other artifact classes were nearly absent. Below this lens was the upper contact with Stratum III which, as discussed above, is characterized by an increase in both faunal bone and building materials, but not other artifact classes. Only 10 cm below the upper boundary of Stratum III, the density of all cultural materials dropped off immediately, and they are almost completely absent after 40–50 cm below this contact. It is assumed that the upper portion of Stratum III in EU 118 is the same as Stratum IIIa identified in MTR 1.

North and South Middens

MTR 1 Sections 3 and 4

MTR 1 continued through the central portion of the study area, with essentially the same stratigraphic profile as identified in Sections 1 and 2, with one exception. Sections 3 and 4 varied slightly from Sections 1 and 2 in that Stratum II was very thin through Section 3 and disappeared by Section 4. Although small isolated sand lenses were identified through the remaining sections of MTR 1, they appear to be the remnants of small ephemeral drainage channels formed through sheet wash rather than the more incised and developed channel identified in the eastern portion of the study area. A concentration of *teja* (roof tiles) was identified during excavation of this trench at approximately 160 cmbd (Datum 12) within Stratum IIIa. A portion of this concentration was recovered during excavation of EU 282. A lens of highly disturbed soil was identified at the western terminus of MTR 1, although it was very thin and only visible in the upper portion of the profile. This stratum is discussed under MTR 2 below.

EU 282

While excavating Section 4 of MTR 1, a dense concentration of tejas was encountered and identified as a potential refuse dump feature dating to the Mission period. EUs 273 and 282 were placed at this location to collect a sample from this concentration and to collect a controlled sample of cultural material from this area. The stratigraphic profile is identical to that recorded in most of MTR 1 with the exception of Stratum II being absent (Table 5.5 and Figures 5.14 and 5.15). The upper 60 cm of EU 282 was excluded from analysis due to the high level of post-depositional disturbance noted in this area. The upper portions of Strata Ia and Ib appear to show signs of heavy disturbance because the relative densities of Mission-period and later Historic-period materials show very little variation. Modern materials, such as chunks of asphalt and colorless glass, were noted in the upper levels of Stratum Ia. The lower levels of Stratum Ib were only slightly less disturbed and show less of a later Historic-period presence. Here lower densities of glass and metal were observed, and as well as peaks in both densities of Native American and nonnative ceramics, but the overall densities are low and vary little from one artifact class to another.

Table 5.5. Relative Densities of Cultural Materials from EU 282

Stratum/Level (cmbd [Datum 12])	Bone*	Stone Tool	Lithic Debitage	Earthenware Building Materials**	Glass-Colorless	Glass-Olive	Imported Ceramics	Metal	Native American Ceramics	Shell	Totals
	Densities Per Cubic Meter										
Ia	25.00			2,051.44	111.11	55.56		55.56	111.11		**2,409.78**
65–70	25.00			2,051.44	111.11	55.56		55.56	111.11		**2,409.78**
Ia/Ib	82.71			77.46		20.83	41.67	104.17	104.17	20.83	**451.83**
70–80	82.71			77.46		20.83	41.67	104.17	104.17	20.83	**451.83**
Ib	2,340.69			2,378.85	146.83	250.00	751.98	181.55	755.95	226.19	**7,032.05**
80–90	172.92			311.15			125.00	145.83	41.67		**796.56**
90–100	309.29			265.11	35.71	142.86	178.57	35.71	214.29	35.71	**1,217.25**
100–110	994.44			1,108.53	111.11	83.33	305.56		333.33	166.67	**3,102.97**
110–120	864.05			694.07		23.81	142.86		166.67	23.81	**1,915.26**
Ic/ Silt lens	2,228.89	15.87	15.87	1,402.91	15.87	55.56	373.02	83.33	281.75		**4,473.07**
120–130	2,071.11			982.28		55.56	277.78	83.33	138.89		**3,608.94**
130–140	157.78	15.87	15.87	420.63	15.87		95.24		142.86		**864.13**
IIIa	943.62			6,695.84	46.88		179.83	15.63	409.23	39.43	**8,330.45**
140–150	267.81			136.14	31.25		78.13		218.75	15.63	**747.70**
150–160	320.95			597.86			47.62		190.48	23.81	**1,180.71**
160–170	90.63			4,269.53	15.63		15.63	15.63			**4,407.03**
170–180	264.23			1,692.31			38.46				**1,995.00**
IIIb	5.00			4.47							**9.47**
180–190	5.00			4.47							**9.47**
Totals	**5,625.91**	**15.87**	**15.87**	**1,2610.97**	**320.68**	**381.94**	**1,346.50**	**440.23**	**1,662.20**	286.46	**22,706.64**

Note: *Faunal Bone divided by a factor of 10 to be comparable to other artifact densities. **Earthenware building materials divided by a factor of 100 to be comparable to other artifact densities.

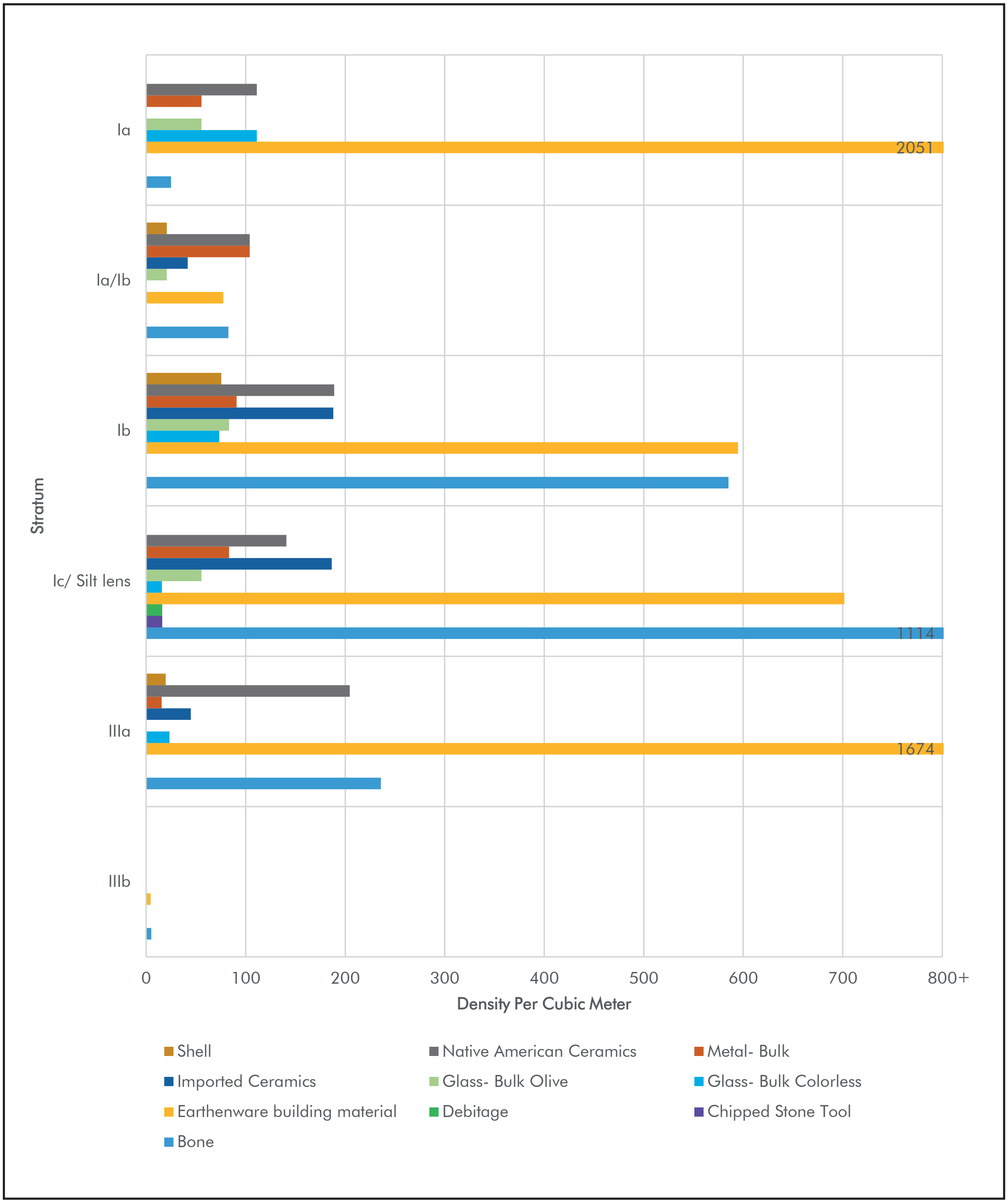

Figure 5.14. Relative densities of cultural materials recovered from EU 282.

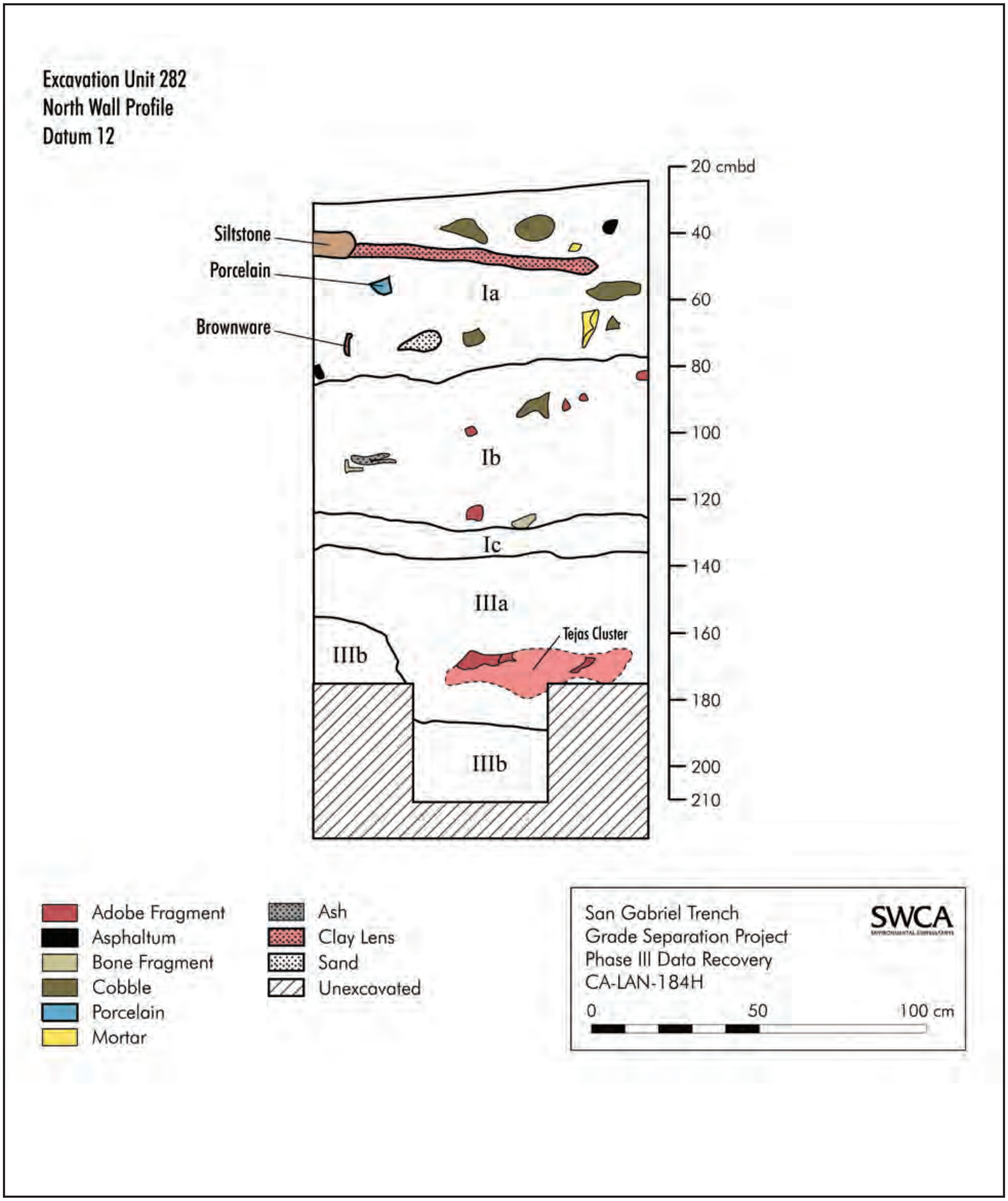

Figure 5.15. Stratigraphic profile of EU 282, north wall.

Stratum Ic was identified as a fine silty lens with light compaction. Like overlying strata, Stratum Ic displayed diversity in artifact types (albeit at low densities), with the exception of bone and earthenware building materials. Faunal bone density peaks in this stratum, then drops off significantly in Stratum IIIa.

Stratum IIIa in EU 282 showed an increase of the ratio of Native American to nonnative materials. Native American ceramics were found in higher densities, and some of the few lithic artifacts recovered on the site were found in this stratum. Stratum IIIa in EU 282 contained the highest ratios of Native American to nonnative ceramics in the excavation unit. At approximately 160 cmbd (Datum 12), a relatively thin but dense concentration of teja fragments was identified. This concentration appears to be a portion of a refuse dump that likely extended to the north and south of the excavation unit. Materials other than tejas were present in much lower densities. The concentration was approximately 10–20 cm thick, and was only evident in a portion of the excavation unit, but it appeared to continue beyond the unit boundaries. In EU 282, Stratum IIIb was encountered at approximately 10 cm below the concentration, and it appeared to be culturally sterile with the exception of a few fragments of bone and earthenware building materials that were likely transported to this depth via bioturbation.

MTR 3 Section 3

MTR 3 was located in the northern portion of the project area, north of the railroad tracks in an area that is heavily disturbed. Sections 1 and 2 of MTR 3 varied slightly from Section 3 and were in the western portion of the study area, which will be described below. Section 3 of MTR 3 showed heavy signs of disturbance from previous subsurface directional boring to bury fiber optic cable. Disturbance was also evident as a result of activity associated with construction of Mission Road. SWCA geoarchaeologist Mary Ann Vicari determined that the entire profile of Section 3 of MTR 3 was a lens of disturbed and redeposited site material.

EU 269

EU 269 was placed near the eastern edge of MTR 3 Section 2 to investigate a possible refuse dump feature at approximately 30 cmbd (Datum 12). The stratigraphic profile for EU 269 fits the common sequence identified elsewhere at the site (Table 5.6 and Figures 5.16 and 5.17). The upper portion of the excavation unit was heavily disturbed, likely to a depth of at least 80 cmbd (Datum 12). Stratum I contained abundant later Historic-period artifacts including items of metal, glass, and nonnative ceramics. In addition, Native American ceramics, faunal bone, and earthenware building materials were found in relatively low densities. Stratum I was excluded from the analysis of this excavation unit due to its highly disturbed nature. While Mission-period materials were found in this upper stratum, they are most likely the result of redeposition from modern road and railroad construction and the placement of a fiber optic cable in this area.

A dense cluster of teja was encountered at approximately 30 cmbd (Datum 12) within Stratum Ia. A drop in the density of later Historic-period materials such as metal and colorless glass was seen at the upper contact and within the 10–20 cm layer of feature fill. The density of faunal bone was also very low in this concentration, but increased in lower levels with a peak in Stratum Ib. This concentration overlay Stratum Ib. In this excavation unit, Stratum Ib had a relatively low density of cultural materials with little variation in relative densities between the various artifact types, with the exception of faunal bone. As with the transitional Strata Ia–Ib, there was a marked increase in the density of earthenware building materials largely related to the teja concentration. Faunal bone densities peaked in the levels just below the concentration and solidly within Stratum Ib. Densities of earthenware construction materials dropped off significantly in the levels below the concentration. A thin ash lens was also identified in the transitional Strata IIa–IIb. Artifact densities in this lens were similar to those seen in other strata in the excavation unit, although interestingly, this is the first stratum in this unit where Native American ceramics outnumbered those of nonnative manufacture.

Table 5.6. Relative Densities of Cultural Materials from EU 269

Stratum / Level (cmbd [Datum 12])	Faunal Bone*	Lithic Debitage	Earthenware Building Materials**	Glass-Colorless	Glass-Olive	Imported Ceramics	Metal	Native American Ceramics	Shell	Totals
	Density Per Cubic Meter									
Ia	79.55		248.69	525.25	88.38	255.05	351.01	55.56		**1,603.48**
36–50	25.00		81.11	222.22	27.78	194.44	138.89	55.56		**745.00**
50–60	54.55		167.58	303.03	60.61	60.61	212.12			**858.48**
Ia / Ib	201.15		1,834.59	280.77	75.00	367.31	1,009.62	100.00	57.69	**3,926.13**
60–70	46.15		317.94	230.77		192.31	134.62		57.69	**979.48**
70–80	155.00		1,516.65	50.00	75.00	175.00	875.00	100.00		**2,946.65**
Ib	1,467.80	23.61	9,984.29	363.89	283.53	315.67	592.06	226.98	45.83	**13,303.67**
80–90	22.50		4,982.58	100.00	37.50	87.50	87.50			**5,317.58**
90–100	183.33	11.11	3,043.28	88.89	88.89	88.89	77.78	55.56	33.33	**3,671.06**
100–110	651.25	12.50	968.09	112.50	112.50	112.50	275.00	100.00	12.50	**2,356.84**
110–120	610.71		990.35	62.50	44.64	26.79	151.79	71.43		**1,958.21**
Ib / IIa	316.67		400.23	21.74	36.23	50.72	137.68	43.48		**1,006.75**
120–130	316.67		400.23	21.74	36.23	50.72	137.68	43.48		**1,006.75**
IIa / IIb / ash lens	209.30		252.67	23.26	15.50	7.75	23.26	85.27		**617.01**
130–140	209.30		252.67	23.26	15.50	7.75	23.26	85.27		**617.01**
IIb	53.37		89.00	6.58	13.16	6.58	19.74	32.89		**221.31**
140–150	40.79		50.21	6.58	13.16	6.58	19.74	32.89		**169.95**
150–160	12.58		38.79							**51.36**
IIc						6.29		18.87		**25.16**
150–160						6.29		18.87		**25.16**
Totals	**2,327.83**	**23.61**	**12,809.46**	**1,221.48**	**511.81**	**1,009.38**	**2,133.36**	**563.05**	**103.53**	**20,703.52**

*Faunal Bone divided by a factor of 10 to be comparable to other artifact densities. **Earthenware building materials divided by factor of 100 to be comparable to other artifact densities.

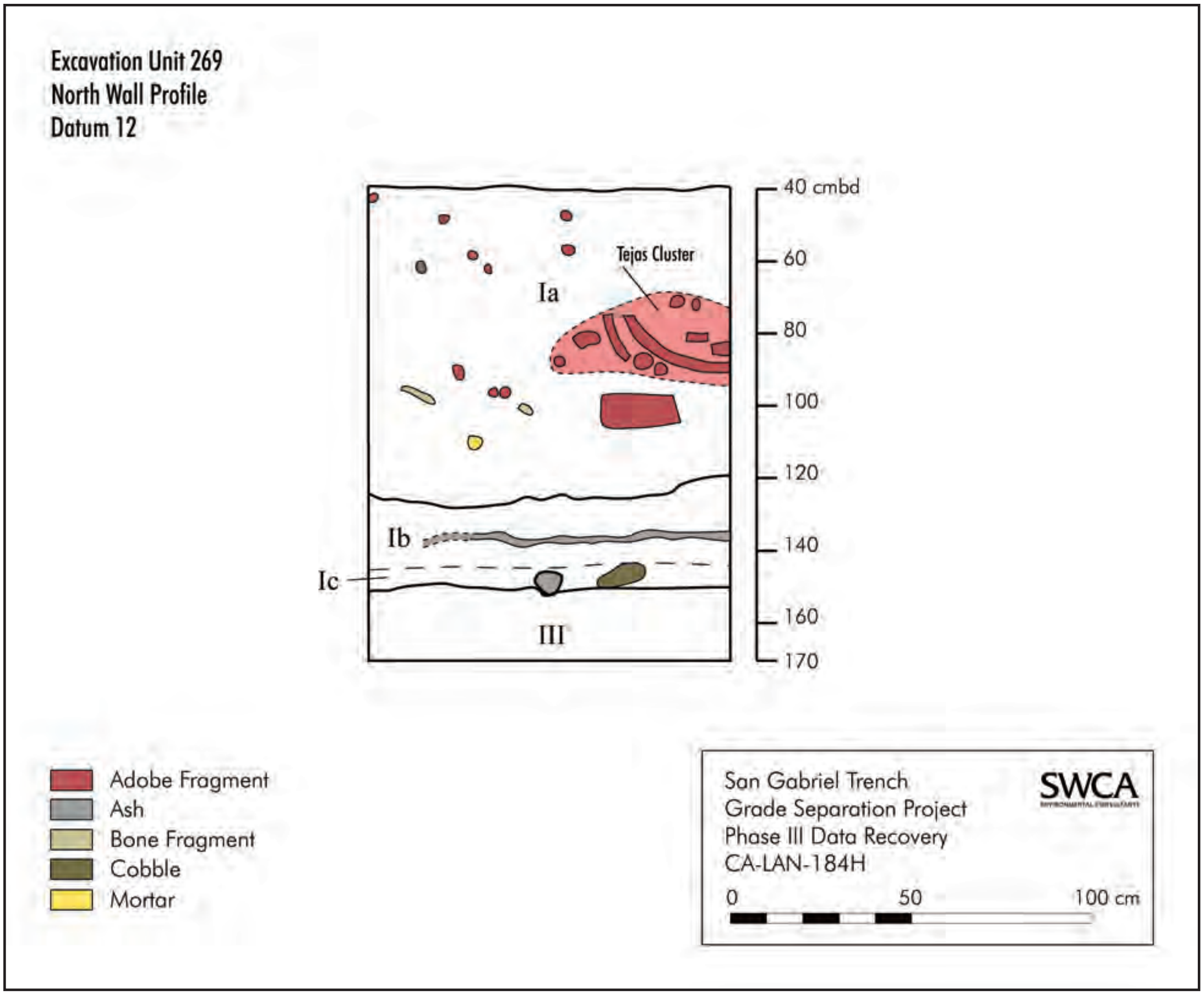

Figure 5.16. Stratigraphic profile of EU 269, north wall.

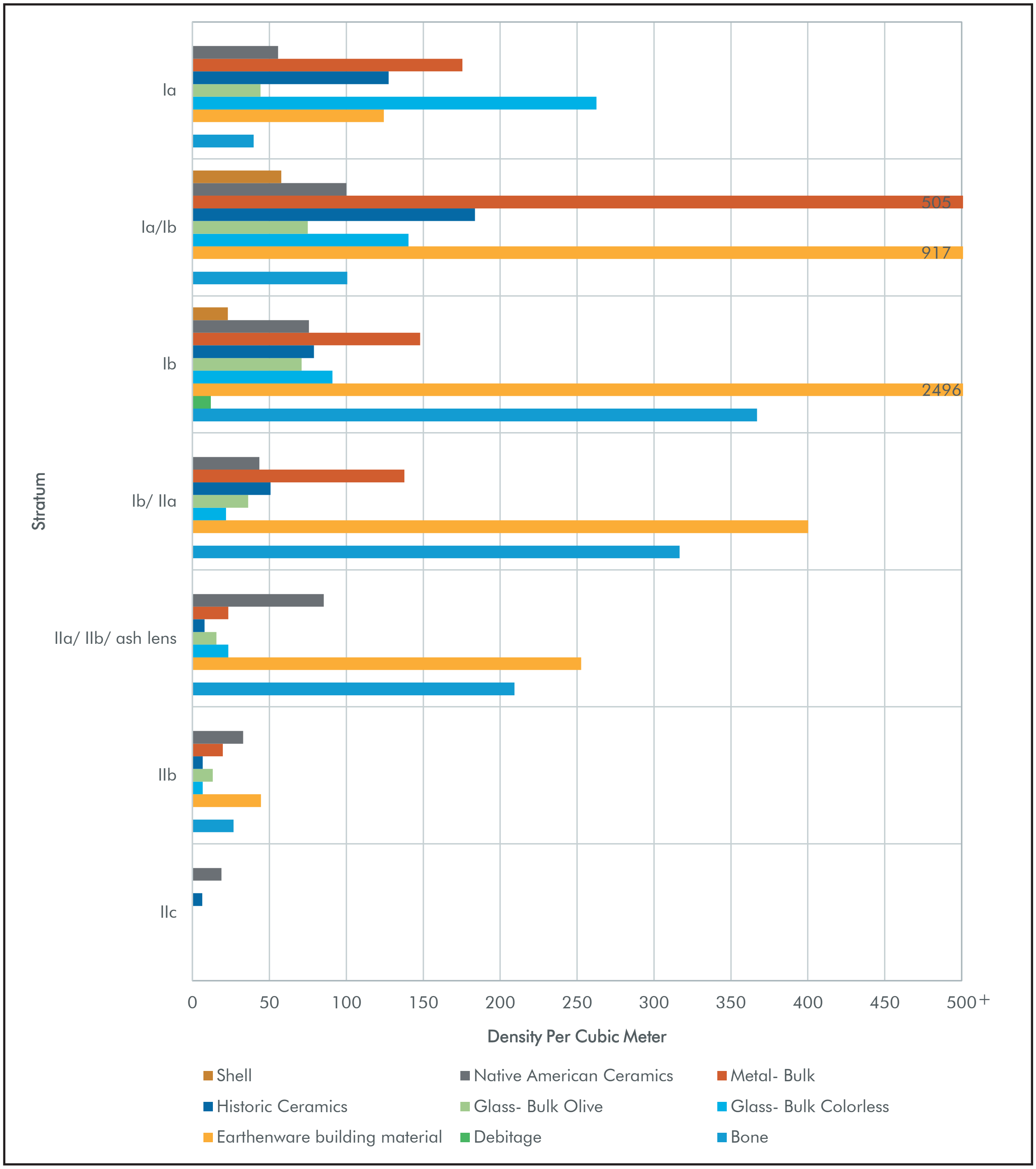

Figure 5.17. Relative densities of cultural materials recovered from EU 269.

Stratum Ic underlay Stratum Ib in EU 269, and contained moderate densities of cultural materials with slightly fewer nonnative items such as ceramics and glass. Metal artifacts were still found in this stratum with decreasing density at lower depth. A slight increase in Native American ceramics was seen in this level. However, other Native American–made materials such as lithic artifacts were not present. Bone and earthenware-based building materials also dropped off dramatically in the lower levels of Stratum Ic. Stratum III underlay Stratum Ic in EU 269, and it contained almost no cultural material.

Area 1

MTR 2 Section 1

MTR 2 was essentially a continuation of MTR 1 in the western portion of the project area, but its stratigraphy was very different from the stratigraphy of MTR 1 (Figure 5.18). As mentioned previously, an area of heavy disturbance was noted in the upper layers of the western terminus of MTR 1. In the eastern portion of MTR 2, this disturbance continued and increased with depth, where it made up a large portion of the trench profile. MTR 2 did not expose any of the pronounced soil horizons or depositional strata visible in MTR 1, with the exception of Strata II and III. The fill overlying Strata II and III had a very mixed, homogenous character, and contained a high density of unstratified Historic-period material, including metal cans, railroad ties, ceramics, glass, melted adobe, fragments of fired earthenware building materials and mortar. Historical artifacts were dispersed throughout the Historical Fill and Modern Fill deposits, which measured over 1.5 m in thickness.

No intact Historic-period features were observed in fill deposits. Several pockets of loose, poorly sorted gravel and deposits of fired brick fragments were observed, suggesting that the area was either used historically to dispose of construction debris, or filled in more recently with redeposited Historic-period occupation debris from elsewhere on the site. Redeposition and associated soil mixing would also account for the homogenous character of the deposit. The thickness of artifact-bearing deposits in MTR 2 relative to other areas of the site suggests that sediments were deposited during infilling of a large borrow pit or other depression. No abrupt contact between the fill and underlying native soil was observed, suggesting the overlying deposit accumulated at a sufficiently gradual rate to allow for pedogenic mixing, which obscured stratigraphic boundaries. Additionally, lenses of coarse sands and gravels (Stratum II) were noted, and they are possibly the remnants of braided stream channels as was noted in the Historic-period occupation deposits.

In MTR 2, Stratum III underlay the thick disturbed lens. No cultural material was noted in Stratum III in this location within the trench. The eastern boundary of this fill deposit was not identified conclusively during fieldwork, but MTR 2 terminated at the eastern edge of EUs 134 and 135, which were placed to investigate the remnant of a large adobe structure foundation (Feature 3) that comprises Area 1.

EUs 147–152

A series of excavation units were placed in an east–west orientation to obtain a cross-sectional stratigraphic profile through Features 3, 5, 9, and 14 in Area 1. The stratigraphic profile in this area is very complex, for it cuts through the footings of the large adobe structure (Features 3 and 5), the interior and possible floor of the structure (Feature 9), and a large refuse deposit (Feature 14) that was excavated into the floor of this structure. Soil stratigraphy is very similar to that seen in other trenches and excavation units on the site, with the exception of disturbance from the large structure and refuse pit features. Originally, there was a thin lens of Modern Fill in this area, much of which was removed prior to the documentation of stratigraphy in this location. Underlying this lens was a thin lens of unstratified Historical Fill. Below the Modern and Historical Fills was Stratum I, which extended to a depth of approximately 210–220 cmbd (Datum 6). In this area, we could not distinguish the various substrata of Stratum I identified at other locations, such as in MTR 1.

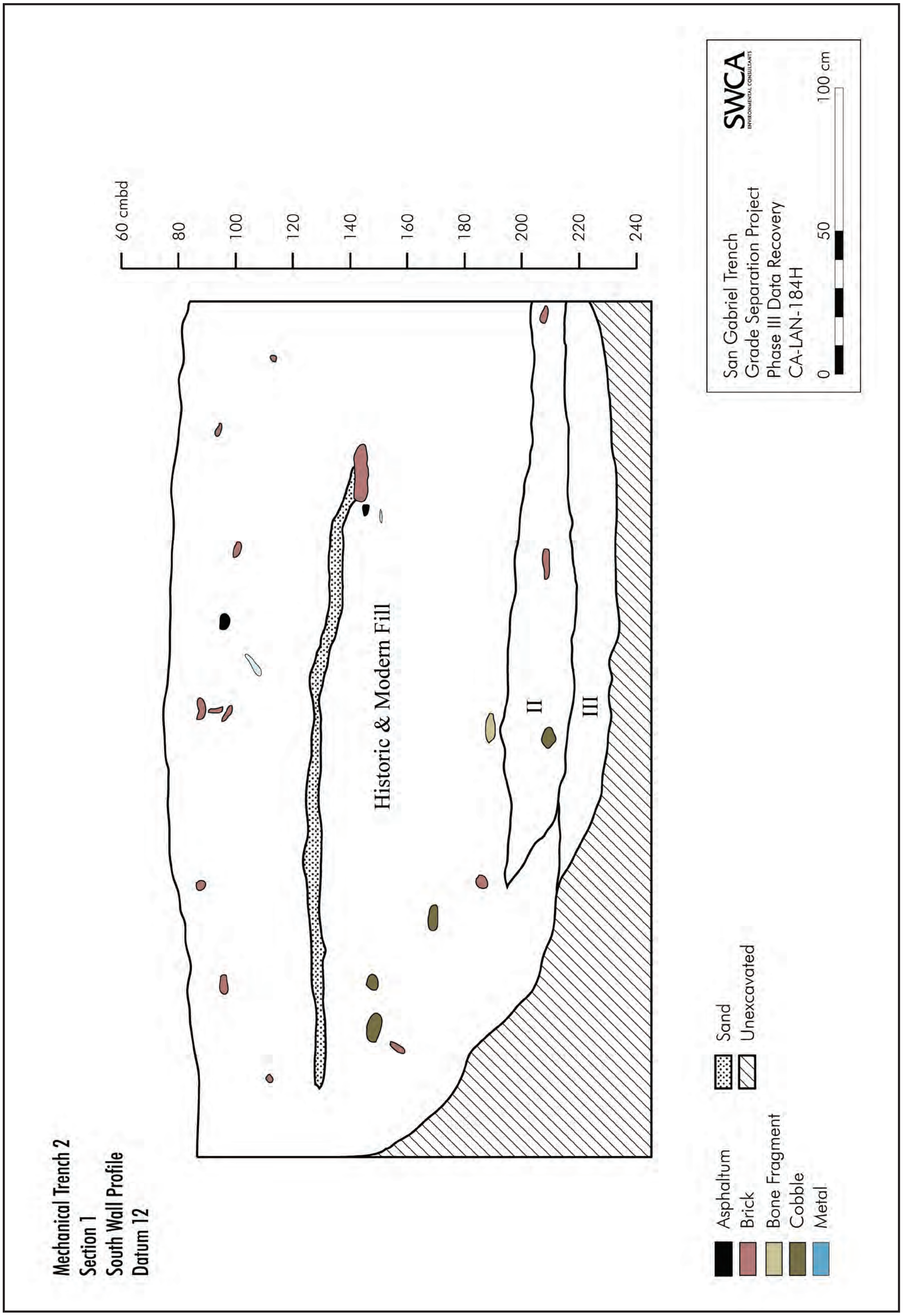

Figure 5.18. Stratigraphic profile of south wall of MTR 2 Section 1.

Stratum I was found to have abundant Mission-period and later cultural materials such as brick and tile fragments, large mammal bones, and ceramics. Visually, this material appeared to drop in density with depth.

Through the majority of this profile, Stratum I was truncated by two features: Features 3, 5, and 9, the footings and floor surface of a large adobe structure; and Feature 14, a large refuse pit that truncated the floor of Features 3 and 5. As Figures 5.19, 5.20, and 5.21 show, Feature 14 was a dense refuse dump containing numerous artifacts that appear to represent post-Mission period occupation of the site. The features will be discussed in more detail below. Strata IIIa and IIIb underlay Stratum I. These strata represent late Pleistocene/early Holocene alluvial activities and are nearly devoid of cultural materials. Any artifacts found in these strata were likely the result of bioturbation.

Features 3 and 5 were the cobble footings for a large structure that was oriented roughly north–south in Area 1. The profile in this location clearly displays the remnant of an earthen floor surface approximately 10–20 cm below what is assumed to have been the ground surface during the Mission period. This surface was a fine silty lens approximately 5 cm thick. Underlying this surface was a very thin (1 cm or less) lens of plaster (Figure 5.21; see also Figure 5.19). Similar plaster lenses were found near cobble footings at other locations of the site, and it may represent a pre-treatment that was placed below earthen floor surfaces, as seen in this feature. Stratum I was also found to overlie this grey silt lens, and near the western stone footing there was a truncated lens of asphaltum that appears to represent fallen roofing material.

An historical sketch of San Gabriel Mission produced by Henry Miller in 1856 includes a building in the approximate location of the foundation in Area 1 (Figure 5.22, lower right). It has a flat roof without tiles, and it likely represents an adobe building roofed with reeds that were coated with tar. It is possible that the lens of asphaltum seen in this profile is the remnant of a roof structure that collapsed or slowly fell into disrepair. This surface was exposed in EUs 191, 242, and 243 (Figure 5.23). Where it was not truncated by Feature 14, this lens of asphaltum was identified in most of the units excavated within the interior of this structure.

MTR 3 Sections 1 and 2

MTR 3 was located in the northern portion of the project area, north of the railroad tracks and south of Mission Road. Although the northern portion of the project area has suffered significant disturbance, the disturbance largely underlay Sections 1 and 2 of MTR 3. Subsurface horizontal boring conducted prior to SWCA's involvement with the project was used to lay a fiber optic cable in this location, thereby disturbing only the lower, usually culturally sterile strata. Four strata were observed in the western portion of MTR 3. The sequence is similar to MTR 1 and other locations profiled on site: Modern Fill, then Strata Ia–Ic–III (Figure 5.24). The uppermost stratum was a heavily disturbed Modern Fill lens containing modern refuse and construction debris as well as redeposited Mission-period materials. This poorly-sorted, mixed deposit displayed no soil development characteristics, and it appeared to represent a relatively recent dumping episode, possibly associated with construction of the railroad grade or Mission Road. Most of this stratum was removed prior to documentation of stratigraphy in this trench.

In this area of the site, Stratum Ia underlies Stratum I and was relatively thin, containing abundant bioturbation and disturbance related to the construction of the railroad and other post-Mission-period activities. The stratum has a clear lower boundary and distinct oxidized coloring, suggesting that it formed due to weathering of adobe materials (adobe melt) preserved in situ at the western terminus of the trench. Stratum Ic underlies Stratum Ia, and is relatively thick in this portion of the site compared to other locations such as in MTR 1 to the south. Like other locations in the site, Stratum Ic contains abundant Mission-period cultural materials and sandy gravel lenses representing overland sheetflow and braided stream deposits.

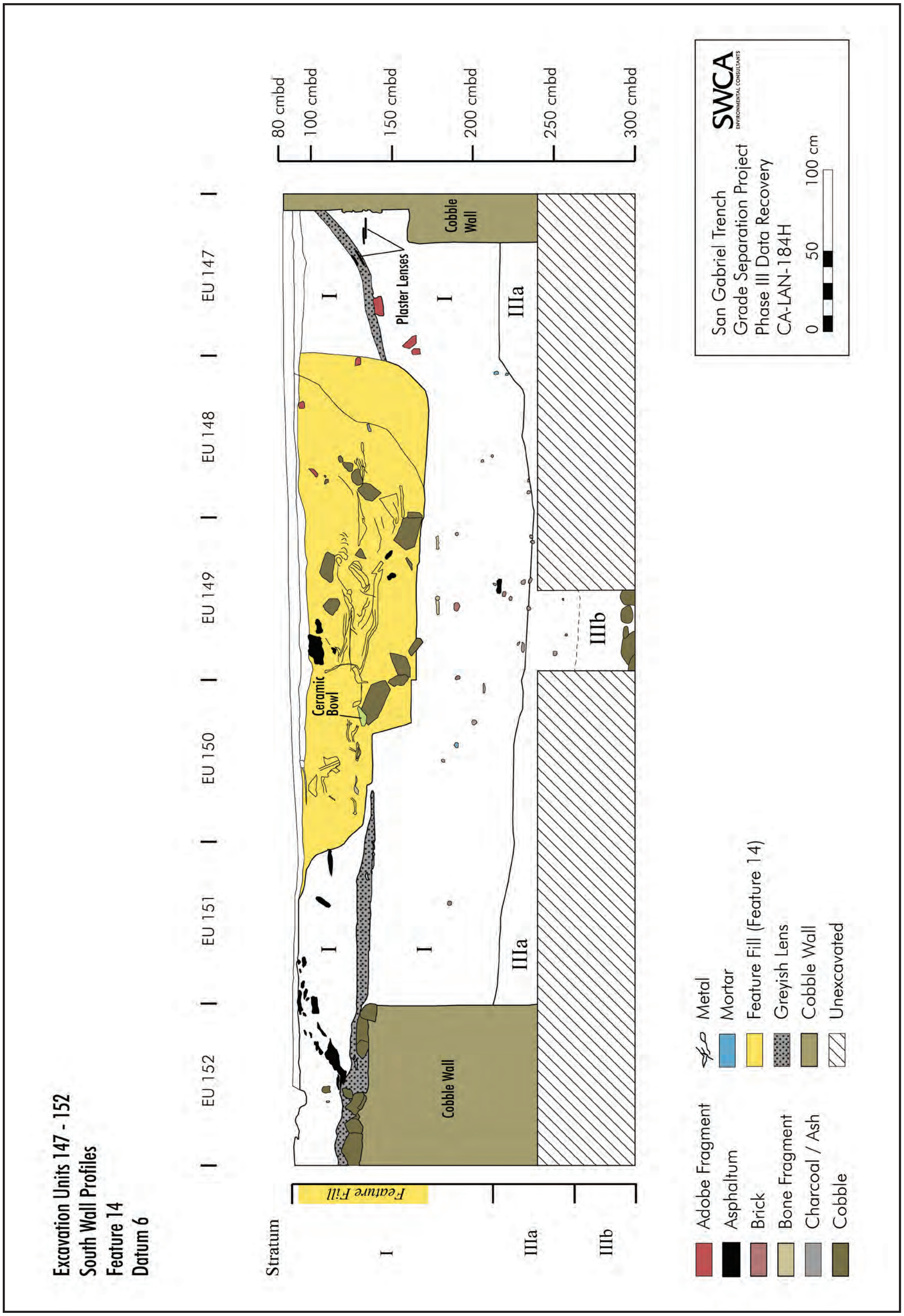

Figure 5.19. Stratigraphic Profile of EUs 147–152, south wall.

Figure 5.20. Feature 14 in profile, view facing north.

Figure 5.21. EU 152 north wall profile.

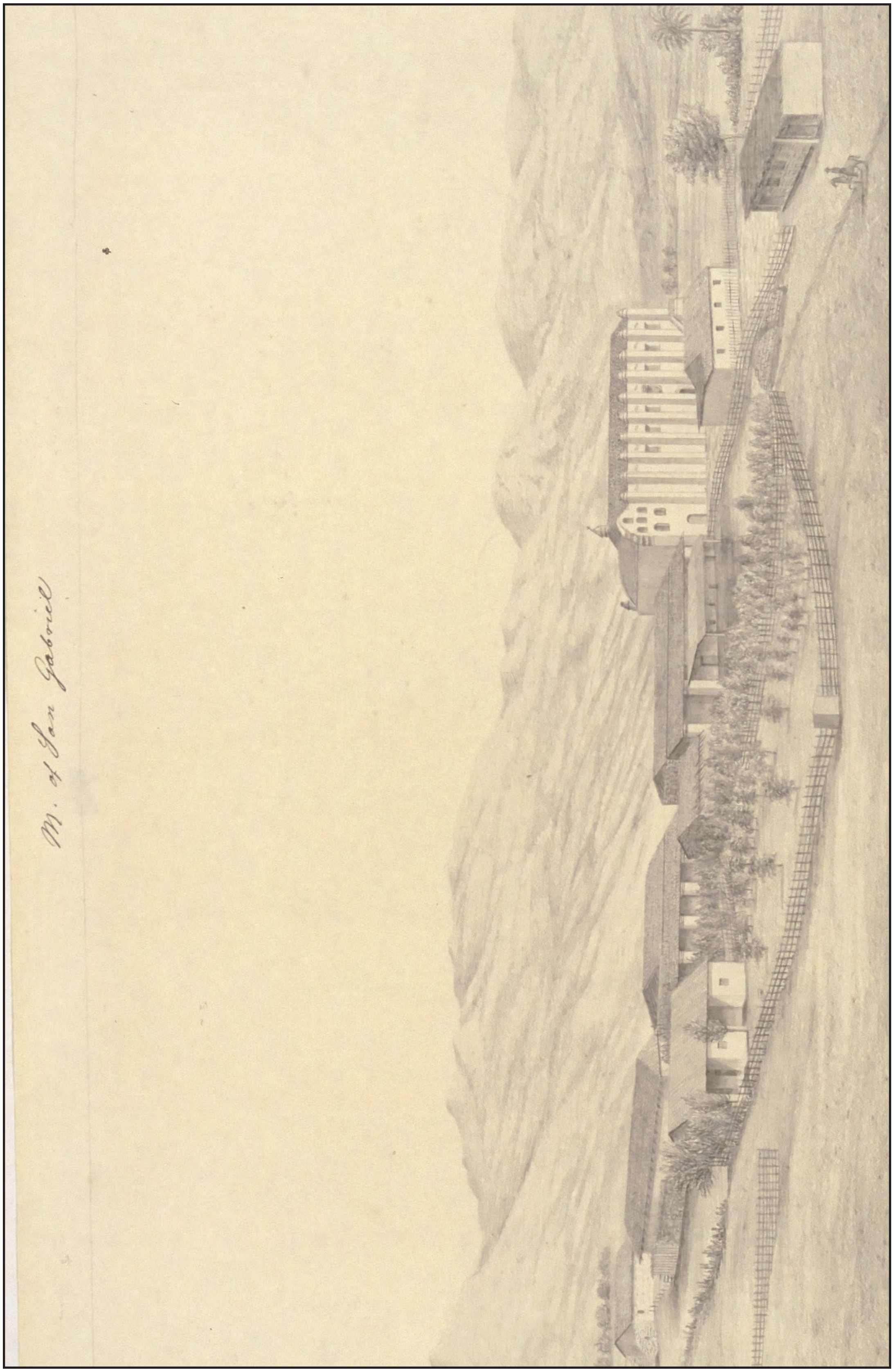

Figure 5.22. Sketch of San Gabriel Mission by Henry Miller in 1856. Possible tar-roofed structure in foreground at bottom right. Image courtesy of The Bancroft Library, University of California, Berkeley.

Figure 5.23. Photograph of EUs 191, 242, and 243 showing surface of asphaltum.

Several charcoal lenses were identified, possibly representing episodes of trash burning or dumping of ash. Several of the charcoal lenses are concentrated at the stratum's lower boundary, and may represent an historical occupational surface. This stratum is roughly equivalent to Stratum Ic in MTR 1. The lowest stratigraphic layer identified in MTR 3 is Stratum III. In MTR 3, Stratum III has a relatively low density of cultural materials. The upper portion of this lens is representative of early Holocene or late Pleistocene alluvium, and the upper boundary likely contains the earliest Mission-period components at the site.

Summary

Stratigraphic integrity was relatively high for most areas of San Gabriel Mission archaeological site investigated during this study, especially considering the amount of human alteration of this landscape following the Mission period. The effects of modern and historical alterations from the placement of the railroad, and historical and modern roadways have made a surprisingly low impact on the site. More modern features such as conduit for fiber optic lines and water lines have made much stronger impacts on cultural resources within the study area. Surprisingly, we see very little evidence of farming activities at the site. Although we know that much of the study area fell within a location known as a garden area, we saw no stratigraphic evidence for this type of use. It is likely that the mixing of the upper strata relates to such activity—which would have created a type of plow zone—but there were no signs of furrows or plow scars, elements that are often seen in areas

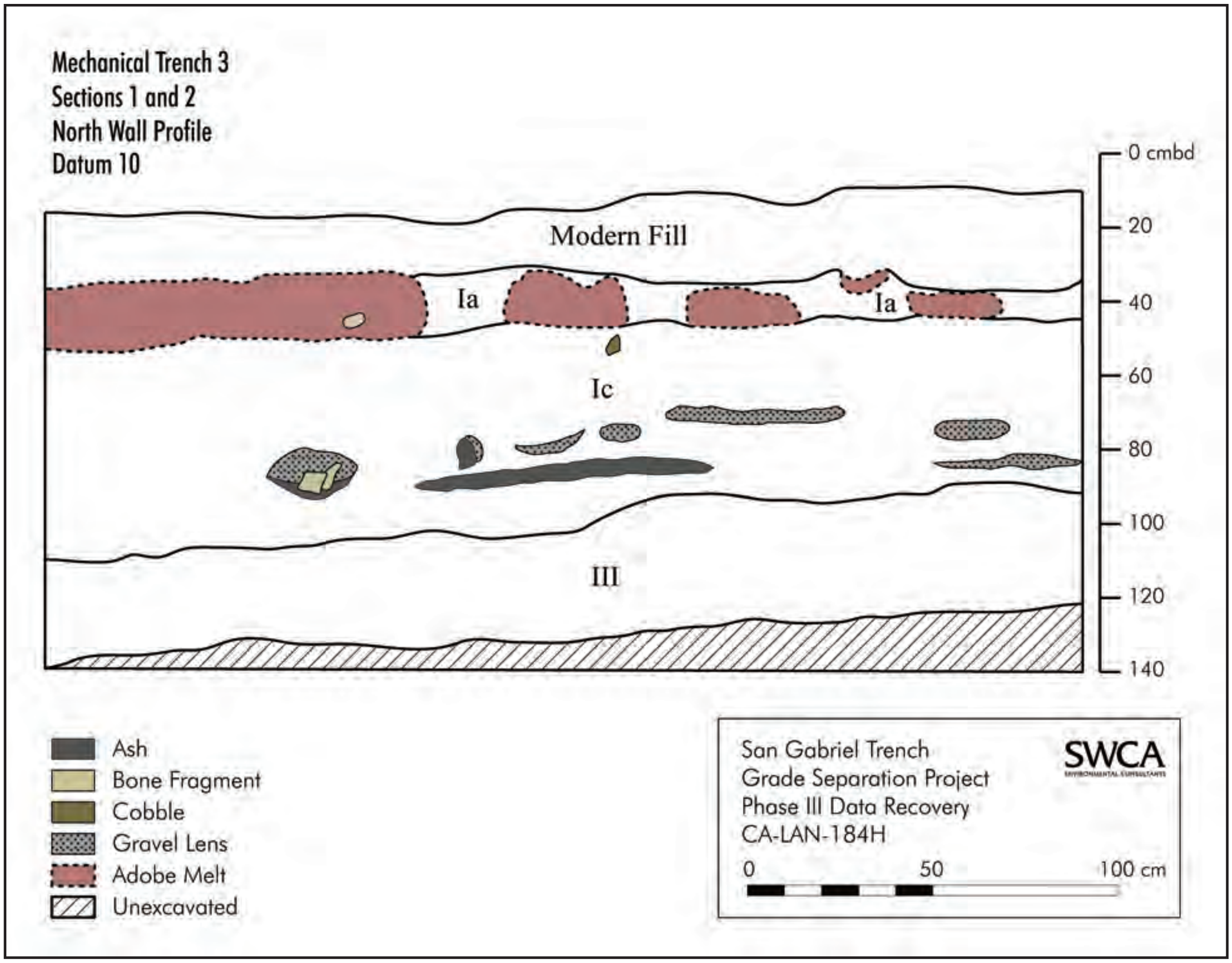

Figure 5.24. Stratigraphic profile of MTR 3 Sections 1 and 2, north wall.

where large-scale farming takes place. It is likely, that the area under investigation was subject to small-scale farming that resulted in less of an impact to the buried cultural resources at the site.

A general stratigraphic sequence is repeated at most locations that were recorded in detail, with some important variations. Generally, disturbed modern fill deposits overlie a series of relatively stable surfaces containing varying amounts of cultural materials (Stratum I). Stratum I can be divided into three soil horizons (Strata Ia, Ib, and Ic) with varying degrees of stratigraphic integrity and a diversity of cultural materials. Generally, Stratum Ia (an A horizon soil) is heavily bioturbated and contains a mixture of modern, late Historic-period, and Mission-period cultural materials. For the most part, features were not identified within this stratum, although structural features such as the millrace complex in Area 2 and the large adobe structure in Area 1 intersect Stratum Ia.

Stratum Ib appears to be less disturbed than Stratum Ia; however, it still contains a fairly high density of later Historic-period cultural material, indicating that it may be later in age. Stratum Ib tends to have a high amount of adobe-based construction debris, such as melted adobe bricks, fragments of fired adobe bricks, tiles, and pipes, and other construction debris. Stratum Ib also contains abundant Mission-period artifacts such as Native American ceramics, early nonnative ceramics, and artifacts of metal and glass. It is likely that Stratum Ib represents a late Mission-period/early Secularization-period deposit. Some features such as ash lenses and refuse deposits were found in this stratum.

Stratum Ic, while showing signs of bioturbation, seems to have the most stratigraphic integrity of the three sub-strata that compose Stratum I. In most areas where Stratum Ic was recorded, ash lenses and other possible dumping features were identified (Figure 5.25). Relatively higher densities of artifacts of Native American manufacture are found in this stratum, such as brown ware ceramics, lithic artifacts, and shell beads. Items of nonnative manufacture are also present in this stratum, but they are generally seen at somewhat lower densities, which may indicate that Stratum Ic dates to earlier in the Mission period. Stratum Ic is a buried A horizon soil, indicating surface stability. Stratum Ic contains the remnants of Mission-period activity areas and midden accumulation with its upper boundary, likely representing an earlier Mission-period surface.

Stratum II is only found in the eastern and east-central portions of the study area. As described above, Stratum II is representative of higher velocity alluvial flows comprising interbedded sands and gravel layers. Stratum II is the remnant of a channel that runs roughly from the northwestern portion of the study area to the southeast, where it intersects the millrace feature complex in Area 2. Where possible, Stratum II was divided into five sub-strata with varying degrees of coarseness and sand content, indicating differences in intensity of flow. The bedding indicates pulses of flow followed by periods of slower sedimentation, which points to regular and repetitive use of the channel. Near the millrace feature complex, the various substrata of Stratum II have relatively high densities of cultural materials. Adobe-based construction debris, large mammal bones, and Native American and nonnative ceramics are the cultural materials found in highest densities

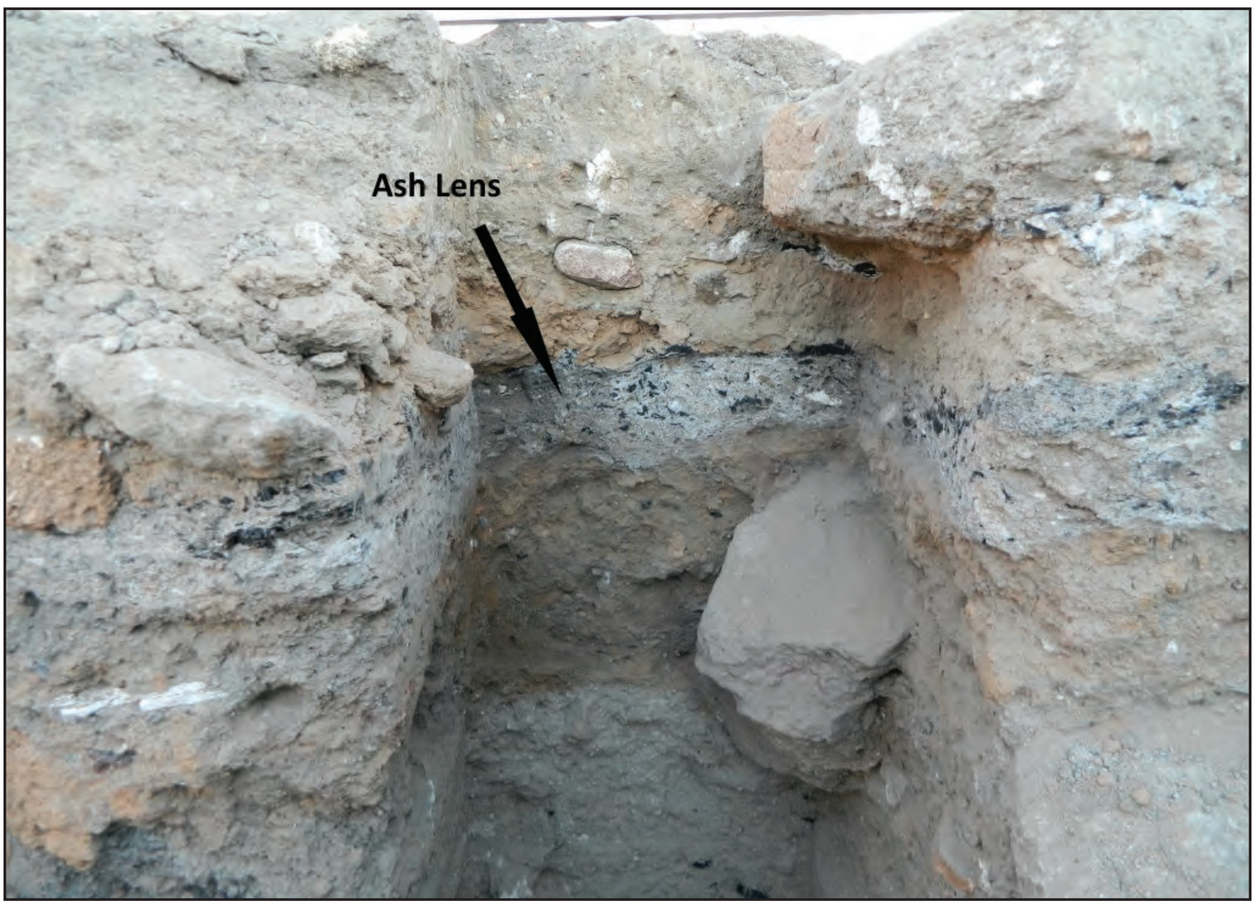

Figure 5.25. Ash lenses in Stratum Ic, view facing north.

in this stratum. It is not clear whether these cultural materials were dumped into the channel or whether they were washed down the channel to this location from other parts of the site. Another possibility is that this material was purposely deposited to stabilize and control the incising or down-cutting of the channel. It is also not clear whether this channel was completely natural, or if it was created or simply enhanced by human activity. We posit that this channel was a precursor to the millrace and fed the reservoir feature that was part of the millrace complex.

Stratum III is represented in all locations where relatively deep excavation was conducted on the site. Stratum III was divided into two sub-strata (Strata IIIa and IIIb) where possible. Stratum IIIa likely represents the earliest Mission-period occupation of the site and as well as early Holocene alluvium, while Stratum IIIb dates to the Pleistocene and generally is devoid of cultural materials. The upper portions of Stratum III generally contain what appears to be early Mission-period materials and tend to have higher ratios of Native American to nonnative ceramics, as well as artifacts of Native American manufacture such as shell beads and lithic debitage and tools. The contact between the upper portion of Stratum III and either Stratum Ib or Stratum II may in fact represent a relic surface dating to the early Mission period. Some features such as refuse dumping locations are located in Stratum III, and some structural elements such as cobble footings for adobe structures and components of the millrace feature complex intersect this stratum (Figure 5.26).

Figure 5.26. Cobble footing for Millrace in Stratum IIIa, view facing northwest.

CHAPTER 6: FEATURES

Laura E. Hoffman, James M. Potter, and Heather Gibson

Forty-five features were excavated during data recovery excavations at San Gabriel Mission (Table 6.1, Figures 6.1, 6.2, and 6.3). This chapter describes the attributes and associations of each feature and, when possible, offers interpretations of the function(s), dates of construction, and use of each.

The features can be divided into those that were part of a structure and those that were not. Of the 45 features, 20 were structural. These included

- two sections of Chapman's Millrace (Feature 1 south of the railroad tracks and Feature 2 north of the tracks);
- nine wall segments: four wall segments (Features 3, 5, 36, and 44) that constituted the foundation of a building in Area 1, three wall segments (Features 12, 21, and 31) that comprised portions of the reservoir complex in Area 2, one wall segment (Feature 20) that was associated with Chapman's Mill and Millrace, and one isolated wall segment (Feature 34) that is interpreted as a portion of the garden wall;
- four tile floors: three (Features 9, 13, and 45) associated with the interior and exterior of the structure in Area 1, and one (Feature 10) which is a reservoir floor in Area 2;
- a tile-ringed enclosure (Feature 11) adjacent to the east wall of the millrace;
- two ceramic pipelines (Features 37 and 47) associated with the reservoir complex in Area 2;
- a spillway (Feature 39); and
- a surface (Feature 22) associated with the building in Area 1.

The 25 non-structural features (with the exception of Feature 14) were generally not associated with the structural remains in Areas 1 and 2, and consisted of

- one isolated packed earthen surface (Feature 8);
- five ash features: two ash lenses or layers (Feature 7 and 29); and three ash-filled pits (Features 24, 25, and 28);
- one charcoal deposit (Feature 48);
- five post holes (Features 19, 49, 50, 51, and 52);
- seven wood posts (Features 16, 17, 18, 27, 32, 41, and 46);
- five refuse concentrations: four refuse pits (Features 14, 15, 35, and 38); and one artifact concentration (Feature 30); and
- one metal pipe (Feature 40).

The following sections discuss the details of each feature. Major structural features are organized by feature complex, which is defined as a collection of associated structural features. Non-structural and isolated features are described individually.

Table 6.1. Features Investigated in the Study Area during Data Recovery

Feature No.*	Feature Description	Associated Excavation Units	Width	Length	Thickness	Shape	Cross Section	Fully Excavated or Exposed	Stratum
1	Millrace	102, 103, 125, 126, 127, 128, 129, 130, 131, 132, 138, 139, 141, 142, 143, 144, 153, 154, 156, 169, 173, 174, 179, 180, 181, 182, 183, 184, 186	2.3 m E/W	9.46 m N/S	1.33 m	Linear	Basin	Yes	Originates in Stratum III and intersects Strata IIa-IIc and Ia-Ic
2	Millrace	MTR6 Sec3, HTR5, UNM 2, 264	2.54 m E/W	5.03 m N/S	0.45 m	Linear	Basin	No	Originates in Stratum III and intersects Strata IIa-IIc and Ia-Ic
3	Exterior wall segment	111, 112, 113, 114, 119, 120, 121, 122, 147, 188, 189, 190, 192, 195, 202, 216, 230, 232, 233, 234, 244	1.1 m E/W	12.93 m N/S	1.3 m	Linear	Rectangular	No	Originates in Stratum III and intersects Stratum I
5	Exterior wall segment	152, 159, 160, 161, 162, 163, 217, 218, 240	1.03 m E/W	6.93 m N/S	1.0 m	Linear	Unknown	No	Originates in Stratum III and intersects Stratum I
7	Ash lenses	118	14 cm E/W	26 cm N/S	6 cm	Irregular	Flat	Yes	Stratum Ic
8	Surface	115, 116, 117, 118	2 m E/W	2 m N/S	6 cm	Unknown	Flat	No	Contact between Ic and II

Table 6.1. Features Investigated in the Study Area during Data Recovery

Feature No.*	Feature Description	Associated Excavation Units	Width	Length	Thickness	Shape	Cross Section	Fully Excavated or Exposed	Stratum
9	Tile floor	120, 121, 133, 136	1.13 m E/W	1.6 m N/S	0.05 m	Irregular	Flat	No	Stratum I
10	Reservoir floor	101, 102, 103, 104, 123, 137, 138, 140, 199, 245, 246, 261, 262	4.52 m E/W	5.35 m N/S	Unknown	Triangular	Flat	No	Originates at the contact between Strata II and IIc
11	Tile-ringed enclosure	107, 108, 127, 142, 145	1.3 m E/W	2.01 m N/S	30 cm	Rectangular	Flat	No	Originates in Stratum Ia
12	Wall segment	129, 132, 157, 158, 169, 173, 198, 199, 200, 245, 246, 262	0.75 m SE/NW	9.0 m NW/SE	1.11 m	Linear	Rectangular	No	Originates in Stratum III
13	Tile floor	159, 163, 164, 165, 166, 167, 172, 177, 187, 259, 265	2.97 m E/W	5.39 m N/S	0.05 m	Irregular	Flat	No	Stratum I
14	Trash pit	147, 148, 149, 150, 151, 197, 241, 257	3.69 m E/W	4.15 m N/S	1.56 m	Irregular	Basin	No	Stratum I
15	Rubble pit	105, 106, 126	Unknown	Unknown	50 cm	Unknown	Basin	No	Originates at the contact between Strata Ia and IIa and continues through IIa, IIb, and IIc
16	Wood post	155	15.5 cm E/W	17 cm N/S	82 cm	Rectangular	Flat	Yes	Unknown origination, possibly Stratum III
17	Wood post	162	12 cm N/S	20 cm E/W	24 cm	Rectangular	Flat	Yes	Unknown origination, possibly Stratum III
18	Wood post	161	40 cm E/W	55 cm N/S	43 cm	Rectangular	Flat	Yes	Unknown origination, possibly Stratum III

Table 6.1. Features Investigated in the Study Area during Data Recovery

Feature No.*	Feature Description	Associated Excavation Units	Width	Length	Thickness	Shape	Cross Section	Fully Excavated or Exposed	Stratum
19	Posthole	158	25 cm E/W	40 cm N/S	26 cm	Irregular	Irregular	Yes	Unknown origination, possibly Stratum III
20	Exterior wall segment	HTR4, 168, 170, 171, 208, 236, 237, 209, 210	3.78 m E/W	2.93 m N/S	1.59 m	Irregular	Unknown	No	Unknown origination, possibly Stratum III
21	Exterior wall segment	HTR 3, HTR 4, HTR 6, HTR 7, 168, 169, 170, 171, 173, 175, 176, 209, 210, 215, 226, 227, 238, 239, 249, 251, 252	9.12 m E/W	5.22 m N/S	1.29 m	Irregular	Rectangular	No	Originates in Stratum III
22	Floor surface	112, 151, 152, 201, 243, 255, 256, 263	Unknown	Unknown	0.01 m	Irregular	Flat	No	Stratum I
24	Ash pit	154, 155	27 cm E/W	21 cm N/S	10 cm	Circular	Basin	Yes	Originates at the base of Stratum I and terminates in Stratum III
25	Ash pit	155	30 cm E/W	30 cm N/S	15 cm	Irregular	Irregular	Yes	Originates at the base of Stratum I and terminates in Stratum III
27	Wood post	192	10 cm E/W	10 cm E/W	60 cm	Circular	Flat	Yes	Unknown origination, likely Stratum III
28	Ash pit	103, 104	1.5 m E/W	1.0 m N/S	14 cm	Irregular	Flat	Yes	Post-use feature fill

Table 6.1. Features Investigated in the Study Area during Data Recovery

Feature No.*	Feature Description	Associated Excavation Units	Width	Length	Thickness	Shape	Cross Section	Fully Excavated or Exposed	Stratum
29	Ash layer	179, 203, 204, 205, 206, 219, 224, 225, HTR 1	5.8 m E/W	1.2 m N/S	17 cm	Irregular	Flat	No	Stratum Ic
30	Artifact concentration	216, 228	48 cm E/W	50 cm N/S	17 cm	Irregular	Irregular	No	Stratum Ia
31	Wall segment	HTR1, HTR2,179, 180, 183, 219, 220, 221, 245, 261	0.60 m SE/NW	7.79 m SW/NE	0.62 m	Linear	Irregular	No	Originates in IIIa, continues through to Ia
32	Wood post	MTR 1 Section 4	30 cm E/W	36 cm N/S	58.5 cm	Irregular	Flat	No	Stratum III
34	Wall segment	MTR 6, 270, 271, 283	1.45 m N/S	1.82 m E/W	Unknown	Linear	Flat	No	Stratum Ia
35	Trash pit	MTR 3 Sec 2, 268	1.0 m E/W	40 cm N/S	40 cm	Unknown	Unknown	No	Stratum Ia
36	Exterior wall segment	HTR8, UNM4, 267, 272	2.66 m N/S	5.33 m (E/W)	Unknown	Irregular	Unknown	No	Unknown origination, likely Stratum III
37	Caño	249, 250, 252	0.45 m E/W	4.65 m (N/S)	0.37 m	Linear	Cylindrical	No	Feature fill
38	Rubble pit	274	1 m	1 m	43 cm	Unknown	Flat	No	Stratum Ia
39	Spillway	HTR 1, HTR 2, 211, 212, 213, 214, 245	1.80 E/W	1.80 m N/S	0.10 m	Square	Flat	Yes	Stratum Ia
40	Metal pipe	MTR 1 Sec 1	20 cm E/W	1.24 m N/S	17 cm	Rectangular	Circular	No	Stratum III
41	Wood post	251, 252	34 cm E/W	20 cm N/S	30 cm	Square	Flat	No	Unknown origination, likely Stratum III

Table 6.1. Features Investigated in the Study Area during Data Recovery

Feature No.*	Feature Description	Associated Excavation Units	Width	Length	Thickness	Shape	Cross Section	Fully Excavated or Exposed	Stratum
44	Interior wall segment	114, 197, 255, 256	0.60 m N/S	3.70 m (E/W)	Unknown	Linear	Unknown	No	Unknown origination, likely Stratum III
45	Tile floor	254, 255	0.70 m E/W	1.03 m N/S	0.05	Irregular	Flat	No	Stratum Ia
46	Wood post	255	10 cm E/W	10 cm (4 inches) N/S	Unknown	Square	Unknown	Observed but not excavated	Unknown origination, likely Stratum III
47	Caño	250, 284	0.33 m E/W	0.96 m N/S	0.26	Linear	Cylindrical	No	Feature fill
48	Charcoal	264	22 cm E/W	20 cm (8 inches) N/S	3 cm	Irregular	Flat	No	Stratum Ia
49	Post hole	245, 261	23cm N/S	24 cm E/W	10 cm	Circular	Flat	Yes	Unknown origination, likely Stratum III
50	Post hole	123,199	36cm N/S	35 cm E/W	6 cm	Circular	Flat	Yes	Unknown origination, likely Stratum III
51	Post hole	104, 137	73cm	24 cm	10 cm	Circular	Flat	Yes	Unknown origination, likely Stratum III
52	Post hole	131	25cm N/S	24cm E/W	6 cm	Circular	Flat	Yes	Unknown origination, likely Stratum III

**Note:* Not all feature numbers are used

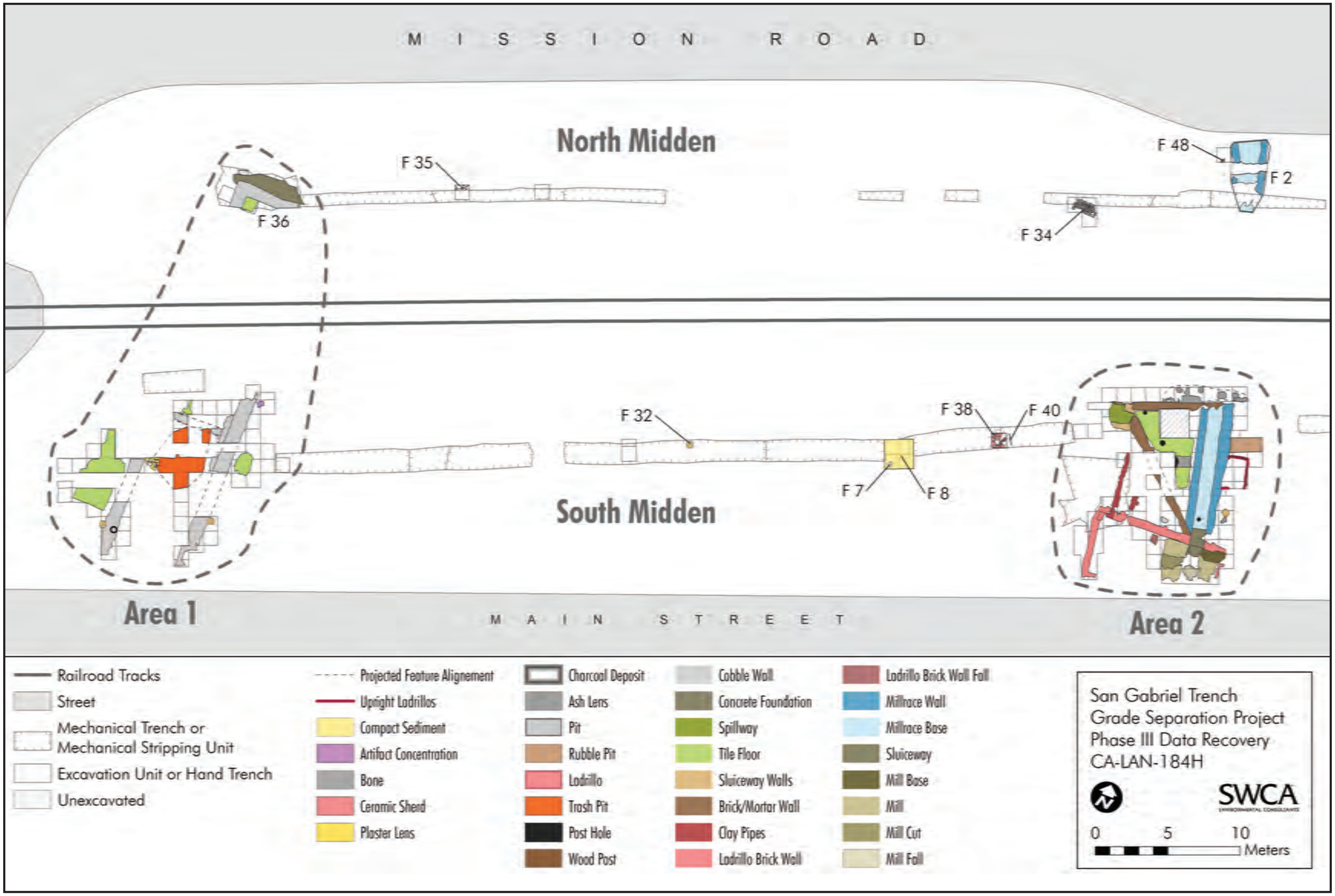

Figure 6.1. Features investigated in the study area during data recovery. Features within Areas 1 and 2 are labeled in Figures 6.2 and 6.3.

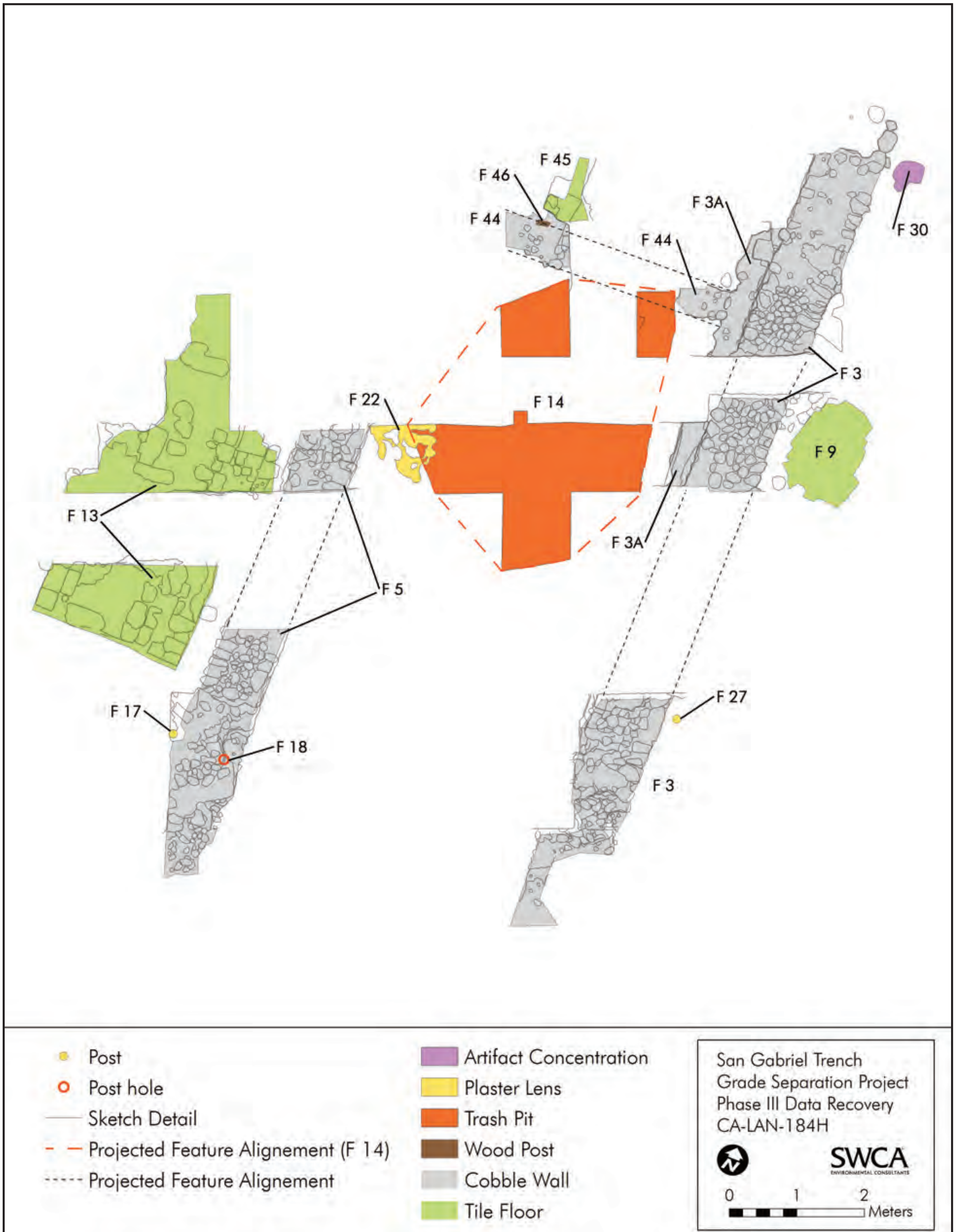

Figure 6.2. Area 1 features in the portion south of the railroad tracks.

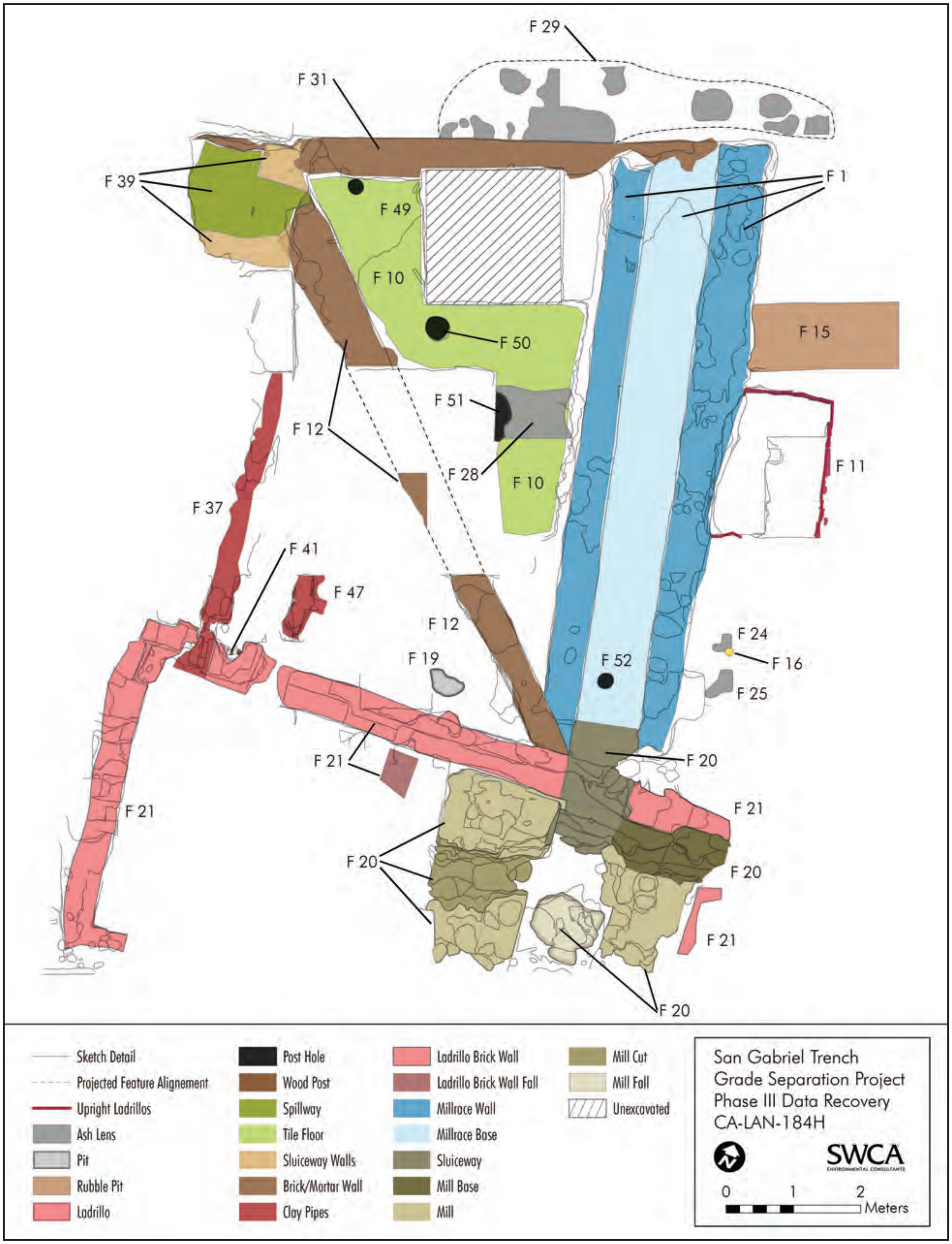

Figure 6.3. Area 2 features.

Structural Feature Complexes

Rectangular Reservoir: Features 21, 37, and 47

The rectangular reservoir was a complex of features located in the center of Bishop's Garden and associated with Chapman's Mill and Millrace. It was constructed during the Mission period, likely prior to the construction of the triangular reservoir and Chapman's Mill and Millrace. Its original purpose was likely as a reservoir to store water for domestic, agricultural, and industrial uses. It was later incorporated into Chapman's Mill, at which point it was likely no longer used as a reservoir.

The rectangular reservoir comprised Features 21, 37, and 47 and was rectangular in shape, measuring 5.06 m (north-south) × 9.39 m (east-west) (Figure 6.4). Feature 21 consists of the wall segments of the reservoir, and Features 37 and 47 were two pipelines made from caños encased in mortar and tile fragments. Feature 37 intersected the north wall of the reservoir, and Feature 47 likely also intersected the north wall of the reservoir, although the final segment of the pipe was absent. Although the northern extents of Features 37 and 47 were not exposed during data recovery excavations, the two pipelines were identified while monitoring the removal of the millrace. At their northern extents, Features 37 and 47 intersected Feature 12, the west wall of the triangular reservoir. Feature 41 was a wood post that was intrusive to the reservoir at the northwest corner.

To expose the reservoir, the team excavated four hand trenches, 17 excavation units, and one mechanically stripped unit (MSU). All sediment from the hand-excavated units and trenches was screened through ⅛-inch hardware mesh, with a few exceptions. Sediment from three levels from four excavation units, as well as from three levels from two hand trenches, was screened through ¼-inch hardware mesh. All sediment from the MSU, from two hand trenches, and from 187–260 cmbd (Datum 2) of one additional hand trench was not screened. During excavations for the millrace move, the team mechanically excavated the area adjacent to the reservoir and removed Features 37 and 47, as well as the west wall and the western half of the north wall of Feature 21. The team did not collect sediment or other samples for special analysis from the rectangular reservoir.

Three walls (north, east, and west) of the reservoir were constructed of stacked ladrillos and mortar. The south wall was constructed of cobbles varying in size held together with mortar. It appears that at least the northwest section of the interior of the reservoir was lined with adobe bricks and plastered, although this may be the result of later modifications associated with the incorporation of the reservoir into the structure of Chapman's Mill.

The lower levels of the features originated in Stratum III and extend through Stratum II and Stratum I in their uppermost sections. Sediment removed from the interior of the reservoir consisted of a mix of post-use fill, wall debris, and unfired adobe brick in some areas. Only areas surrounding structural elements were investigated with excavation units, so we do not have stratigraphic information from a large portion of what would have been the interior of this structure.

Construction Details

Feature 21

Feature 21 comprised portions of three sides and a segment of what may have been a fourth side of the rectangular reservoir (see Figure 6.4). Features 21B–21H comprised the north, east, and west sides of the reservoir and were constructed of stacked ladrillos and mortar. One segment of the north wall, Feature 21D, shows evidence of a plaster-lined interior. It is unclear whether the top row of ladrillos at the structure's highest extent (in the northwest corner) represents the top of the walls, or if some courses have been removed. Feature 21A, a fragment of what may be the south wall or an interior wall of the reservoir, was constructed of cobbles and mortar. If this fragment was the south wall, the reservoir would have measured 9.38 m (east-west) × 5.06 m (north-south) × 1.29 m (high). However, if Feature 21A was an interior wall, the north-south extent of the reservoir would have been greater than 5.06 m.

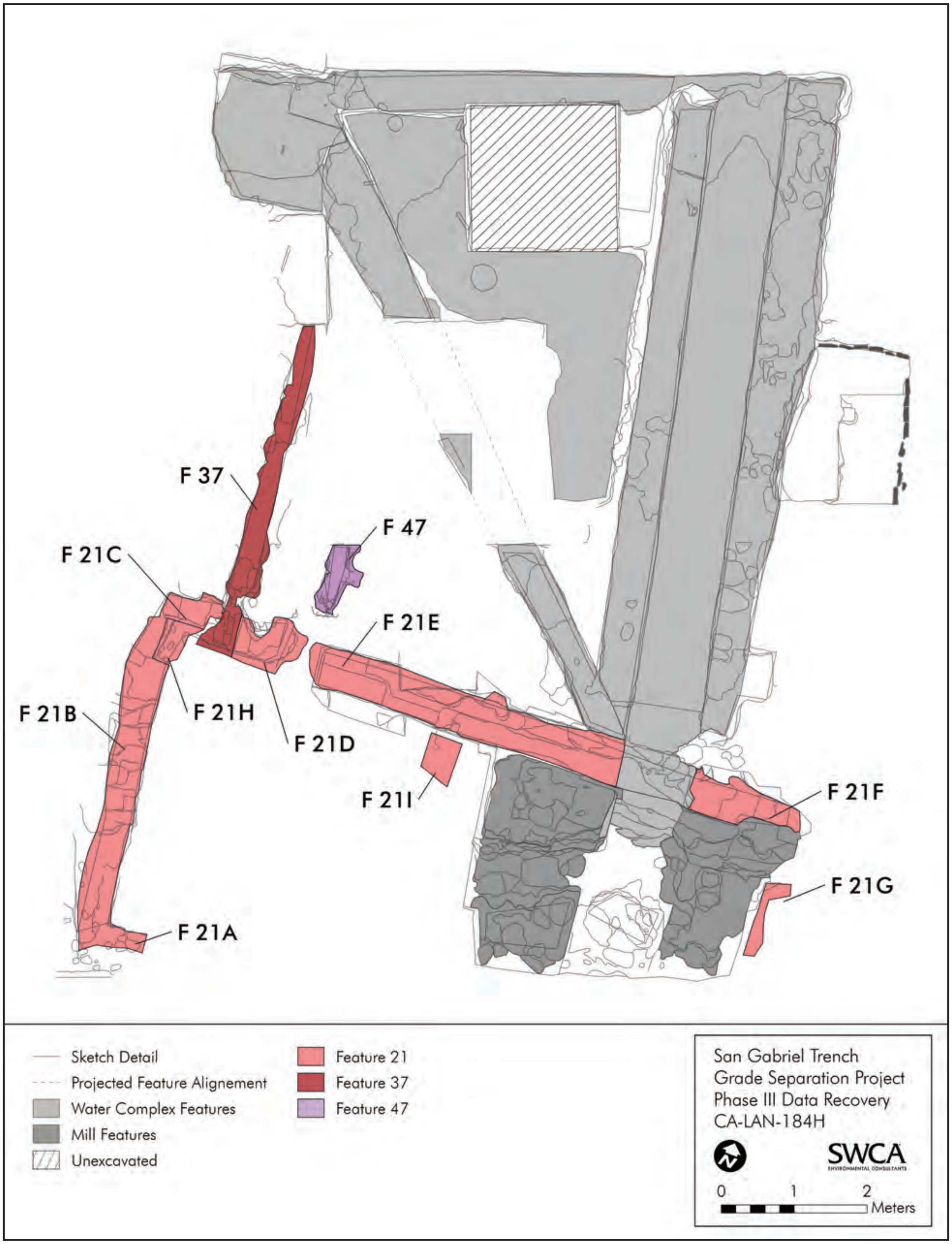

Figure 6.4. Features comprising the rectangular reservoir.

Feature 21I was a detached fragment of wall that was located in the interior of the reservoir. In at least the northwest corner of the reservoir, the ladrillo walls were lined with unfired adobe bricks in the interior of the structure. Like the interior of the Feature 21D, these bricks were also plastered. The interior adobe lining of the walls may be associated with modifications to the structure that were completed after the rectangular reservoir was incorporated into the structure of Chapman's Mill. With 14 excavation units and four hand trenches, the excavation team almost completely exposed the horizontal extent of Feature 21 and partially exposed the vertical extent of the feature.

Feature 21A consisted of a small segment of what may have been the south wall or an interior wall of the structure, measuring 0.33 m (north-south) × 0.52 m (east-west) (Figure 6.5). The team did not excavate the vertical extent of the segment, thus the height is unknown. The construction of Feature 21A differs from the other wall segments; it was constructed of cobbles and mortar rather than stacked ladrillos and mortar. The difference in construction materials may indicate that Feature 21A was a later addition to the structure, a repair to the original wall, or perhaps an interior wall of the structure.

Features 21B–21I were constructed of up to 10 courses of stacked ladrillos and mortar, and comprised the west, north, and east walls of the reservoir (Figure 6.6). Feature 21B was the west wall of the structure, measuring 4.70 m (north-south) × 0.56 m (east-west).

Feature 21C was a segment of the north wall at the northwest corner of the feature and measured 0.49 m (north-south) × 0.72 m (east-west). It was constructed of an unknown number of courses of stacked ladrillos and mortar. The vertical extent of the segment was not exposed, although it was likely the same height as the adjacent west wall (Feature 21B).

Figure 6.5. Feature 21, Segments 21A and 21B, plan view east.

Feature 21D was a segment of the north wall of the reservoir, located adjacent to Feature 21C and measuring 0.78 m (north-south) × 1.15 m (east-west). It was constructed of at least 10 courses of stacked ladrillos and mortar, and the interior of the wall segment was lined with plaster. Feature 37, a pipe made of caños, intersects the reservoir at the top of the wall segment on the west side. Feature 41, a posthole and wood post fragment, was intrusive to Feature 21D.

Feature 21E was another section of the north wall of the reservoir, measuring 0.59 m (north-south) × 4.5 m (east-west). It extended east to the millrace and was constructed of at least 10 courses of stacked ladrillos and mortar. There was a "V"-shaped gap between Features 21D and 21E. The cut appears to have been made at some point after the original construction of the wall, as the cut walls were ragged and without finished edges. If Feature 47, a pipe made of caños, continued southward and intersected the reservoir wall, it would have been present at this location. Because the cut between Features 21D and 21E extends to the bottom of the wall, Feature 21 would no longer have been a functional reservoir once the cut was made.

Feature 21F was the easternmost segment of the north wall, measuring 0.63 m (north-south) × 1.61 m (east-west). The segment was constructed of at least six courses of ladrillos and mortar, and it extends from the east side of the millrace to the northeast corner of the reservoir. There is a 1.04-m gap between Feaures 21E and 21F where the sluiceway into Chapman's Mill was later placed; the segment of the north wall that presumably existed here appears to have been incorporated into the design of the millrace and was covered by the construction of the sluiceway at the south extent of the millrace.

Feature 21G was part of the east wall of the reservoir, located 0.75 m south of the northeast corner of the reservoir and measuring 1.04 m (north-south)

Figure 6.6. Northwest corner of rectangular reservoir showing adobe brick and plaster-lined interior of the structure and the intersection of Features 37, 47, and 21. View facing northwest.

× 0.35 m (east-west). It was constructed of at least three courses of ladrillos and mortar and was incorporated into the construction of Chapman's Mill.

Feature 21H comprised the interior of the northwest corner of the reservoir, measuring 0.55 m (north-south) × 0.70 (east-west). This segment consisted of the remains of adobe bricks and one vertical and two horizontal layers of plaster. The vertical plaster layer forms a continuous surface with the plaster lining of the interior of Feature 21D.

Feature 21I was a fragment of one of the ladrillo and mortar walls, located approximately 0.11 m south of Feature 21E and 3.78 m east of Feature 21B. The fragment measured 0.62 m (north-south) × 0.45 m (east-west), and was likely displaced from one of the wall segments nearby.

Feature 37

Feature 37 was a pipeline made from caños encased in mortar and tile fragments. The segment that was exposed during data recovery measured 4.67 m (north-south) × 0.52 m (east-west) × 0.37 m (high). The pipe intersected Feature 21 at a point 0.64 m east of the northwest corner of Feature 21, and the west edge of Feature 37 aligned with the interior corner of Feature 21 (segment 21H). Feature 37 ran parallel to Feature 47. The pipe was positioned for water to flow directly into the rectangular reservoir (Feature 21). The north end of Feature 37 was exposed during later excavations for the millrace removal, and this end of the pipe intersected the triangular reservoir at its northern extent.

Feature 47

Feature 47 was a pipeline made from caños encased in mortar and tile fragments. The segment exposed during data recovery measured 0.54 m (north-south) × 1.05 m (east-west) × 0.26 m (high). The extant remains of the pipe did not intersect Feature 21, the rectangular reservoir. However, it appears that Feature 47 likely originally intersected Feature 21 at its southern extent, because the segment of wall where Feature 47 would have intersected Feature 21 (between Features 21D and 21E) was cut away in a "V" shape. Feature 47 ran parallel to Feature 37 and was positioned for water to flow directly into the rectangular reservoir. Only the southern segment of the feature was exposed during data recovery excavations, but the remainder of Feature 47 was exposed during excavations for the millrace removal, and Feature 47 intersected the triangular reservoir at its northern extent.

Associated Artifacts

Excavation Units (EUs) 207, 226, 227, 239, 251, and 252 were excavated within the fill of Feature 21 (Figure 6.7). The most numerous artifacts were earthenware building materials (28 percent), glass items (17 percent) and metal items (11 percent) (Table 6.2). Other historical artifacts, such as mortar and asphaltum, made up 37 percent of the items collected.

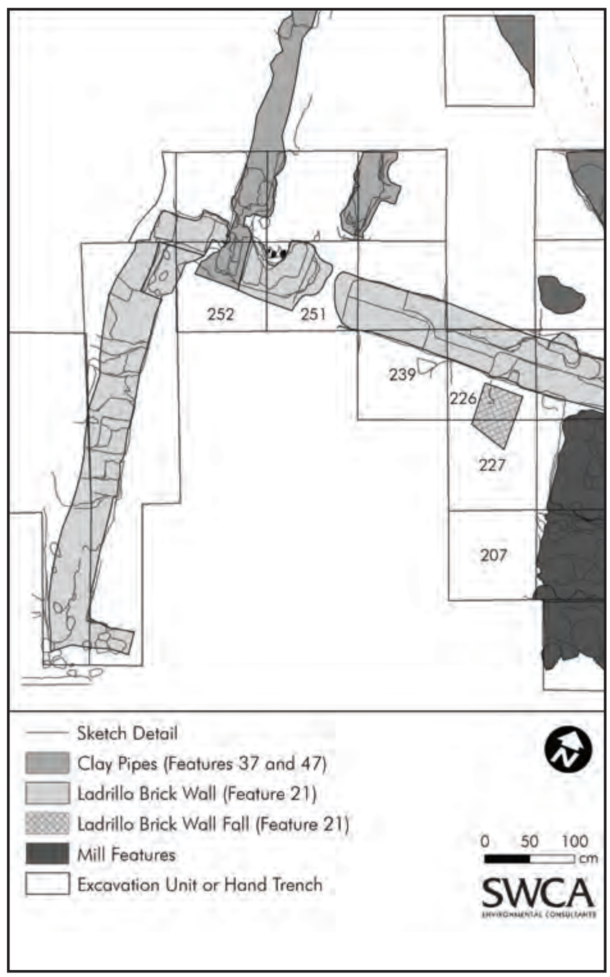

Figure 6.7. Excavation units containing fill from Features 21, 37, and 47, plan view.

Faunal material was also recovered from the feature, including faunal bone, shell, and shell artifacts. The ceramics recovered from these deposits were almost evenly divided between locally and regionally produced Native American ceramics (51 percent) and imported nonnative ceramics (49 percent). The stratigraphy suggests that these artifacts represent a post-use fill assemblage.

Temporally diagnostic artifacts recovered from the Feature 21 fill include several types of imported ceramic wares with production ranges from the mid-eighteenth century through the first decades of the nineteenth century. These include examples of majolica of the San Elizario (1750–1830s) and Puebla blue on white (1769–1830s) varieties; Galera Mexican soft paste earthenware (1780–1830); molded and undecorated creamware (1762–1810); edge decorated pearlware (1780–1820s), and transfer printed whiteware (1830–1860s). The mean ceramic date for this assemblage is 1807. In addition, six Prosser molded beads were recovered from the Feature 21 fill: four from EU 207 and one each from EUs 226 and 239. This manufacture technique post-dates 1840. Shell beads recovered from the fill include several types of olivella disk beads: Class H1b, which is typical of the Late Mission period (1800–1816); Class H2, which is typical of the Terminal Mission period (1816–1834); and Class H3, which is typical of the post-Mission period (1834–1900). The wide range of artifact dates within this fill assemblage suggests that multiple depositional episodes may have occurred following abandonment of the rectangular reservoir.

Interpretation

The rectangular feature complex made up of Features 21, 37, and 47 appears to have been constructed as a water reservoir. The plastered interior and two pipelines leading directly into the structure indicate that the structure was designed to hold water. The rectangular reservoir intersects the south end of both the triangular reservoir and Chapman's Millrace; it also intersects the north side of Chapman's Mill. The rectangular reservoir was incorporated into the structure of Chapman's Mill and Millrace at some point after its original construction; thus it was constructed prior to 1821. The interior adobe bricks observed in the northwest corner of the structure may be associated with this later event, as it seems unlikely that a tile-and-mortar structure designed to hold water would have been lined with adobe.

Triangular Reservoir: Features 1B, 10, 12, 31, and 39

The triangular reservoir was a complex of features located in Area 2 associated with Chapman's Mill and Millrace. It was constructed during the Mission period, possibly contemporaneously with Chapman's Mill, perhaps as the original millpond that stored water to power the mill. It was later incorporated into the final segment of Chapman's Millrace, at which point it was no longer used for its original purpose. It may have continued to be used to store water for some time, but during the Late Mission period (1825–1834) it ceased to be used as a reservoir and was subsequently filled with sediment and debris.

The triangular reservoir was comprised of Features 1B, 10, 12, 31, and 39, and had the shape of a rough right triangle. The three sides of the triangle measured 8.40 m, 10.60 m, and 12.08 m long (Figure 6.8). Feature 10 formed the floor of the reservoir, Feature 12 formed the west wall, Feature 1B formed the east wall, and Feature 31 formed the north wall. Feature 39 was the sluiceway into the reservoir, located at the northwest corner of the structure (Figure 6.9). Features 49, 50, and 51 were intrusive to the reservoir, and Features 1A and 1C were constructed on top of the triangular reservoir, likely to take advantage of the increased support and stability provided by the reservoir floor (Feature 10).

To expose the triangular reservoir, the team excavated four hand trenches and 42 excavation units. All sediment was screened through 1/8-inch mesh, with the exception of eight 20-cm levels from two excavation units as well as one 54-cm level and one 55-cm level from two hand trenches, which were screened through ¼-inch mesh. An additional 24 excavation units and four hand trenches were excavated to more fully expose the exterior of the reservoir and the stratigraphic context of the feature complex. This sediment was also screened through 1/8-inch mesh, with the exception of one 60-cm level and one 56-cm level from two hand trenches, which were screened through ¼-inch hardware mesh.

Table 6.2. Artifacts recovered from fill inside Feature 21

EU	Imported Ceramics	Local and Regional Ceramics	Earthenware Building Material	Faunal Bone	Shell	Shell Artifact	Glass	Ceramic and Glass Beads	Metal	Flaked Stone	Ground Stone	Other Historic Artifact	Total
207	41	14	349	150	4	4	556	7	741	-	-	486	**2,352**
226	6	18	674	196	2	1	695	1	323	-	1	984	**2,901**
227	6	16	581	166	-	-	338	-	265	1	-	1,142	**2,515**
239	8	11	507	90	1	2	416	2	53	1	-	729	**1,820**
251	2	14	923	43	-	-	114	-	26	-	-	632	**1,754**
252	12	6	557	54	-	-	120	-	20	-	-	756	**1,525**
Total	**75**	**79**	**3,591**	**699**	**7**	**7**	**2,239**	**10**	**1,428**	**2**	**1**	**4,729**	**12,867**

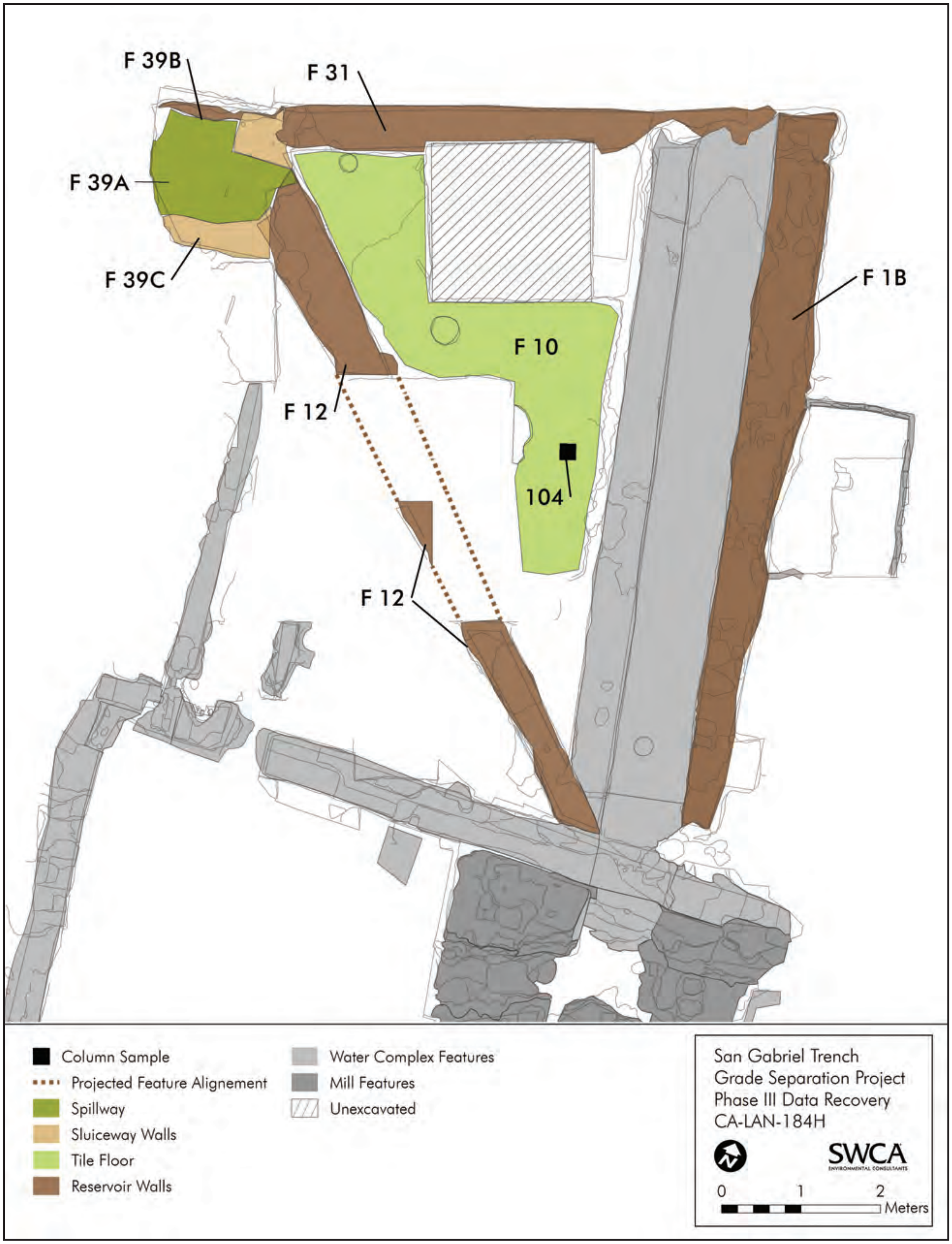

Figure 6.8. Triangular reservoir comprised of Features 1B, 10, 12, 31, and 39, plan view.

One column sample was collected from EU 104, located near the center of the reservoir. The 10 × 10-cm sample was collected stratigraphically, with additional arbitrary breaks at 10-cm intervals from 60 to 132 cmbd (Datum 2). The column sample was submitted to PaleoResearch Institute for macrobotanical and pollen analysis. An additional sediment sample was collected from shovel test pit (STP) 103—located under the floor of the reservoir inside EU 137—and submitted to PaleoResearch Institute for pollen analysis. The results of the analysis revealed evidence for a disturbed landscape dominated by native, shrubby weeds, with few trees. The sample included *Cerealia* pollen, representing direct contact with processed or unprocessed cereal grains such as wheat, barley, rye, or oats. In addition, a projectile point from EU 154 was submitted for protein residue analysis, but produced negative results (see Chapter 9 and Appendix C).

The three walls of the reservoir were constructed of cobbles varying in size held together with mortar. The mortar was tempered with fragments of tiles. The reservoir sluiceway and floor were constructed of ladrillos and mortar, and were covered with a smooth plaster finish. The interior sides of the walls were also finished with plaster. The upper portion of the reservoir and sluiceway walls had been removed in all areas that were exposed, but the base of the walls remained intact. The original height of the walls is unknown.

Sediment removed from the interior of the reservoir consisted of post-use fill that contained Mission-period artifacts, indicating that this fill was likely deposited while the millrace was in use, during the Mission period. The structure of the feature fill was complex, including lenses of ash, melted adobe, dense concentrations of artifacts, and lenses of debris such as broken tile, brick fragments, and plaster likely related to the demolition and deterioration of structures in this location. The complexity of the stratigraphy indicates that the reservoir was not filled by a single episode, but rather in a sequence of dumping events. The reservoir floor is built on top of the coarse sands of Stratum II and on the contact between Stratum I and Stratum IIIa. Importantly, the channel feature (Stratum II) was identified underlying the tiled floor of the reservoir (see Chapter 5).

Construction Details

Feature 1B: East Wall of Reservoir

Feature 1B was the north-south-trending wall that formed the east wall of the reservoir (see Figure 6.8). It measured 9.70 m (north-south) × 0.80 m (east-west) and was constructed of cobbles, fragments of tile, and mortar. Eighteen excavation units were hand excavated to expose the horizontal and vertical extent of the feature. Feature 1B varied in width from 0.80 m at its widest point, approximately 3.39 m south of its northern extent, to 0.35 m in width at its narrowest point at the south end of the feature. The height of the feature ranged from 1.33 to 0.8 m; however, an unknown amount of the upper portion of the wall had been removed prior to data recovery excavations, likely by railroad maintenance crews. Feature 1B was incorporated into Chapman's Millrace after the original construction of the triangular reservoir (see Feature 1 below). Webb (1952:166) indicates that the millrace was 76 cm deep, although it is unclear how much of that structure was part of the original height of the triangular reservoir.

Feature 10: Plastered Tile Floor

Feature 10 was the floor of the triangular reservoir. It was constructed of ladrillos and mortar covered with plaster to form a smooth surface (see Figures 6.8 and 6.9). The feature was partially exposed by hand excavating 13 excavation units. The exposed portion measured 5.98 m (northwest-southeast) × 3.04 m (east-west) at its greatest extent, and encompassed an area measuring 7.14 m^2. The exposed floor sloped down from north to south with a drop in elevation of 0.65 m over 5.98 m, an approximate slope of 0.11. The floor was 10 cm thick. Including the unexposed sections of Feature 10, the projected measurements were approximately 9.41 m (northwest-southeast) × 6.83 m (east-west), covering an area of approximately 30.93 m^2.

The junctures between Feature 10 and Features 12, 31, and 39 were plastered and formed rounded

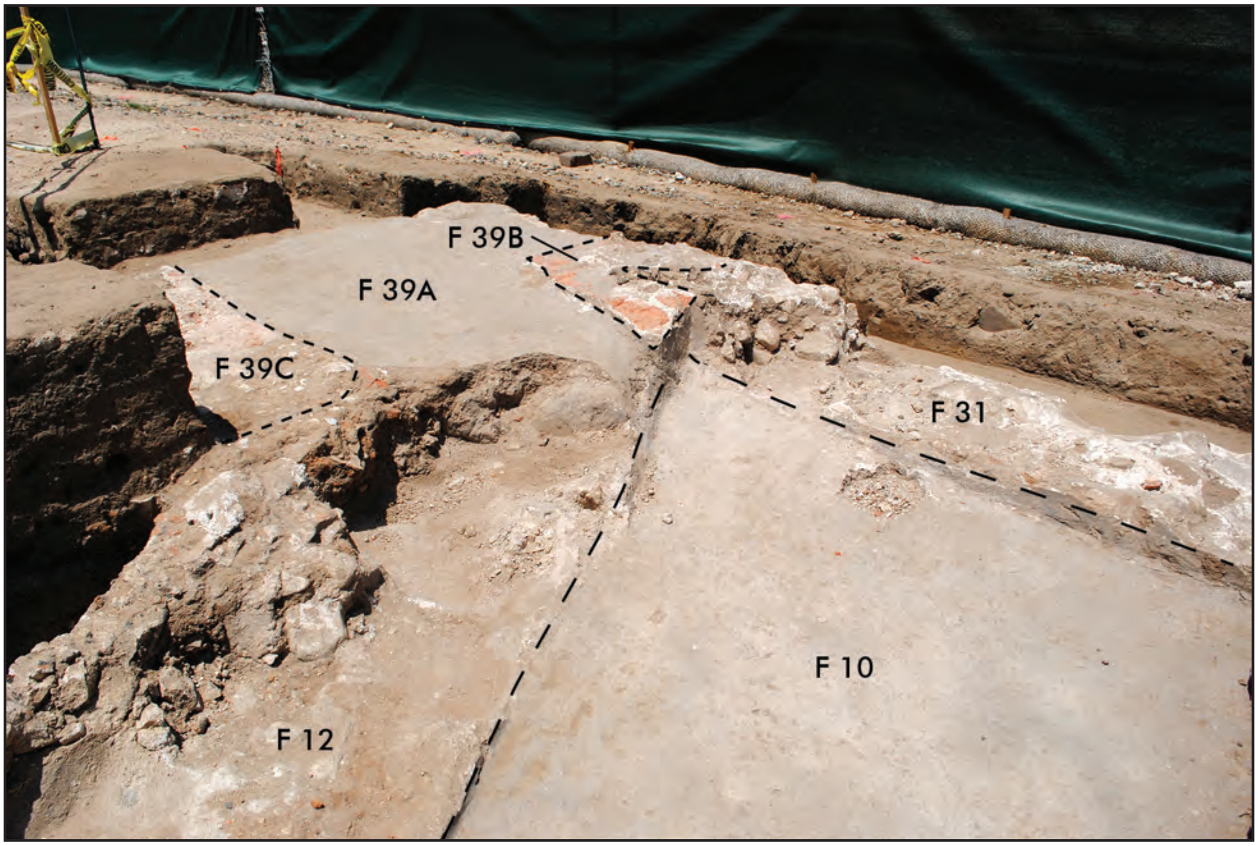

Figure 6.9. Northwest corner of triangular reservoir, including Feature 39 and segments of Features 10, 12, and 31, view facing northwest.

curves without visible seams. The plaster continued along the interior surface of Features 12 and 31 and onto the surface of Feature 39. Feature 10 extended beneath Feature 1A, which was constructed on top of Feature 10. Feature 31, the north wall of the reservoir, continued underneath Feature 1A, where it connected to Feature 1B, which formed the east wall of the reservoir (Figure 6.10). Feature 10, the reservoir floor, extended below Feature 1C to the west face of Feature 1B. In addition, mechanical excavations associated with the millrace relocation revealed that Feature 10 extended below the concrete slurry, a poor-quality concrete tempered with gravel as well as fragments of historic trash such as small pieces of building material and faunal bone, present in the south end of the reservoir near the junction of Features 12 and 1A and at the north end of the reservoir near the junction of Features 31 and 1A.

Features 49, 50, and 51, three postholes, were intrusive to Feature 10. A fourth posthole (Feature 52) was present in Feature 1C. They were aligned in an approximately straight line parallel to Feature 12 and spaced approximately 2.5 m apart, suggesting a function as fence posts. The postholes did not completely penetrate the tiles of the floor, but they did extend through the plaster and partly into the top of the tiles.

Feature 12: West Wall of Reservoir

Feature 12 was a northwest-southeast-trending wall that formed the west wall of the triangular reservoir. It measured 9.05 m (northwest-southeast) × 0.75 m (southwest-northeast) × 1.11 m (high). The feature was partially exposed by hand digging 11 excavation units. Feature 12 was constructed of cobbles, fragments of tile, and mortar, similar to Feature 1B (the east wall of the reservoir) and Feature 31 (the north wall of the reservoir). The interior surface of Feature 12 was plastered, creating a smooth surface, while the exterior side was rough and not plastered.

Feature 12 intersected Features 1A and 21E at its southern extent, and it intersected Features 31 and 39 at its northern extent. Feature 39, the sluiceway of the reservoir, was built partially on top of Feature 12. It appears that many of the larger cobbles in the wall were removed at a later date, perhaps to be reused for constructing another structure, such as Chapman's Millrace or Mill.

Feature 31: North Wall of Reservoir

Feature 31 was the north wall of the reservoir. It was constructed of cobbles and mortar and measured 8.5 m (east-west) × 0.60 m (north-south) × 0.62 m (high). The horizontal extent was completely exposed and the vertical extent of the feature was partially exposed by hand excavating six units. Feature 31 abutted the sluiceway (Feature 39) at its western extent, and Feature 1B, the east wall of the reservoir, at its eastern extent. Feature 31 was constructed on top of an alluvial deposit of coarse and fine sand, which may be the remains of a flood event associated with an early zanja. The interior surface of Feature 31 was plastered, creating a smooth surface, while the exterior side was rough and unplastered, although finished.

Feature 39: Sluiceway into Reservoir

Feature 39 was the sluiceway into the reservoir. It measured 1.40 m (north-south) × 1.82 m (east-west) × 0.50 m (high). Six 1 × 1-m units were hand excavated to expose the feature. Feature 39 was located at the northwest corner of the reservoir, at the junction of Features 12 and 31. It was constructed of a combination of cobbles, tiles, and mortar, the surface of which was plastered. The floor of the sluiceway was approximately 0.50 m above the floor of the reservoir (Feature 10). The spillway (a slanted area where water spilled into the reservoir) was approximately 0.76 m wide, although only a 0.19 m wide portion of it remained intact. Feature

Figure 6.10. Northeast corner of triangular reservoir, showing the junction of Features 31 and 1B, view facing south.

39 comprised three distinct segments: Feature 39A, the floor of the sluiceway, and Features 39B and 39C, the sluiceway walls.

Feature 39A

Feature 39A was the floor of the sluiceway. It measured 1.32 m (north-south) × 1.86 m (east-west) × 0.10 m (thickness). The floor was constructed of small- to medium-sized cobbles, tile fragments, and mortar covered in a smooth layer of plaster. An intact segment of the feature was exposed, but the west end of the floor had been damaged and likely continued farther west for an unknown distance. On the east side, the sluiceway floor formed a spillway into the reservoir.

Features 39B and 39C

Features 39B and 39C were the two walls of the sluiceway, which were constructed of ladrillos and mortar. The north wall (Feature 39B) measured 0.70 m (north-south) × 0.77 m (east west), and the south wall (Feature 39C) measured 0.65 m (north-south) × 1.33 m (east west). Like Feature 39B, the south wall likely continued to the west and was truncated at some point. The north wall did not extend to the west end of Feature 39A.

Associated Artifacts

EUs 101, 104, 123, 124, 129, 137, 140, 182, 199, 245, 261, and 262 were excavated within the fill of the triangular reservoir (Figure 6.11). Most of the materials recovered from this feature were earthenware building materials (27 percent) or other historical artifacts such as mortar, asphaltum, and slag (47 percent). Faunal bones (16 percent) were also relatively numerous in this feature (Table 6.3). In comparison with the rectangular reservoir, a much smaller proportion of glass and metal (6 percent and 3 percent, respectively) was recovered from the post-use fill of this feature complex. A majority of the ceramics recovered (60 percent) were locally or regionally produced Native American ceramics, as opposed to imported nonnative ceramics (40 percent).

Temporally diagnostic artifacts recovered from the fill of the triangular reservoir include ceramic varieties with production ranges from throughout the eighteenth and nineteenth centuries. These include Chinese porcelain of the Famille rose (1720–1800), Nanking (1760–1820), and Canton (ca. 1785–1853) varieties, as well as a hand-painted bowl of what may be Imari (1695–1793); majolica of the San Elizario (1750–1830s), Aranama polychrome (1769–1835), wavy rim (1769–1835), and Puebla blue on white (1769–1830s) varieties; creamware (1762–1810), hand painted and undecorated pearlware (1780–1820s); and transfer printed whiteware (1830–1860s). In addition, several examples of lead glazed coarse earthenware such as Galera and Tonala (1780–1830) were recovered. The mean ceramic date for this assemblage is 1803. Diagnostic glass items include several automatic bottle machine bottles (1934–present). Shell beads recovered from the fill include several types of olivella disk beads: Class J1 (1770–1834); Class H1a, which is typical of the Early Mission

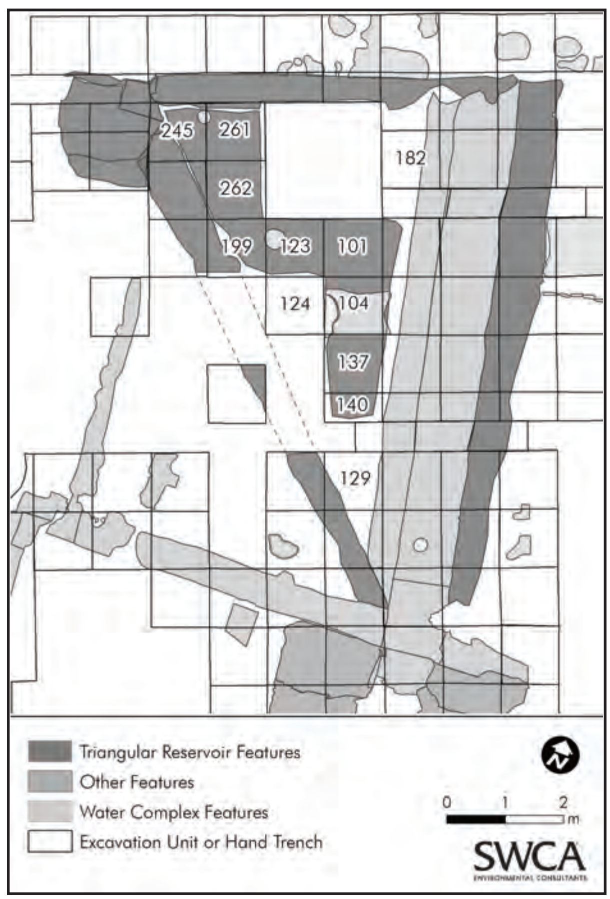

Figure 6.11. Excavation units associated with the triangular reservoir, plan view.

period (1770–1800); Class H1b, which is typical of the Late Mission Period (1800–1816); and Class H2, which is typical of the Terminal Mission period (1816–1834).

Interpretation

The feature complex comprising Features 1B, 10, 12, 31, and 39 was a triangular water reservoir. The plastered interior, associated spillway, and sloping floor were clear indications that the structure was designed to hold water. The construction sequence and stratigraphic relationships indicate that it was built and used prior to Chapman's Millrace, and abandoned during the construction of Chapman's Millrace in the early 1820s. It post-dates the rectangular reservoir.

Reservoirs were used at other missions, such as Santa Inés Mission and Santa Barbara Mission, to store water for domestic, agricultural, and industrial uses, and it is likely that this reservoir served a similar purpose at San Gabriel Mission. While it is possible that the triangular reservoir was built for water storage before the mill was constructed, its location suggests another interpretation. Once the mill was built, the triangular reservoir may have been constructed upslope so that water would flow directly to the mill at the south vertex of the triangle. Thus, this reservoir could be the original millpond used to power the mill. The use of a reservoir as a mill pond was common practice at the missions, as can be seen at El Molino Viejo (Cleland 1951:8), Santa Inés Mission (Hoover 1992), and Santa Barbara Mission (Allen and Felton 1998:11). Water from the millpond could have also been used for other purposes. Perhaps the millrace, which was built on top of the reservoir, was constructed later to increase the mill's efficiency and power. At that point the reservoir would have been abandoned and Mission-period fill would have been deposited in the feature.

Chapman's Mill and Millrace: Features 1, 2, and 20

Chapman's Mill and Millrace comprised three features in Area 2: Features 1, 2, and 20 (Figure 6.12). Feature 20 was the mill, Feature 1 was the segment of the millrace located south of the Union Pacific Railroad tracks, and Feature 2 was the segment of the millrace located north of the Union Pacific Railroad tracks. The mill was completed as a grist mill for the mission by Joseph Chapman ca. 1825. Chapman's mill replaced El Molino Viejo, a less efficient mill located farther away from the mission proper. Chapman also built the millrace that brought water to power the mill, presumably at the same time as the mill itself was built, although perhaps a bit later. Chapman ingeniously incorporated existing structures into his mill, including the rectangular and triangular reservoirs, thus decreasing the labor necessary to complete the much-needed upgraded mill. Chapter 2 discusses the history and technology of Chapman's Mill in greater detail. The mill fell into disrepair after 1834, and much of the remaining structure was destroyed in 1941.

To expose the millrace, the team hand-excavated six hand trenches and 35 excavation units. All sediment from the hand-excavated units and trenches was screened through 1/8-inch hardware mesh, with the exception of sediment from four hand trenches that was screened through ¼-inch mesh. An additional 13 excavation units were hand excavated to more fully expose the stratigraphic context of the feature. All sediment from these units was screened through 1/8-inch hardware mesh. The team did not collect sediment or other samples for special analysis from the millrace.

To expose the mill, the team hand-excavated one trench and 10 excavation units. All sediment from the hand-excavated units and trenches was screened through 1/8-inch hardware mesh, with the exception of one 40-cm level from one hand trench that was screened through ¼-inch hardware mesh, and one additional level from one hand trench that was not screened, but collected in its entirety. The team did not otherwise collect sediment or other samples for special analysis from the mill.

The mill and millrace were constructed of cobbles, ladrillos, and tile fragments that were held together with mortar. The upper part of the west wall of the millrace (Feature 1A) was constructed of stacked ladrillos and mortar, generally matching Feature 1B in dimensions, but not in construction technique.

Table 6.3. Artifacts Recovered from fill Inside Triangular Reservoir

EU	Imported Ceramics	Local and Regional Ceramics	Earthenware Building Material	Bone	Bone Artifact	Shell	Shell Artifact	Glass	Glass Beads	Metal	Flaked Stone	Ground Stone	Other Historical Artifact	Total
101	39	37	1,101	874	-	19	2	153	1	928	-	-	846	**4,000**
104	15	52	1,288	625	-	1	2	169	-	29	1	-	1,512	**3,694**
123	36	45	1,009	777	-	1	-	458	-	23	-	-	157	**2,506**
124	12	12	236	141	-	-	-	274	-	21	1	-	2	**699**
129	18	68	626	512	1	-	-	91	1	6	1	-	-	**1,324**
137	35	44	1,002	981	2	6	2	245	-	19	1	-	10,592	**12,929**
140	9	26	685	485	2	-	2	140	2	9	1	-	73	**1,434**
182	21	16	569	328	-	1	1	177	-	17	1	-	383	**1,514**
199	15	35	2,066	675	-	-	3	206	1	46	-	-	2,316	**5,363**
245	15	15	644	287	-	1	1	101	1	15	1	-	782	**1,863**
261	26	12	1,157	235	-	1	-	95	1	14	-	-	1,935	**3,476**
262	18	34	888	690	-	2	1	212	-	48	1	1	1,293	**3,188**
Total	**259**	**396**	**11,271**	**6,610**	**5**	**32**	**14**	**2,321**	**7**	**1,175**	**8**	**1**	**19,891**	**41,990**

The millrace channel was covered with a smooth plaster finish. Webb (1952:166) indicates that the millrace channel was originally 76 cm deep. Excavation revealed that the upper portion of the millrace walls had been removed but the base of the walls remained intact.

Sediment removed from the millrace channel consisted of post-use fill that contained Mission-period artifacts, indicating that this fill was likely deposited after the mill had been decommissioned but during the Mission period.

Construction Details

Features 1 and 2: Chapman's Millrace

Features 1 and 2 comprised two north-south trending segments of Chapman's Millrace. Feature 1 consisted of the segment of the millrace located south of the Union Pacific Railroad tracks within the data recovery area, and Feature 2 consisted of the segment of the millrace located north of the Union Pacific Railroad tracks. Chapman's Millrace originally extended farther north and west, passing the southern facade of the San Gabriel Mission church.

Feature 1

Feature 1 consists of two walls, east and west, and the millrace channel in the center. The north end of the Feature was truncated in 1874 when the Southern Pacific Railroad tracks were constructed, and the south end terminates at the north side of Chapman's Mill. Feature 1 measured 9.16 m (north-south) × 2.34 m (east-west) × 1.33 m (high). A total of 28 excavation units and six hand trenches were hand-excavated to expose the feature.

Feature 1A, the west wall of the millrace, was constructed of cobbles, fragments of tile, and mortar. Three courses of ladrillos capped the wall. Feature 1A was constructed on top of the triangular reservoir floor (Feature 10). The lower portion of the exterior side was covered in concrete slurry, beginning just underneath the three courses of ladrillos and continuing onto Feature 10. At its southern extent, Feature 1A intersected Feature 12, the west wall of the triangular reservoir. At this junction, it was evident that the west wall of the millrace post-dates Feature 12, because the end of Feature 12 was a finished, straight line, and the west millrace wall was shaped so that it aligned with Feature 12, creating an oddly angled section of the wall (Figure 6.13).

Feature 1B, the east wall of the millrace, was constructed of cobbles, tile fragments, and mortar. The top of the wall was not lined with courses of ladrillos, unlike Feature 1A. Feature 1B formed the east wall of the triangular reservoir prior to the construction of the millrace, and was incorporated into the millrace structure at a later date.

Feature 1C, the channel of the millrace, was constructed of cobbles, tile fragments, and mortar, with a smooth, plastered finish lining the interior of the channel. Like Feature 1A, Feature 1C was constructed on top of triangular reservoir floor (Feature 10), likely in order to use the floor as a stable base for construction. The channel was widest at its northern end, measuring 1.08 m wide, and it gradually narrowed to 0.98 m as its southern extent. A posthole (Feature 52) was present 0.52 m north of the southern extent of Feature 1C. The millrace floor was largely intact, with only minimal damage such as small chips and cracks.

Feature 2

Feature 2 was located north of the Union Pacific Railroad tracks and consisted of three segments of the millrace: Features 2A, 2B, and 2C. Feature 2 curved slightly northwest at this location, and the channel narrows from north to south. The north end of Feature 2 was truncated, perhaps during the construction of the adjacent Mission Road, or it may have been shortened during later railroad improvement and maintenance. The south end of the feature was truncated in 1874 when the Southern Pacific Railroad tracks were constructed. The feature was also cut for the construction of a modern fiber optic line, and was further damaged by other unknown activity. The feature measured 4.80 m (north-south) × 2.50 m (east-west), including the gaps where the feature had been damaged.

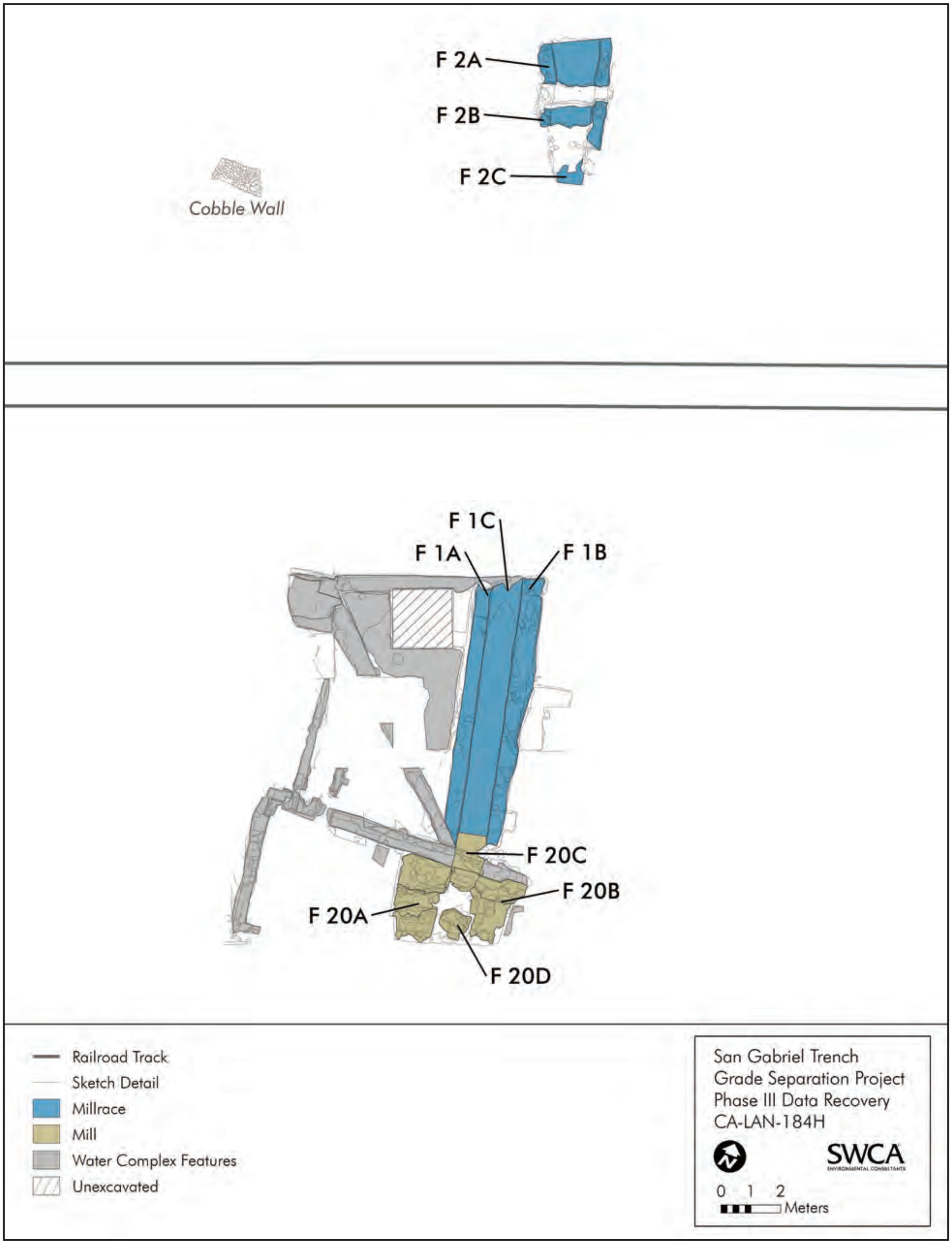

Figure 6.12. Chapman's Mill and Millrace (Features 1, 2, and 20) in Area 2, plan view.

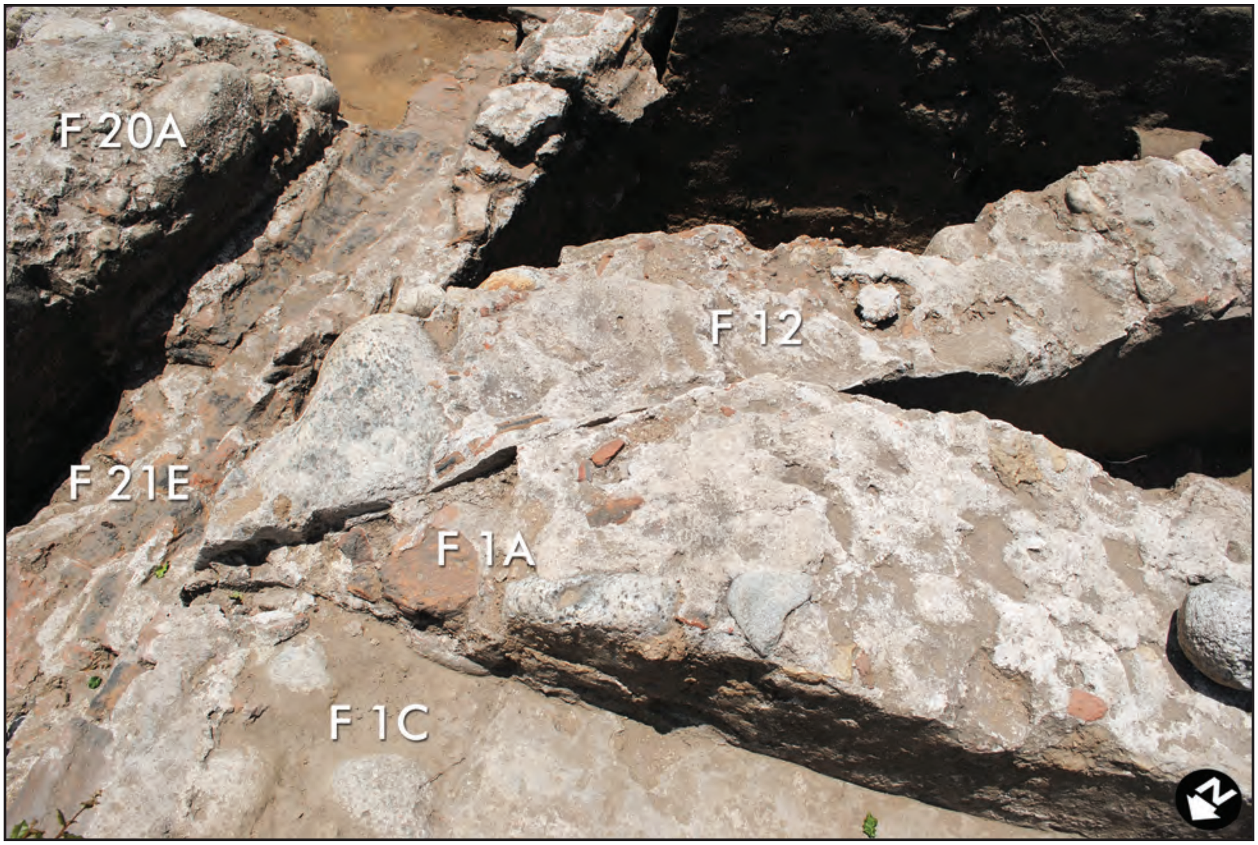

Figure 6.13. Intersection of rectangular reservoir, triangular reservoir, millrace, and mill, showing Features 1A, 1C, 12, 20A, and 20E, plan view southeast.

Feature 2 was constructed of cobbles, tile fragments, and mortar. Although heavily damaged, the remaining elements of Feature 2 indicate that the millrace narrowed and turned at this point, turning from a wider, more east-west-trending shape to a narrower, north-south-trending shape.

Feature 2A was the northernmost segment of the feature, consisting of segments of the east and west walls and the center channel. Feature 2A measured 1.66 m (north-south) × 2.45 m (east-west). The northern extent of Feature 2A had been truncated, presumably by the construction of Mission Road, and the southern extent had been truncated by a trench dug for a fiber optic line that cut through the feature between Features 2A and 2B. The profile of the south face of Feature 2A showed the thickness of this segment of the millrace (0.45 m thick) to be significantly thinner than that of Feature 1 (1.33 m thick).

Feature 2B was the center segment of the feature, consisting of segments of the east and west walls and the center channel and measuring 1.64 m (north-south) × 2.27 m (east-west). Feature 2B was truncated at the south end by unknown factors that created a missing segment between Features 2B and 2C.

Feature 2C was the southernmost segment of the feature, consisting of a fragment of the millrace channel and measuring 0.89 m (north-south) × 0.88 m (east-west). This segment was truncated at the south end in 1874 when the Southern Pacific Railroad tracks were constructed.

Feature 20: Chapman's Mill

Chapman's Mill was located at the south end of the millrace. Portions of the mill foundation were exposed by data recovery excavations. The mill was recorded as Features 20A and 20B, segments of the mill structure, Feature 20C, the foundation of the sluiceway from the millrace into the mill, and Feature 20D, a broken fragment of the mill that had been displaced into the wheel pit of the mill. All sections of the mill structure were constructed of cobbles, tile fragments, and mortar. Feature 20 was constructed among the existing infrastructure in the center of Bishop's Garden. Chapman incorporated segments of the rectangular reservoir into the mill, and he may have also used portions of the triangular reservoir. The millrace was not perfectly aligned with the mill; rather, it was canted slightly to the west. According to Mike Hart, longtime manager of the Sunny Slope Water District and avocational historian, this alignment may have created a splashing problem, as the water was forced to change direction slightly as it increased in speed down the sluiceway (personal communication 2012). It appears that the mill was damaged by the previous installation of a modern telecommunications line, because a trench cuts partially through Feature 20A. The trench does not transect the mill completely, indicating that trench construction was likely halted due to the presence of the stone and mortar structure.

Features 20A and 20B were sections of the structure of the mill separated by the wheel pit. The wheel pit originally housed a wooden water wheel measuring 13.5 feet in diameter (Webb 1952). Feature 20A consisted of the section west of the wheel pit, and Feature 20B consisted of the section east of the wheel pit. Both sections exhibit evidence of adjustments to their construction, which may have been made to solve the splashing problem noted above. The wheel pit and walls are evident in historical photographs (see Figure 2.12).

Feature 20A measured 2.83 m (north-south) × 1.65 m (east-west), and represents the largest remaining section of the mill structure. Feature 20A had been damaged approximately 1.1 m south of the northern extent of the feature; it appeared that a trench was started at this location but was halted prior to cutting through the feature. Feature 21E was incorporated into the mill structure at the northern extent of Feature 20A. On the west side of Feature 20A, a small segment of the sluiceway that led into the wheel pit remained connected to the mill. On the west side, the exterior of Feature 20A had a smooth plaster finish. Feature 20A showed some evidence of adjustment or repair, where the wheel pit was perhaps adjusted (Figure 6.14).

Feature 20B measured 2.25 m (north-south) × 1.68 m (east-west) and was built directly into the existing north wall of the rectangular reservoir (Feature 21F). Feature 20B appeared to have been adjusted after it was finished, as there was a finished surface on what would have been the original interior surface of the wheel pit, and an additional segment of wall had been added to narrow the wheel pit (Figure 6.15).

Feature 20C was the foundation of the sluiceway into the mill at the southern extent of the millrace, and measured 1.92 m (north-south) × 1.04 m (east-west). It is likely that the sluiceway had a smooth plaster finish similar to the millrace channel, but no plaster finish was present. Feature 20C was constructed on top of the north wall of the rectangular reservoir, at the south end of the triangular reservoir.

Feature 20D consisted of a large fragment of the mill that had fallen into the wheel pit, possibly as a result of recent utility disturbance. Feature 20D measures 0.98 m (north-south) × 0.99 m (east-west). We did not expose the vertical extent of the fragment.

Associated Artifacts

A millstone fragment (see Chapter 9, Figure 9.1) was recovered from EU 157, approximately 3 m north of the mill (Feature 20), and to the west of the millrace (Feature 1) and triangular reservoir. This millstone was submitted to PaleoResearch Institute for pollen and phytolith analysis, the results of which confirm its function in grinding domesticated grains (see Chapter 9 and Appendix C).

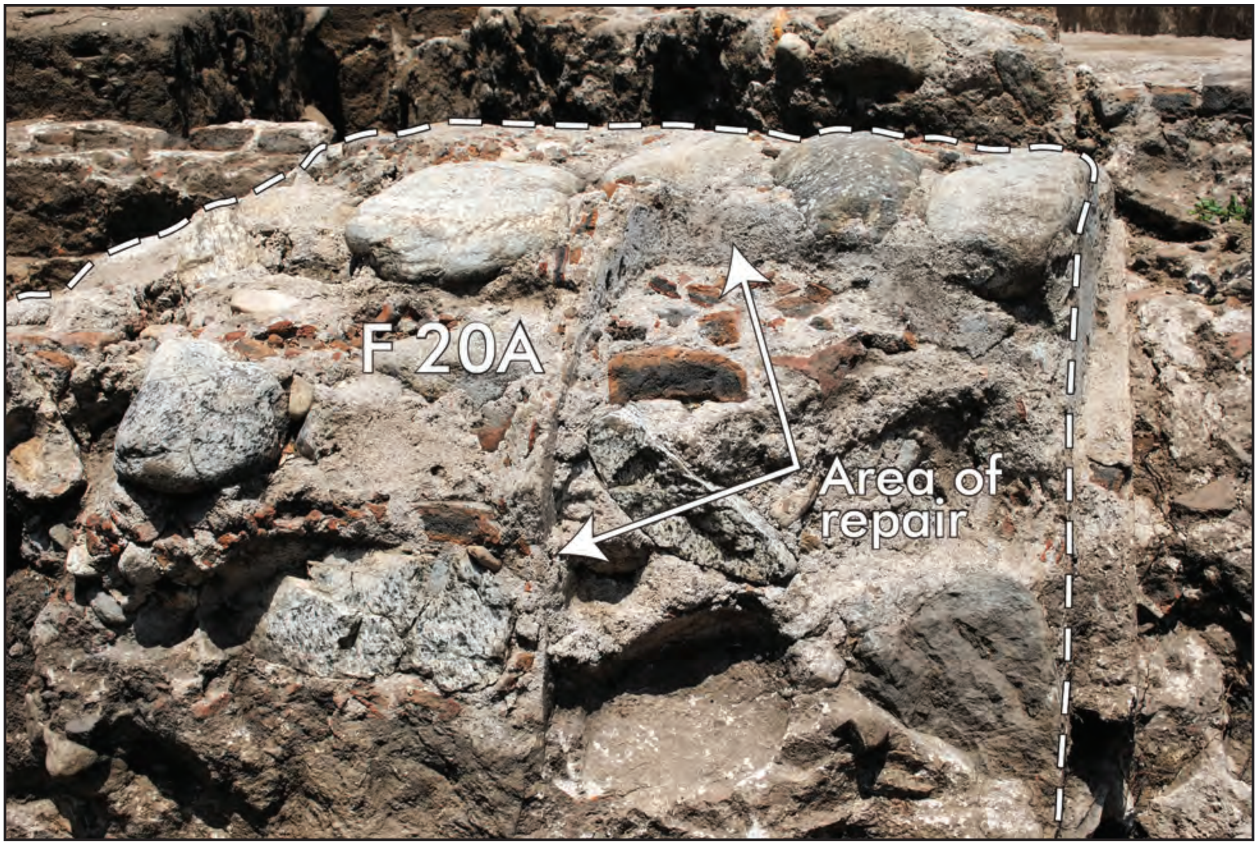

Figure 6.14. Feature 20A, showing area of adjustment or repair, view facing north.

Interpretation

Chapman's Mill (Figure 6.16) was constructed between 1822 and 1825 by Joseph Chapman as a grist mill to replace El Molino Viejo (see Chapter 2). He constructed the adjoining millrace either contemporaneously or shortly after completing the mill. Chapman utilized the existing infrastructure to aid in the construction of the mill and millrace. He used the triangular reservoir as a foundation for the millrace, and he used the rectangular reservoir as a foundation for the mill.

The juncture between the mill, millrace, triangular reservoir, and rectangular reservoir clearly indicates the construction sequence of these feature complexes (see Figure 6.13). Here, the angle at which the south end of the west wall of the triangular reservoir (Feature 12) was built indicates that it was constructed to accommodate the north wall of the rectangular reservoir (Feature 21E). Similarly, the angle of the south end of the west wall of the millrace (Feature 1A) indicates that it was constructed so as accommodate the west wall of the triangular reservoir (Feature 12). In addition, the spillway of the millrace (Feature 20C) and segments of the mill (Features 20A and 20B) were constructed on top of Feature 21. Thus, the construction sequence was as follows: 1) the rectangular reservoir, 2) the triangular reservoir, and 3) Chapman's Mill and Millrace.

Based upon the construction history presented in Chapter 2 and the sequence of construction and repairs described above, the following scenario best fits the available data. Realizing that El Molino Viejo was doubly flawed, being poorly designed and too far away from the grain fields and consumers, Father Zalvidea ordered a replacement to be constructed in Bishop's Garden in 1820. The original design was typical of California mills of its time, with a relatively slow-flowing water supply filling a large millpond (the triangular reservoir). The design was inefficient and the course that the water trav-

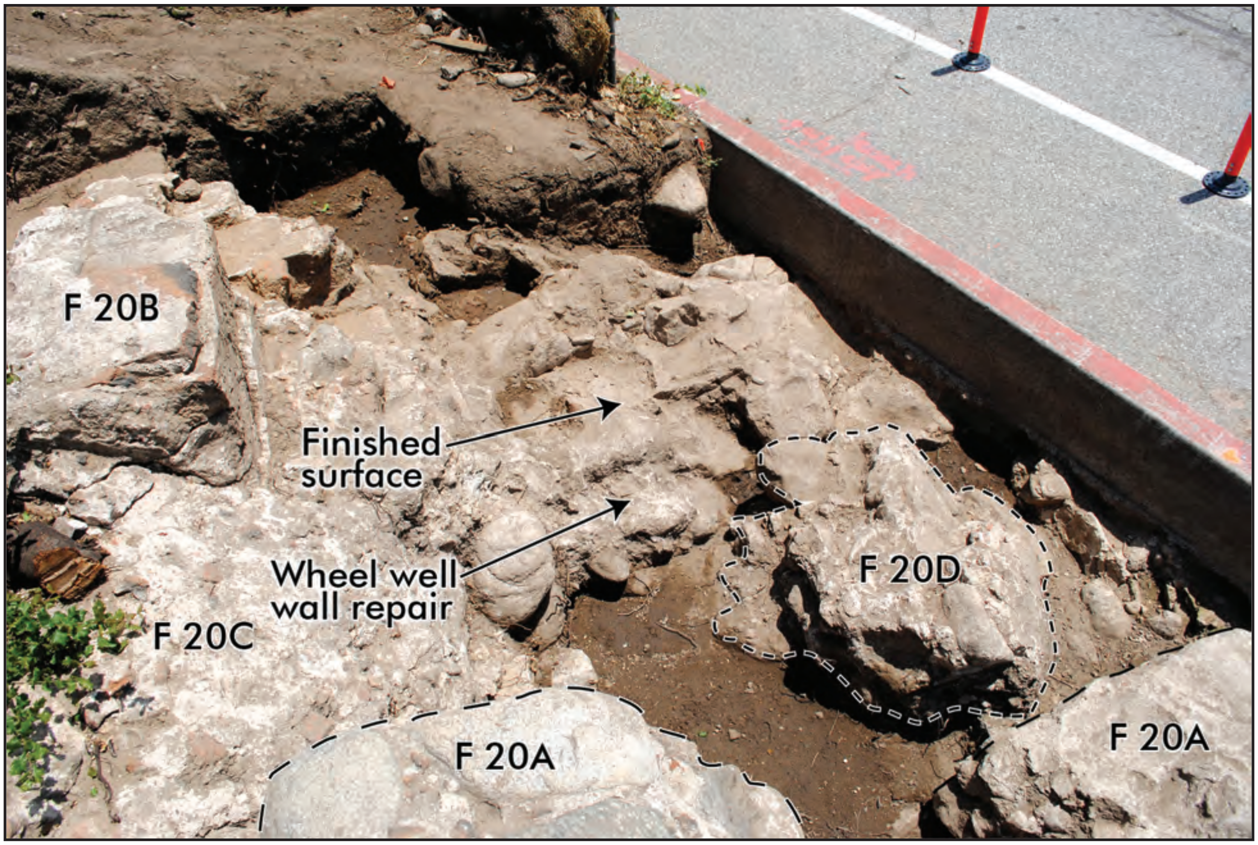

Figure 6.15. Feature 20B, with finished surface and repair, view facing southeast.

eled from the millpond to the wheel pit produced the same splashing that plagued El Molino Viejo. About this time, Zalvidea heard of a talented millwright in the Santa Barbara area named Joseph Chapman. He commissioned Chapman to come to San Gabriel, make adjustments to the existing infrastructure, and produce a mill of superior design as he had done at Santa Inés. Rather than starting over, Chapman used the existing construction as a foundation for his mill, turning the triangular reservoir into a portion of his millrace, and adjusting the angle of the mill to reduce splashing. That his repairs were successful is beyond doubt, as Chapman's contemporaries and subsequent historians have universally proclaimed the beauty of his design and the admiration that he gained as a result of his endeavors.

Area 1 Structure

Located in the western portion of the study area in Area 1, this complex of features comprised portions of a large adobe building and associated surfaces. Feature 3 was the east exterior wall footing of the structure. Feature 5 was the west exterior wall footing. Feature 36 was the exterior wall footings at the northwest corner of the structure. Feature 44 was a segment of an interior wall footing. Features 36C and 45 were two interior tile floors. Features 9 and 13 were two exterior tile floors. Feature 22 was an interior layer of lime or plaster. The structure measured approximately 6.5 m (east-west) by at least 27.5 m (north-south). A large, American-period trash pit (Feature 14) was intrusive to the interior of the structure.

To expose these features, the team mechanically excavated one unit and hand excavated one trench and 49 1 × 1-m excavation units. All sediment from the hand-excavated units and trenches was screened through 1/8-inch hardware mesh, except for two 10-cm levels from one excavation unit that were screened through 1/16-inch mesh, and six levels from three excavation units that were screened through ¼-inch mesh.

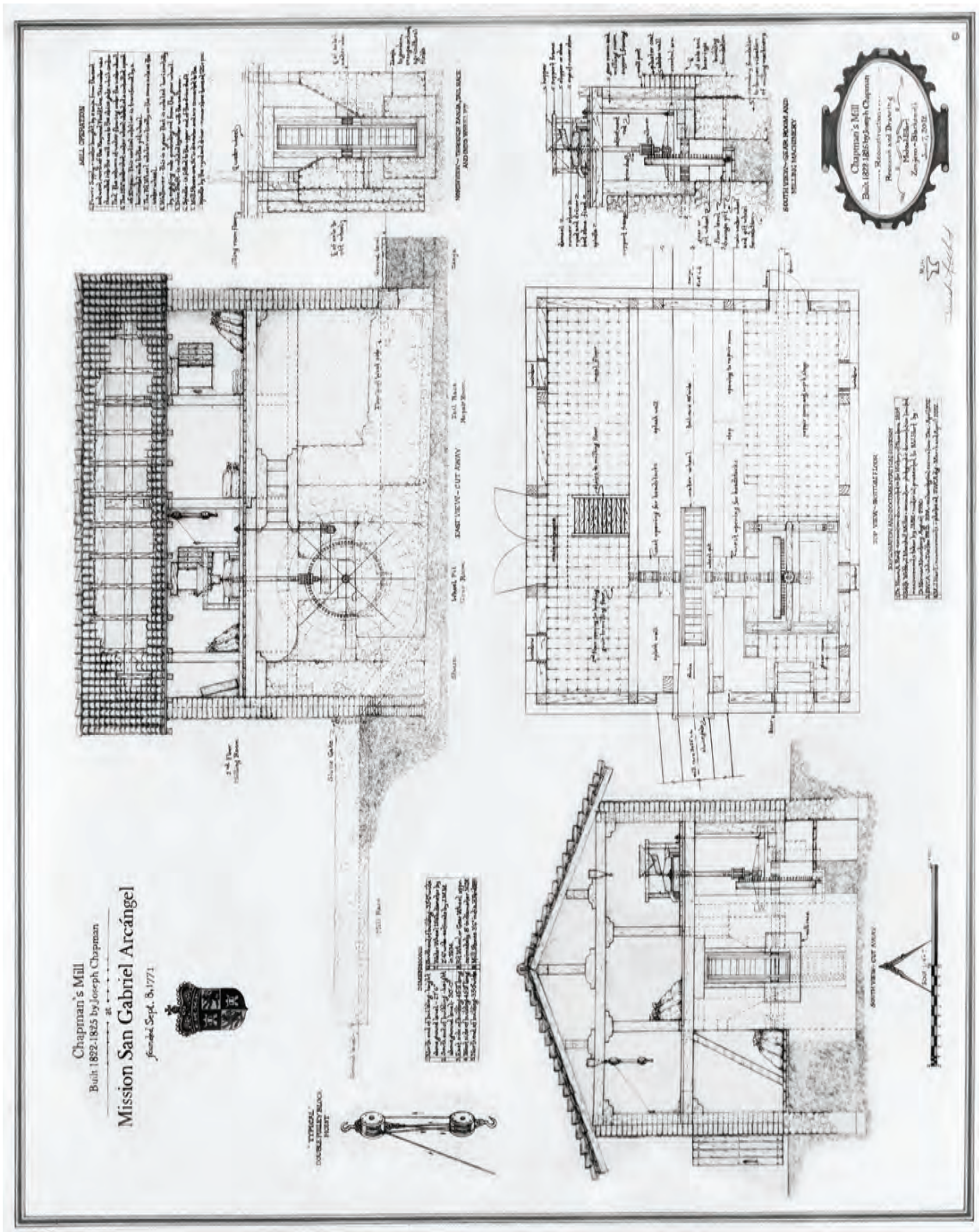

Figure 6.16. Chapman's Mill, built 1822–1825 by Joseph Chapman at San Gabriel Mission. Image courtesy of Michael J. Hart.

The team hand excavated 21 additional 1 × 1-m units to more fully expose the interior of the structure and the stratigraphic context of the feature complex (Figure 6.17). This sediment was also screened through 1/8-inch hardware mesh, with the exception of two levels that were screened through 1/16-inch mesh.

We collected four sediment samples from the Area 1 complex for special analyses (see Figure 6.17). All samples were submitted to PaleoResearch Institute for study (see Chapter 7 and Appendix C). The team collected one column sample from EU 263, located on the interior of the Area 1 structure near the west wall foundation south of the Union Pacific Railroad tracks. The 10 × 10-cm sample was collected stratigraphically, with additional arbitrary breaks at 10-cm intervals from 90 to 250 cmbd (Datum 6). The column sample was submitted for macrobotanical and pollen analysis. We also collected two sediment samples from EU 267, which was inside the Area 1 complex at the northwest corner of the structure, and the samples were submitted for macrobotanical and pollen analysis. We collected two additional sediment samples for pollen analysis: one from EUs 121/247, under the ladrillos of Feature 9, and another from EU 165, under the ladrillos of Feature 13. Analysis of these samples yielded moderate amounts of corn, pine nuts, and tobacco seeds.

We collected seven artifacts for special analysis from the feature complex (see Figure 6.17). All samples were submitted to PaleoResearch Institute for study. The team collected one mano/pestle from EU 161, inside the structure near the south end of the west wall foundation; one mano/pestle from EU 189, outside the structure near the south end of east wall; and one steatite stone bowl fragment from EU 253, outside the structure northwest of Feature 13. These three artifacts were submitted for phytolith and starch analysis. We collected one ground stone bowl fragment and one chert biface from EU 189 and submitted them for Fourier transform infrared spectroscopy (FTIR) and protein analysis. We collected one olla fragment from EU 195, outside of the structure adjacent to the east wall foundation, and submitted it for FTIR analysis. We also collected one mano from EU 248, outside the structure to the southeast of Feature 9, and submitted it for protein residue analysis. Appendix C presents the results of these analyses. Summarized results by artifact type are presented in Chapter 9.

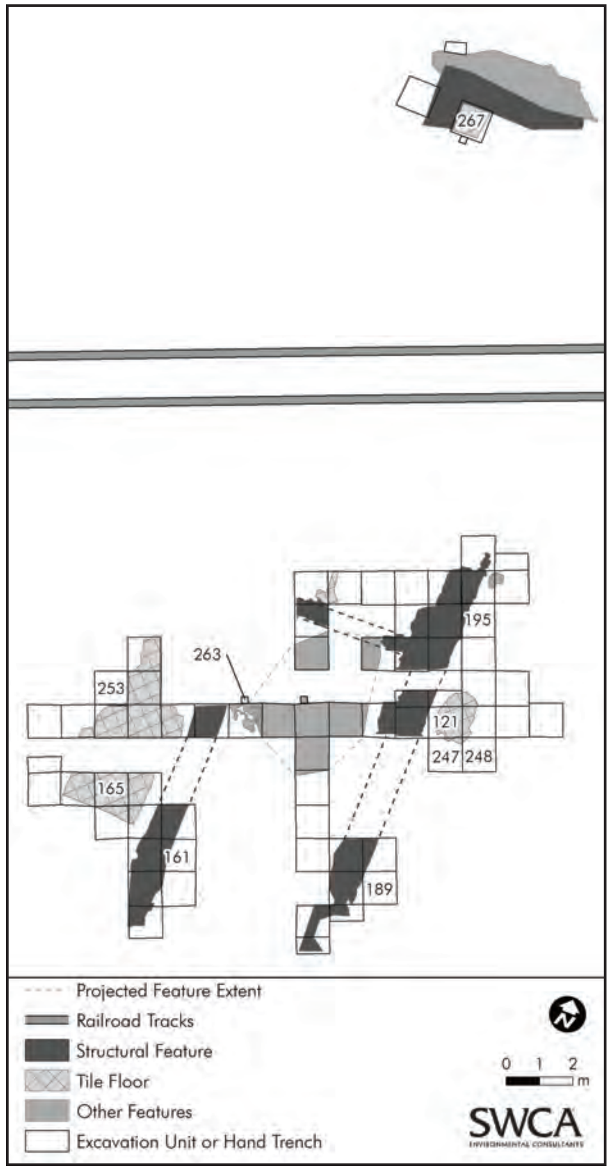

Figure 6.17. Area 1 excavation units containing sediments and artifacts associated with features and selected for special analysis, plan view.

Construction Details

Feature 3: East Wall of Structure

Feature 3 was the foundation of the east adobe wall of the Area 1 structure located south of the Union Pacific Railroad tracks. We exposed three segments of the foundation by hand excavating 20 1 × 1-m units during data recovery excavations, two of which have an associated "step-out" (Feature 3A) on the interior side. The step-out was a lower section of the foundation that was wider than the upper part of the foundation, which was perhaps intended to reinforce the wall.

Feature 3 was constructed of rounded cobbles and packed earth. The interior and exterior edges of the top of the wall were lined with flat siltstone slabs. Feature 3 measured 13.14 m (north-south) × 1.09 m (east-west), including the areas between the exposed segments. The northernmost exposed segment of the wall foundation measured 3.74 m (north-south) × 1.10 m (east-west). The central exposed segment of the wall foundation was located 0.62 m south of the northern segment and measured 1.46 m (north-south) × 1.04 m (east-west). The southernmost segment of the exposed wall foundation was located 3.38 m south of the central segment and measured 3.6 m (north-south) × 1.07 m (east-west).

Feature 3A, a step-out, was located adjacent to the interior side of the north and central segments of Feature 3 (Figure 6.18), approximately 0.5 m below the top of the foundation. The feature was constructed of rounded cobbles and packed earth and measured 4.10 m (north-south) × 0.45 m (east-west). The segment of Feature 3A adjacent to the north section of Feature 3 measured 2.05 m (north-south) × 0.44 m (east-west). The southern segment of Feature 3A was approximately 1.09 m south of the north segment and measured 1.01 m (north-south) × 0.40 m (east-west).

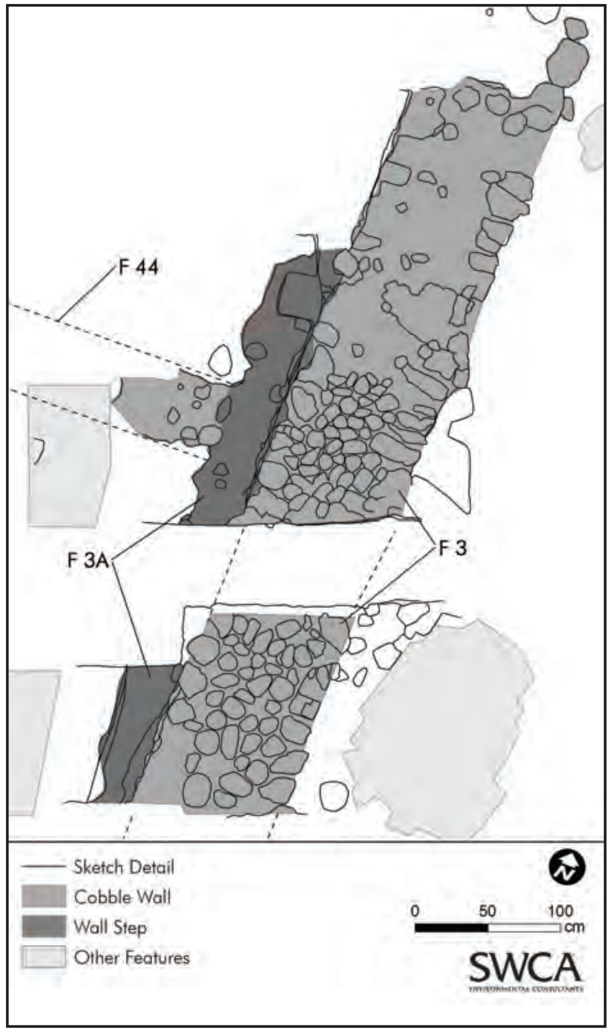

Figure 6.18. Features 3 and 3A, plan view.

Feature 5: West Wall of Area 1 Structure South of Union Pacific Railroad Tracks

Feature 5 was the foundation of the west wall of the Area 1 structure located south of the Union Pacific Railroad tracks. We exposed two segments of the foundation by hand excavating nine excavation units during data recovery excavations. No step-out was apparent. Feature 5 was constructed of rounded cobbles and packed earth. The interior and exterior edges of the top of the wall were lined with siltston. Feature 5 measured 6.93 m (north-south) × 1.06 m (east-west), including the areas between the exposed segments. The northern segment of the wall foundation measured 1.04 m (north-south) × 0.85 m (east-west). The southern segment of the wall foundation was 2.21 m south of the northern segment and measured 3.85 m (north-south) × 1.06 m (east-west).

Feature 9: Tile Floor on East Side of Structure

Feature 9 was an irregularly-shaped tile floor adjacent to the east side of the structure foundation (Feature 3), on the exterior of the structure. It was constructed of 26 ladrillos of varying sizes laid flat without mortar, and measured 1.52 m (north-south) × 1.15 m (east-west). We completely exposed the horizontal extent of the feature by hand excavating six excavation units. Feature 9 was not aligned parallel to the foundation; the southwest corner of Feature 9 was located 0.25 m east of the east edge of Feature 3, and the northwest corner of Feature 9 was located 0.50 m east of the east edge of Feature 3. The edges of the tile floor were irregular, and cobbles and tile fragments were present in the gap between Features 3 and 9.

Feature 13: Tile Floor on West Side of Building

Feature 13 was a rectangular tile floor located adjacent to the west side of Feature 5, on the exterior of the structure. We partially exposed the feature through hand excavation of 12 1 × 1-m units. The exposed portion of the feature measured 5.41 m (north-south) × 2.48 m (east-west) and was constructed of ladrillos of varying sizes laid flat without mortar. We exposed the south edge of the floor, including the southwest and southeast corners. The southern extent of the feature was the most intact section. The northwest segment of the feature had been previously disturbed, and many of the tiles were severely damaged. During excavations, large fragments of modern asphalt and concrete were observed on top of and adjacent to the damaged area of the floor. Due to the location of the floor, it is likely that these disturbances were associated with construction of the modern road, sidewalk, and railroad crossing located approximately 9 m west of the floor.

Feature 22: Lime/Plaster Layer in Structure Interior

Feature 22 was a layer of lime or plaster located in some areas of the interior of the structure. Feature 22 appeared in patches throughout the interior of the structure, with very diffuse boundaries and thus without measurable horizontal dimensions. It ranged in thickness from a few millimeters to approximately 1 cm. Feature 22 was located below a layer of asphaltum fragments observed throughout many units in this feature complex.

Feature 36: Northwest Corner of Structure

Feature 36 comprised the northwest corner of the building (Figure 6.19). Feature 36A was the foundation of the northwest corner of the adobe wall. Feature 36B was a concrete foundation adjacent to the north side of Feature 36A. Feature 36C was the fragmented remains of an interior tile floor at the northwest corner of the structure. We partially exposed Feature 36 by mechanically excavating one undefined mechanical excavation unit, and hand excavating two excavation units and one hand trench.

Feature 36A was constructed of rounded cobbles and packed earth. The interior and exterior edges of the top of the wall were lined with siltstone. Feature 36A measured 1.92 m (north-south) × 4.44 m (east-west). Feature 36B was connected primarily to the exterior of Feature 36A on the north side of the foundation, and a small segment of Feature 36B was connected to the west side of Feature 36A at the northwest corner (see Figure 6.19). Feature 36B was constructed of concrete tempered with angular cobbles. The materials used in Feature 36B may indicate that it was constructed at a later date than Feature 36A. Feature 36C was an interior tile floor. All that remained of the floor was 15 fragments of ladrillos, and the original shape and size of the floor was not discernible.

Feature 44: Interior Wall of Structure

Feature 44 was the foundation of an east-west trending interior adobe wall within the Area 1 structure. We hand-excavated five excavation units to partially expose the feature. Feature 44 was constructed of rounded cobbles and packed earth. The exposed segment measured 0.76 m (north-south) × 3.66 m (east-west). The northeast corner of Feature 44 was located approximately 2.30 m south of the northwest corner of the exposed segment of Feature 3 (see Figure 6.2).

Feature 45: Interior Tile Floor of Structure

Feature 45 was an interior tile floor located adjacent to the north side of Feature 44, approximately 0.6 m east of the northwest corner of the exposed segment of Feature 44. We partially exposed the feature by hand-excavating two excavation units. Feature 45 was constructed of ladrillos of varying sizes laid flat without mortar, and it measured 1.04 m (north-south) × 0.75 m (east-west).

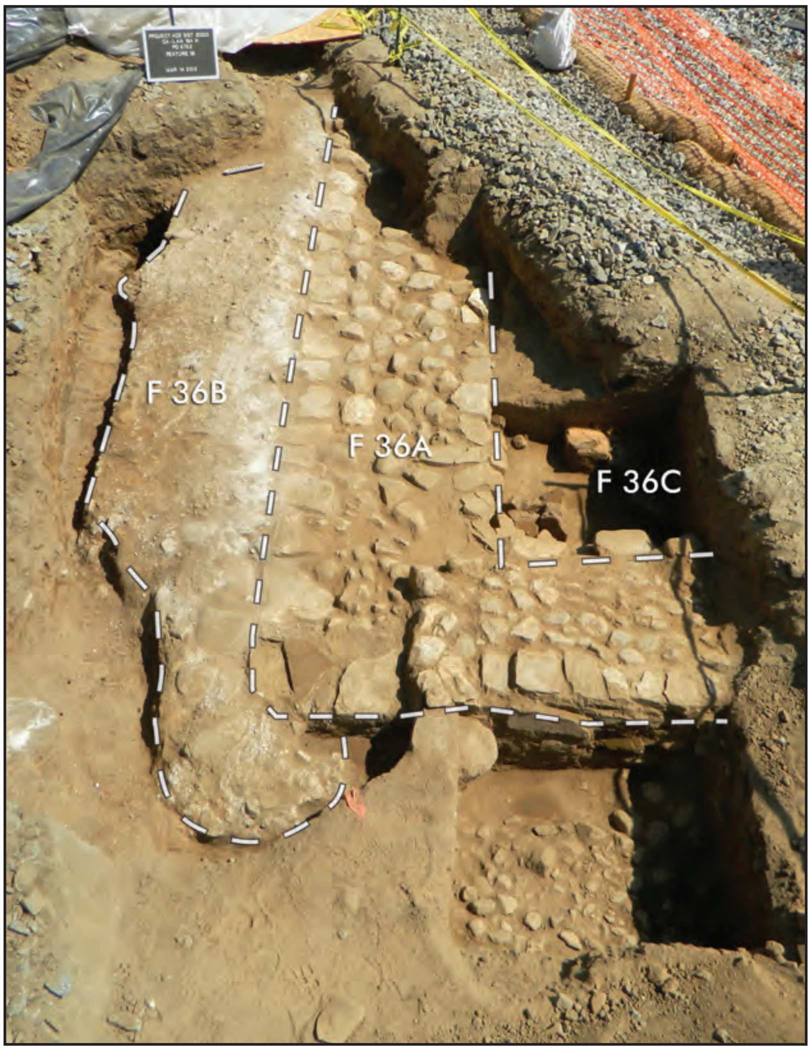

Figure 6.19. Feature 36, view facing east.

Associated Artifacts

EUs 111, 161, 191, 201, 218, 231, 240, 242, 243, 254, 255, 256, and 267 were excavated within the fill of the Area 1 structure (Figure 6.20). Most of the materials recovered from this feature were earthenware building materials (9 percent), glass (11 percent), or metal (5 percent). Faunal bone was also relatively abundant in this feature (Table 6.4). In contrast to the reservoir complex in Area 2, these units contained more nonnative imported ceramics (58 percent of ceramics recovered) than locally or regionally produced Native American ceramics. This pattern is borne out and discussed in greater detail in Chapter 11 (Spatial Analysis) and may signify a chronological difference between the two areas, with Area 1 post-use fill dating slightly later than the fill associated with the reservoirs.

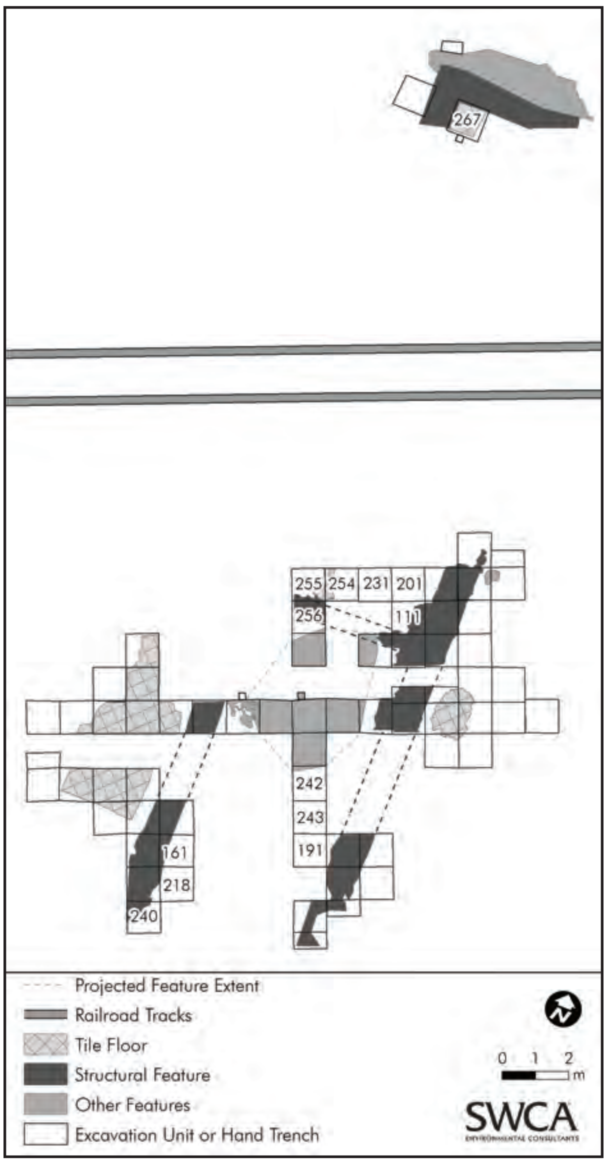

Figure 6.20. Excavation units within the fill of Area 1 features, plan view.

Interpretation

The function of this structure is not entirely clear. Based upon its dimensions, construction materials, location, and contents, the most likely interpretation is that it was a granary. The dimensions of the structure are an approximate match with several buildings constructed at San Gabriel Mission, particularly those of three granaries built in 1811 and 1812, each measuring 36.5 m (42 varas) in length (Table 6.5). The projected length of the Area 1 structure is 33 m (38 varas), which is based on the assumption that the interior wall bisects the structure. The distance from the center of the interior wall (Feature 44) to the exterior of the northern wall (Feature 36) was 16.5 m, thus the total length of the exterior wall would be 33 m. The building's total width was 6 m (7 varas).

The Area 1 structure was long and rectangular and built of adobe walls, possibly with an asphaltum roof. It had at least two rooms, and the archeological evidence suggests at least one of these was tiled. It was located in Bishop's Garden, within easy reach of both grain fields and Chapman's Mill. Botanical data recovered from the excavations associated with the structure, however, do not strengthen the interpretation of the building as a granary (see Chapter 7: Plant Remains). The artifacts recovered were inconclusive with regard to the building's function (see Table 6.4), as they are not markedly different from other assemblages from the study area.

Like a similar structure documented by archaeologists at La Purísima Mission, there is not definitive evidence to substantiate the interpretation of this structure as a granary, but there is not contradictory evidence either (Deetz 1964; Farris 1997:11). In the case of the structure at La Purísima Mission, the archaeologists argued that the lack of artifacts found in association with the feature is evidence that it was used for storage.

Table 6.4. Materials Recovered from the Fill of the Area 1 Structure

EU	Imported Ceramics	Local and Regional Ceramics	Earthenware Building Material	Bone	Shell	Shell Artifact	Glass	Glass Beads	Metal	Flaked Stone	Ground Stone	Other Historical Artifacts	Total
111	15	7	66	74	1	-	121	-	33	-	-	72	389
161	1	6	23	46	2	-	10	-	11	0	1	109	209
191	7	23	109	64	-	1	79	-	73	-	-	503	859
201	10	2	79	33	-	-	190	1	18	1	-	406	740
218	-	2	13	4	-	-	4	-	3	-	-	9	35
231	-	2	37	75	-	-	185	-	12	-	-	131	442
240	1	-	9	1	-	-	2	-	-	-	-	30	43
242	10	6	114	52	-	-	63	-	69	-	-	113	427
243	17	5	57	28	-	-	69	-	18	-	-	499	693
254	6	3	263	55	1	-	239	-	57	1	-	747	1,372
255	10	6	157	60	1	1	163	-	48	1	-	242	689
256	16	8	71	51	-	-	169	-	269	-	-	5,686	6,270
267	8	4	171	134	-	-	58	1	14	1	-	111	502
Total	**101**	**74**	**1,169**	**677**	**5**	**2**	**1,352**	**2**	**625**	**4**	**1**	**8,658**	**12,670**

Table 6.5. Construction Data for the San Gabriel Mission's Second Location

Year	Function	Length (varas)*	Width (varas)*	Walls	Roof
1776	Guardhouse	—	—	Palisades	—
1776	Granary/storage/ residences	50.0	6.0	Palisades	—
1776	Chapel/church	18.0	6.0	Palisades	Tule
1778	Room	7.0	5.0	Adobe	Earth
1778	Room	6.5	5.0	Adobe	Earth
1778	Room	6.0	5.0	Adobe	Earth
1778	Room	4.0	5.0	Adobe	Earth
1779	Granary	56.0	5.5	Adobe	Earth
1783	Church	36.0	7.0	2 Adobes	Pine beams, oak canes, earth, tule
1783	Sacristy	5.0	5.0	2 Adobes	Pine beams, oak canes, earth, tule
1783	Storeroom	50.0	5.5	Adobe	Jacal
1783	Storeroom	25.0	6.0	Adobe	Earth/jacal
1783	Storeroom	7.0	6.0	—	—
1783	Room	20.0	6.0	Adobe	Earth/jacal
1783	Kitchen	6.0	5.0	Adobe	Earth/jacal
1783	Sala	7.5	6.0	Adobe	Earth/jacal; tiled by 1789
1783	Room	6.0	6.0	Adobe	Earth/jacal; tiled by 1789
1783	Room	6.0	6.0	Adobe	Earth/jacal; tiled by 1789
1783	Room	6.0	6.0	Adobe	Earth/jacal; tiled by 1789
1783	Guest room	—	—	Adobe	Earth/jacal; tiled by 1789
1783	Sick room	10.0	2.0	Adobe	Jacal, tiled by 1789
1783	Sick room	10.0	2.0	Adobe	Jacal, tiled by 1789
1783	Monjerio	7.0	5.0	Adobe	Jacal, tiled by 1789
1783	Tannery	5.0	5.0	Adobe	Jacal, tiled by 1789
1783	Tannery	5.0	5.0	Adobe	Jacal, tiled by 1789
1783	Hennery	5.0	4.0	Adobe	Jacal, tiled by 1789
1783	Storeroom	—	—	Adobe	—
1783	Guardhouse	—	—	—	—
1789	Room	16.0	5.0	Adobe	Tile
1789	Room	8.0	5.0	Adobe	Tile
1789	Room	8.0	5.0	Adobe	Tile
1790	Storeroom	23.0	6.0	Adobe	Tile
1804	Various	125.0	13.0	—	Pine timbers and tile
1805	Various	135.0	6.5	Adobe	Tile
1805	Church	60.2	15.0	Stone	Pine timbers and tile
1807	Neophyte houses	6.0	5.0	Adobe	Tile
1808	Neophyte houses	6.0	5.0	Adobe	Tile
1810	Wing	70.0	6.0	Adobe	Tile
1810	Tannery	30.0	6.0	—	—
1809	Granary	60.0	7.0	Adobe	Tile
1811	Granary	62.0	8.0	Adobe	Tule
1811	Granary	42.0	7.0	Adobe	Tile
1812	Granary	42.0	7.0	Adobe	Tile
1812	Granary	42.0	7.0	Adobe	Tile
1813	Granary	55.0	7.0	1.5 Adobes	Tile

Table 6.5. Construction Data for the San Gabriel Mission's Second Location

Year	Function	Length (varas)*	Width (varas)*	Walls	Roof
1814	Hospital	112.0	12.0	Adobe	Tile
1815	Room	100.0	6.0	Adobe	Tile
1814	Chapel	37.0	5.3	Adobe	Tile
1816	Mill	18.8	9.3	—	—
1816	Smithy	18.8	7.0	—	—
1817	Water basin	—	—	—	—
1817	Drainage sewer	—	—	—	—
1817	Drainage sewer	67.0	50.0	Adobe	—
1819	Hennery/dovecote	—	—	—	—
1820	Mill (wheat)	—	—	—	—
1820	Mill (oil)	—	—	—	—
1821	Granary	66.0	7.0	—	—
1821	Granary	51.0	7.0	—	—
1823-25	Sawmill	—	—	—	—
1823	Forge	—	—	—	—
1825	Mill-corn	—	—	—	—

Note: Data from Engelhardt (1927a:21–22, 74–75, 93) and Geiger (1968:35–36, 39).

*1 vara = 0.87 m (2.85 feet)

Other Features and Deposits

Twenty-two features were identified that were not directly related to the Area 1 structure, the reservoir complex, or the mill and millrace complex. These other features consisted of one segment of an adobe wall, one tile-ringed enclosure, three rubble pits, one large refuse pit, eight post features, five ash features, one surface, a pipe, and a charcoal deposit.

Walls and Enclosures

Feature 11

Feature 11 was a small, walled enclosure adjacent to the east millrace wall. The wall was constructed of mortared adobe tiles standing on end (Figure 6.21). The excavated portion of the enclosure measured 2 m (north-south) × 1.3 m (east-west). It was preserved to a height of 30 cm and was a single course wide. The tiles measured approximately 20 × 5 cm and were held together by mortar. The tiles also appeared to have been covered in plaster on their interior sides. The feature is entirely within Stratum Ia, and appears to have some internal stratigraphy. A lens of highly compacted fine loam was identified in the interior of this feature. The function of this feature is unknown, but lighter sediment containing a lower density of artifacts was present at the base of the walls and was interpreted as a possible surface. The area enclosed by Feature 11 may have served as a storage area within the garden. Associated excavation units were EUs 107, 108, 127, 142, 145, and 146 (Figure 6.22). Ceramics, faunal and floral remains, glass, metal, and charcoal were observed in these units.

Feature 34: Garden Wall

Feature 34 was a section of a cobble wall foundation discovered during the mechanical excavation of mechanical trench (MTR) 5. Once exposed, mechanical excavation was stopped and EUs 270, 271, and 283 were opened to explore the feature (Figure 6.23).

Feature 34 measured 1.45 m (north-south) × 1.82 m (east-west). The height of the wall is unknown, but the exposed portion was 38 cm high. The feature was constructed of angular, sub-angular, and round cobbles ranging in size from 7 to 25 cm in diameter.

Figure 6.21. Overview of Feature 11, view facing north.

No mortar was present, suggesting that the wall was held together by compacted soil. Larger cobbles (~25 cm in diameter) composed the outer portion of the wall, while medium-to-small cobbles (~7 cm in diameter) filled the center. A layer of melted adobe was noted by excavators immediately overlying the footing as it was exposed. The melted adobe is the remnant of unfired adobe bricks that would have formed a wall structure overlying the footing. Both ends of the wall appeared to have been truncated by post-depositional activities. The western edge of this feature was truncated during the American period, and refuse was dumped or backfilled in this location, as evidenced by well-preserved metal cans located immediately adjacent to the western edge of the feature. The eastern edge of Feature 34 was not fully exposed and excavation did not extend to the full depth of the wall foundation due to the proximity of the excavations to the Union Pacific Railroad grade.

The northeast corner of EU 271 contained a small number of artifacts adjacent to the wall. The northwest and southwest portions of EU 270 contained moderate numbers of artifacts. Feature 34 was similar in construction to Features 3 and 5 in the southwestern portion of the study area. In contrast to Features 3 and 5 however, this wall footing was only one course of cobbles thick, and did not employ the same construction methods as seen in the other features. For example, Feature 34 does not have the same shaped siltstone capstones that were identified as the outer edges and uppermost layers of Features 3 and 5. Features 3 and 5 were many courses thicker and would have supported a higher load, such as a much more substantial roofed structure. As a single-course footing, Feature 34 would not have supported much weight, and is not likely to have supported a roof or cross-members.

Following the data recovery phase, Feature 34 appeared to be a small isolated wall segment and its function was poorly understood. However, the context of this segment was revealed during the subsequent construction monitoring phase, which will be reported in detail as part of a future construction monitoring report. During construction monitoring, a larger segment of the wall represented by Feature 34 was exposed. This larger segment, which aligns perfectly with Feature 34, was clearly a portion of the main enclosing wall of the mission garden.

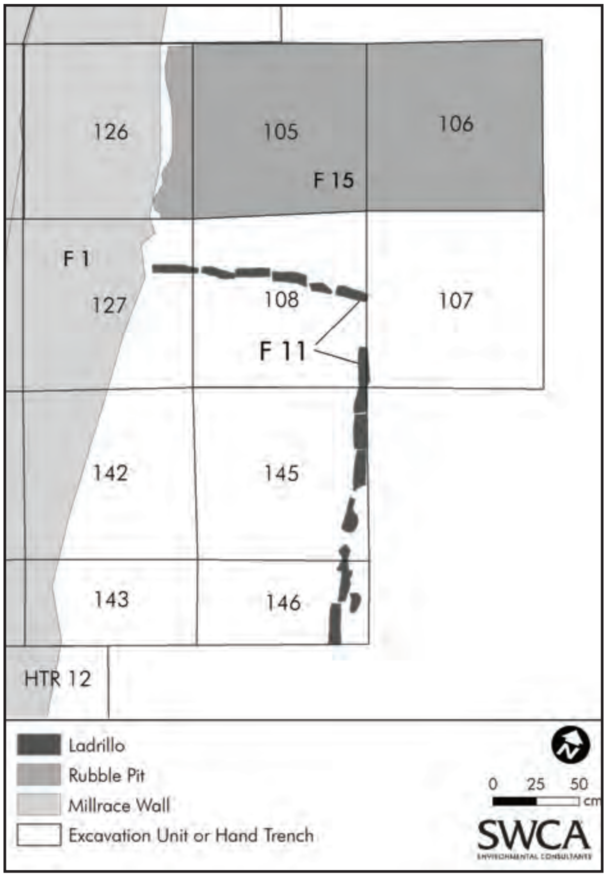

Figure 6.22. Features 11 and 15 with associated excavation units, plan view.

The data recovery plan indicated the possibility that a section of wall exposed in Area 1 during prior project phases represented the garden wall (Dietler and Hoffman 2011) However, this wall segment was one of the remnants of the Area 1 structure discussed above.

Refuse Concentrations

Five refuse concentrations were identified during data recovery excavations. Two of the concentrations (Features 15 and 38) likely represent demolition events and are primarily composed of architectural materials. Features 14 and 35 represent refuse disposal pits. Feature 30 was an artifact concentration consisting primarily of broken pottery.

Feature 15

Feature 15 was a dense refuse concentration adjacent to and east of Feature 1B (see Figure 6.3) that contained tile fragments, broken caños, faunal bone, sand, cobbles, and decomposed mortar, adobe brick, and tile fragments. This feature represents the channel feature that underlay the millrace in this area (see Chapter 5). Similar artifacts were found in other locations within the channel feature, but the artifact density in this area is much higher. There is a range of possible reasons for this high density: multiple dumping episodes; an area where the channel terminated and larger materials collected; or an area where these materials were placed as riprap to slow water flow and erosion of the earthen channel.

The size of Feature 15 was not determined because it was not fully excavated. The observed portion of the feature measured at least 1 m (north-south) × 2.28 m (east-west), and the deposit was 0.5 m thick. The shape is undetermined, as the feature was present throughout EUs 105, 106, and 126, and no edges were defined during excavation (see Figure 6.22). The stratigraphic sequence is complex within these units, and includes, increasing in depth from the surface, Strata Ia, Ib, IIa, IIb, IIc, and III. The artifact concentration comprising Feature 15 makes up the channel fill that has been identified as Strata IIa–c in other locations across the site (see Chapter 5). Strata IIa–c are described as the product of high-energy alluvial deposits. These deposits contain abundant cultural materials and represent pulses of high energy transport of alluvial materials and artifacts within a relatively large earthen water channel. Bedding and upward fining were identified within these strata, providing further evidence that the channel experienced episodes of high-energy flows as well as more moderate flows. The lower portion of this feature lies at the contact between Stratum II and Stratum IIIa. The concentration in this location does not display a classic pit shape, but instead cuts through Stratum IIIa in a slightly undulating fashion. This further suggests that the cultural materials in this location were deposited into an existing channel.

Figure 6.23. Feature 34, view facing south.

Over 6,000 artifacts were recovered from Feature 15 (Table 6.6), including 3,423 faunal bones, 1,760 building material pieces, and 689 ceramic items. In addition, three glass beads were recovered from the feature, one from EU 126 and two from EU 105. Two of these beads are classified as San Gabriel Type 3 bright aqua seed beads, and the third is a San Gabriel Type 10 medium-blue seed bead.

Temporally diagnostic artifacts from Feature 15 include ceramics (imported and locally or regionally produced) and buttons. The ceramic assemblage is dominated by San Gabriel Mission Brown Ware, which accounts for a total of 493 sherds, or 72 percent of the total ceramic assemblage from Feature 15. Other types of low-fired earthenware present include Southern California Brown, and Colorado Desert Intermediate Brown. Imported ceramic ware types include Puebla Blue-on-White, Aranama Polychrome, San Elizario, and Monterey Polychrome varieties of majolica, as well as Tonala and Galera Mexican lead-glazed coarse earthenware, and hand-painted Chinese porcelain. The ceramic assemblage is notable because it does not include any white-bodied refined earthenwares such as creamware, pearlware, or whiteware. This absence of white-bodied earthenwares, as well as the dominance of Mission San Gabriel Brown and majolica, suggests a relatively early date for the feature. The mean ceramic date for this deposit is 1796.

In addition, three buttons were recovered from Feature 15. Two are one-piece flat disk buttons, one with a drilled eye shank (1700–1850), and one with an alpha loop shank (1770–ca. 1800). The third button is a circular domed button with a colorless glass faceted insert in the center, which dates from the eighteenth to the mid-nineteenth century. The limited quantity of glass (three fragments of bottle glass and three beads) is also consistent with an earlier date for this feature. Faunal material recovered from Feature 15 includes cow, sheep/goat, chicken, and deer remains.

Table 6.6. Artifacts Recovered from Features 15, 30, 35, and 38

Feature No.	Imported Ceramics	Local and Regional Ceramics	Earthenware Building Material	Bone	Bone Artifact	Shell	Shell Artifact	Glass	Glass Beads	Metal	Rubber	Flaked Stone	Ground Stone	Stone Building Material	Other Historical Artifacts	Total
15	38	651	1,760	3,423	2	18	–	3	3	150	–	3	1	1	39	**6,109**
30	2	94	23	319	–	–	–	9	–	2	–	–	–	–	22	**471**
35	32	25	351	2,231	–	20	–	33	–	73	1	1	1	1	19	**2,797**
38	5	4	102	461	–	–	4	10	–	10	–	–	–	–	18	**616**
Total	**77**	**774**	**2,236**	**6,434**	**2**	**38**	**4**	**55**	**3**	**235**	**1**	**4**	**2**	**2**	**98**	**9,993**

Feature 30

Feature 30 was an artifact concentration adjacent to Feature 3 in Area 1 (see Figure 6.2). The feature measured 50 cm (north-south) × 48 cm (east-west) × 17 cm (thick). The feature contained primarily ceramics and faunal bone, with 94 sherds of Mission San Gabriel Brown Ware and 319 fragments of bone (see Table 6.6). Small numbers of imported ceramic, glass, metal, earthenware building material, and asphaltum were also present. The feature was amorphous and irregular in its horizontal shape, and it had a convex vertical shape indicating that the concentration was placed in a pile rather than in a pit. The feature was located entirely within Stratum Ia, likely resting on a historic occupation surface just east of the eastern wall of Feature 3.

Feature 35

Feature 35 was an amorphous refuse deposit located on the north side of the railroad tracks, east of Area 1 (see Figure 6.1). It measured 40 cm (north-south) × 1.0 m (east-west) × 40 cm (thick). It was discovered at a depth of 90–130 cmbd (Datum 11) during the mechanical excavation of MTR 3. The feature's stratigraphic integrity was poor and its boundaries were diffuse, and no recognizable shape could be determined. Recovered artifacts, including ceramic and glass artifacts, indicate an early to mid-nineteenth century date for this feature.

Feature 35 was identified during the backhoe excavation of MTR 3, at which point mechanical excavation was stopped and EU 268 was excavated to explore the feature. The upper 10 cm of the unit exhibited heavy disturbance related to the nearby railroad tracks and contained a high quantity of ballast gravel. The upper boundaries of the feature were within Stratum Ic and continued down into Stratum III. The feature likely originates at what was interpreted as an historical occupation surface (Stratum Ic) and was excavated into older alluvium (Stratum III). Artifacts within the feature were mainly faunal bone. No ash or burned earth was noted, suggesting that the feature functioned as a disposal pit rather than a re-purposed roasting pit or hearth clean-out disposal area. Building material was also present in small quantities. Faunal bone was identified in the field as primarily sheep or goat.

Artifacts that were collected include 57 ceramic artifacts; 351 earthenware building material items, including fragments of ladrillos, tejas, and caños; and 2,231 faunal bones. One ground stone bowl fragment and one piece of flaked stone debitage were also recovered (see Table 6.6). Imported ceramic wares include edge-decorated pearlware, hand-painted and transfer-printed whiteware, lusterware, annular ware, and Chinese export porcelain. In addition, a kaolin pipe stem fragment was recovered from this feature.

The feature appears to have functioned as a refuse disposal pit dating to the early to mid-nineteenth century containing a faunal assemblage dominated by sheep/goat remains.

Feature 38

Feature 38 was a concentration of Mission-period building materials, such as ladrillos and asphaltum, which was located west of the Millrace (see Figures 6.1 and 6.24). The feature was identified at 67 cmbd (Datum 3) during mechanical excavation of MTR 1. Upon discovery, the mechanical excavation was halted and EU 274 was opened to explore the feature.

The horizontal extent of the feature is unknown because it was not fully excavated. However, it measured at least 1 × 1 m and was at least 33 cm thick in EU 274. The feature was located within Stratum Ib near the contact with Stratum II. Most of the ladrillo fragments in this concentration were lying flat, possibly indicating that these materials were placed or dumped on a historic occupation surface.

The concentration of ladrillos, mortar, and asphaltum exhibited no discernible pattern or edges, suggesting that it represented a discard pile rather than an in situ architectural feature. Artifacts within the feature were concentrated in the lower levels, underneath the majority of the architectural rubble, and consisted of 9 fragments of ceramic, 461 pieces of faunal bone, and 102 pieces of earthenware building material, including ladrillos, tejas, and caños (see Table 6.6). In addition, aqua, green, and colorless vessel glass was present, and one square nail (wrought or cut) was collected.

Temporally diagnostic artifacts recovered from Feature 38 include a fragment of pearlware tableware (1780–1820s) and a fragment of a Galera lead-glazed earthenware jar or bowl (1780–1830s). In addition, four shell beads were recovered from the feature. These include two olivella class H1a beads, which typically date to the Early Mission period (1770–ca. 1805), and one class H2 bead, which typically dates to the Terminal Mission period (1816–1834).

Feature 14

Feature 14 was a large refuse pit that post-dated the main occupation of the site. It measured 4.2

Figure 6.24. Feature 38, view facing west.

m (north-south) × 3.7 m (east-west) and was likely ovate in plan, extending to a depth of 1.79 m below Datum 6 (Figure 6.25). The feature was basin-shaped in profile, but it is not clear whether the bottom was flat, rounded, or pointed, because the bottom depth was exposed only within an excavation unit measuring 0.5 × 0.5 m (Figure 6.26). Feature edges and boundaries were diffuse, and there was no evidence that the feature was prepared in any way. Feature 14 was originally excavated into the floor of Feature 3, the Area 1 structure. It is therefore an intrusive feature that post-dates that structure. The fill that constituted the Feature 14 assemblage was deposited in at least two episodes, one of which included the deposition of a dog carcass. The fill was composed of brown, unconsolidated, clayey silt with cobble inclusions. Nine excavation units were excavated within or in association with Feature 14: EUs 147, 148, 149, 150, 151, 197, 241, 242, and 257 (see Figure 6.25). The feature boundary observed in EU 242 was very diffuse, and thus the artifacts recovered from that excavation unit were excluded from the Feature 14 analysis.

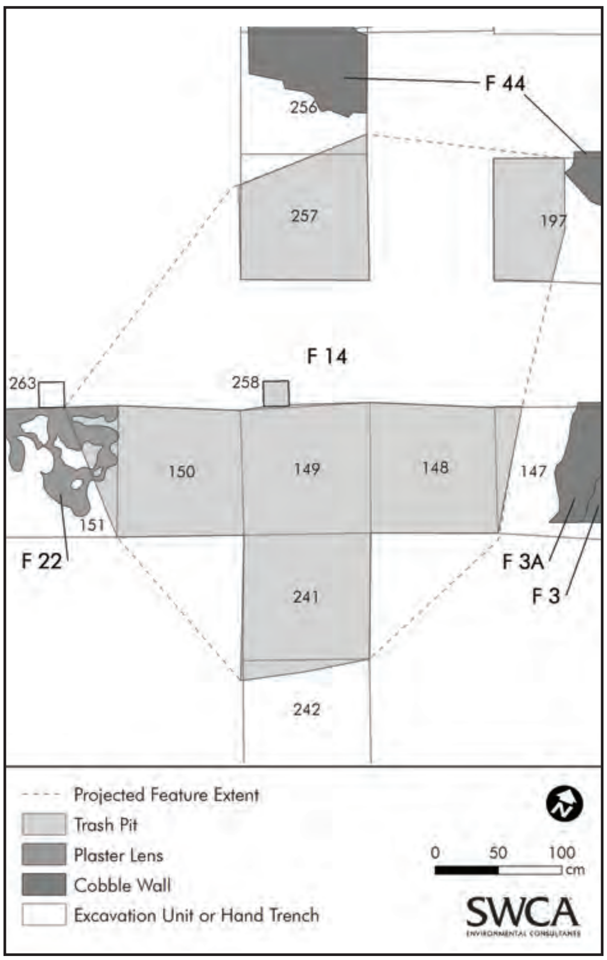

Figure 6.25. Feature 14 and associated excavation units, plan view.

The fill sequence for Feature 14 consisted of two depositional phases. The first phase of deposition was represented by loose, gravelly sand that contained a low density of artifacts. The second phase, as represented in the upper fill stratum, was a dense cultural deposit of historical refuse, including metal, bone, ceramics, cobbles, and glass. Dog remains were present in both strata.

A total of 35,867 artifacts were recovered from the Feature 14 refuse pit (Table 6.7). These included imported European and Asian ceramics, as well as locally and regionally produced Native American ceramics, Prosser buttons, earthenware building materials, bottle and container glass, square and wire nails, wire, cans, shoes, and garment closures. Metal items, mostly cans, were by far the most common artifacts recovered. The greatest number of the artifacts came from EU 149; over 17,000 items were recovered from this unit, representing 47 percent of the artifacts from Feature 14.

Temporally diagnostic artifacts recovered from Feature 14 include imported ceramics with production ranges throughout the late-eighteenth and nineteenth centuries, such as creamware, edge-decorated pearlware, transfer-printed whiteware, and ironstone. The mean ceramic date for the assemblage based on these wares is 1845. Five four-hole Prosser buttons, which date after 1840, were recovered from EU 149 and one was recovered from EU 148. Other artifacts from the refuse pit, including machine solder seam cans and glass bottles, date the refuse primarily to the late nineteenth and early twentieth centuries. An 1816 Spanish real coin (Ferdinand VII) was found in EU 149. This coin is not thought to date Feature 14, because it is much older than the other materials that were present. It may have been kept as an heirloom (as is common with coins of precious metal) prior to being discarded in this refuse pit.

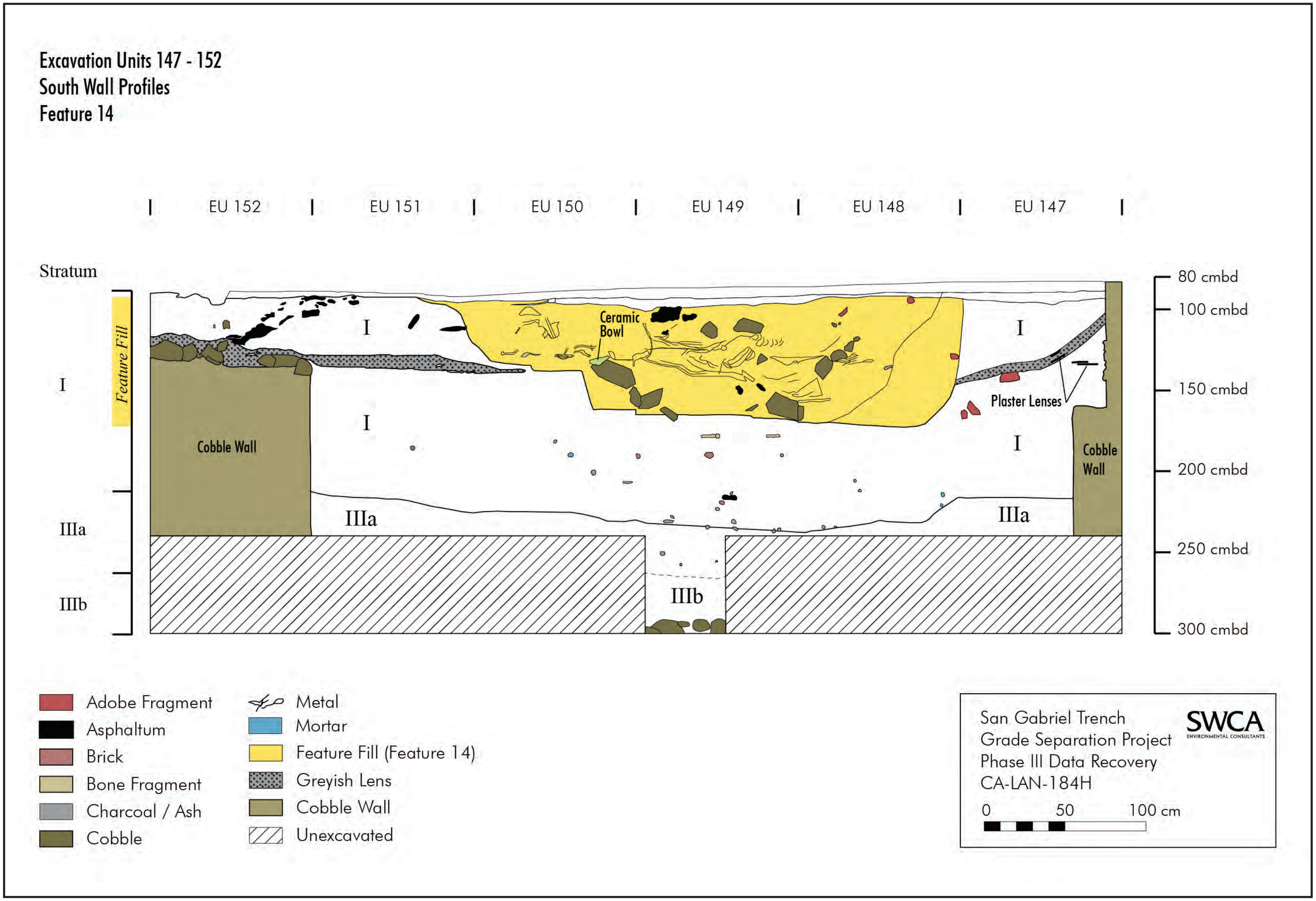

Figure 6.26. Feature 14 profile, view facing south.

Table 6.7. Artifacts Recovered from Feature 14

EU	Imported Ceramics	Local and Regional Ceramics	Earthenware Building Material	Bone	Shell	Shell Artifact	Glass	Glass Beads	Metal	Plastic	Rubber	Textile	Wood	Leather	Flaked Stone	Gunflint	Stone Building Material	Other Historical Artifacts	Total
147	12	4	11	40	–	–	105	–	80	–	–	–	–	–	1	–	–	65	**483**
148	37	21	259	779	–	–	451	–	4044	1	–	–	1	25	–	1	2	405	**6,027**
149	106	15	375	2,361	2	1	1,328	–	11724	1	34	9	1	41	2	–	49	983	**17,023**
150	176	24	115	428	135	–	279	–	5010	–	–	3	–	5	–	–	2	317	**6,494**
151	7	-	17	23	–	–	22	–	55	–	–	–	–	–	–	–	–	353	**517**
197	8	5	233	109	–	–	136	–	716	1	–	–	13	-	1	-	43	1378	**2,643**
241	7	3	23	15	–	–	42	–	512	–	–	–	–	–	–	–	1	27	**1,023**
257	2	4	116	60	1	–	141	–	1779	–	–	–	–	27	–	–	8	106	**2,295**
258	1	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	**2**
Total	**356**	**76**	**1,149**	**3,815**	**138**	**1**	**2,504**	**1**	**23,921**	**3**	**34**	**12**	**15**	**98**	**4**	**1**	**105**	**3,634**	**35,867**

The composition of the assemblage is typical of domestic refuse from the late nineteenth and early twentieth centuries. It includes a range of consumer items such as glass bottles and containers (Table 6.8) and metal cans of different manufacture techniques and forms. Numerous garment and shoe-related items are also present, including 53 buttons, 9 buckles, 23 eyelets, a corset busk, shoe tacks, and shoe leather.

Feature 14 exhibited the highest diversity of plant remains in the study area (see Chapter 7). Pine nuts, charred and uncharred Cheno-am remains, corn, Elderberry, fig, watermelon, pepper, tobacco, alfalfa, tomatillo, chamomile, juniper, cherry, and redwood were found in association with this feature. Faunal remains recovered included those of cat, chicken, cattle, dog, pig, gopher, rabbit, sheep/goat, and squirrel (Table 6.9). The faunal assemblage from this feature was unique in its relatively high proportion of dog, chicken, and pig remains. It was the only feature excavated to contain the remains of a cat (see Chapter 8).

The Feature 14 trash pit was probably dug during in the late nineteenth century, possibly in relation to the construction of the railroad, and was subsequently filled with trash by people on the property or in the neighborhood. The pit is situated between the two Area 1 structure wall foundations. It is likely, however, that the location of the pit has no association with the structure itself, as the adobe walls had likely long ago melted at the time that the pit was originally excavated. The lower strata of the pit fill (Phase 1) contained little cultural refuse, so the initial reason for the excavation of the pit is unknown. It is possible that it was initially a borrow pit related to railroad construction that was used later as a refuse pit.

Table 6.8. Feature 14 Glass Bottles Forms and Manufacture Techniques

Form	Hand Blown	Turn Mold	Cup Bottom Mold	2 Part Mold (Iron-Hinged)	Automatic Bottle Machine	Indeterminate	Total
Beer bottle	–	–	–	–	12	–	**12**
Champagne/ Wine bottle	1	–	–	–	–	1	**2**
Condiment	–	–	4	11	–	42	**57**
Cup	–	–	–	–	–	2	**2**
Flask	–	–	–	1	–	4	**5**
Indeterminate form	1	2	–	14	1	38	**56**
Indeterminate food container	1	–	–	–	–	–	**1**
Jar	1	–	–	19	5	7	**32**
Jug	16	–	–	–	–	–	**16**
Lid Liner	–	–	–	–	–	1	**1**
Liquor bottle	2	–	–	–	–	4	**6**
Medicine/ extract bottle	–	–	–	–	19	2	**21**
Milk	–	–	–	–	–	1	**1**
Soda/ water bottle	1	–	–	–	–	4	**5**
Toiletries	–	–	–	–	–	1	**1**
Total	**23**	**2**	**4**	**45**	**37**	**107**	**218**

Table 6.9. Vertebrate Faunal Remains Recovered from EU 149 in Feature 14

Species	Count	Percent
Cat	1	0.0
Chicken	101	4.1
Cattle	300	12.3
Dog	1,777	72.8
Pig	12	0.5
Gopher	13	0.5
Rabbit	3	0.1
Sheep/Goat	102	4.1
Squirrel	8	0.3
Unidentified	124	5.1
Total	**2,441**	**100.0**

Posts and Post Holes

Eleven posts and post holes were encountered during data recovery (Table 6.10; see Figures 6.1, 6.2, and 6.3). Each appeared to represent a fence post, and all except one were intrusive to Mission-period features, indicating a later temporal association for the post and post hole features. These features are most likely related to ranching activities dating to the American period. One pit of unknown function was excavated near Feature 1. This pit (Feature 19) may have been a post hole, but its irregular shape reduces the confidence of this interpretation.

Feature 19

Feature 19 was a small pit feature located between the exterior walls of the rectangular reservoir (Feature 21E) and the triangular reservoir (Feature 12C). The feature measured 40 cm (north-south) × 25 cm (east-west) in plan and was 26 cm deep. Feature 19 was irregularly shaped in profile (Figure 6.27). Sediments within the feature were well-sorted silts with low compaction and light brown color (10YR 5/3), which contrasted with the

Table 6.10. Post and Post Hole Features

Feature No.	Feature Type	Location	Shape	Dimensions (cm)	Stratigraphic Relationships	Temporal Affiliation	Artifacts
16	Wood post and post hole	EU 155	Rectangular	15.5 E/W × 17 N/S × 82 deep	Intrusive into Feature 24/25	Post Mission	Metal, asphaltum
17	Wood post and post hole	EU 162	Rectangular	12 N/S × 20 E/W × 24 deep	Intrusive into Feature 5	Post Mission	None
18	Post hole	EU 161	Rectangular	40 E/W x 55 N/S × 43 deep	Intrusive into Feature 5	Post Mission	None
27	Post hole and metal train tie	EU 192	Circular	10 E/W × 10 N/S × 60 deep	Intrusive into Feature 5	Post Mission	Brick, metal, faunal
32	Wood post and post hole	MTR 1 Section 4	Irregular	30 E/W × 36 N/S × 58.5 deep	Isolated	Unknown	None
41	Wood post and post hole	EU 251, 252	Rectangular	34 E/W × 20 N/S × 30 deep	Intrusive into Feature 21/23	Post Mission	None
46	Wood post	EU 255	Square	10 E/W × 10 N/S	Intrusive into Feature 44	Post Mission	N/A
49	Post hole	EU 245/261	Circular	23 E/W × 24 N/S × 10	Intrusive into F10	Post Mission	None
50	Post hole	EU 123/199	Circular	36 E/W × 35 N/S × 6	Intrusive into F10	Post Mission	None
51	Post hole	EU 104/137	Circular	73 E/W × 24 N/S × 10	Intrusive into F10	Post Mission	None
52	Post hole	EU 131	Circular	25 E/W × 24 N/S	Intrusive into F1	Post Mission	None

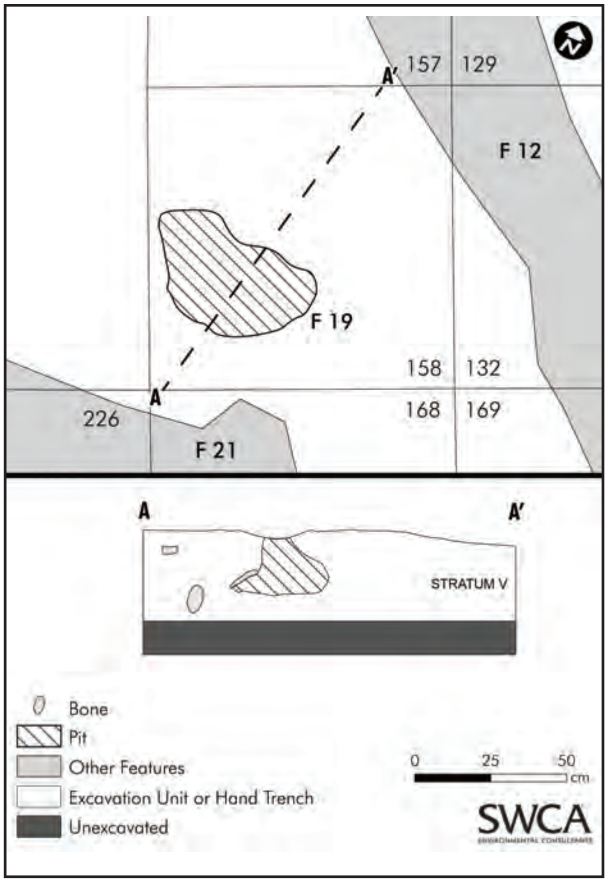

Figure 6.27. Profile of Feature 19.

highly compact and dark brown surrounding matrix. Charcoal was present in the fill but no oxidation was present, indicating that this feature was not a hearth or fire pit. No artifacts were recovered from this feature.

Ash Features

Six ash and charcoal features were identified during data recovery excavation, none of which exhibited evidence of use as a hearth. These features probably represent ash dumps from hearth clean-out episodes.

Feature 7

Feature 7 comprised three small pockets of ash associated with Feature 8, a compact surface (see below). Feature 7 measured 26 cm (north-south) × 14 cm (east-west) × 4 cm (thick). It was irregular in plan and cylindrical in profile. The feature was found in Stratum Ic immediately above Feature 8 (which was in Stratum II). The feature contained a dark grey (10YR 4/1) ashy sediment with small charcoal inclusions. No oxidation was present and the boundaries of the feature were highly diffuse. The ashy feature was within dark organic soil, which terminated at the compact surface. No artifacts were recovered from this feature.

Feature 24

Feature 24 was a small ash deposit that may represent part of a larger pit, together with Feature 25, that was disturbed by a posthole (Feature 16). The feature was circular in plan and basin-shaped in profile. It measured 27 cm (north-south) × 21 cm (east-west) × 10 cm (thick). The fill consisted of loosely compacted ashy silt with 10 percent gravel inclusions. A ceramic spindle whorl was collected from the fill of this feature.

Feature 25

Feature 25 was a shallow ash deposit adjacent to Feature 24; these features may compose a single larger ash feature that was disturbed by a post hole (Feature 16). This feature measured 30 × 30 cm in plan and was 15 cm thick. It was irregular in shape, both in plan and profile. The fill was loosely compacted silty ash with 40 percent charcoal inclusions and 10 percent gravels (0.1–0.8 cm long). One faunal bone, a possible sheep pelvis, was recovered from this feature.

Feature 28

Feature 28 was an ash lens adjacent to the east side of Feature 1, the Area 1 structure wall. It measured 100 cm (north-south) × 150 cm (east-west) × 14 cm (thick). The sediment consisted of a light brownish gray silty ash with 40 percent charcoal inclusions. The feature was irregular in plan and relatively flat in profile. Artifacts collected from this feature included several ceramic sherds, fragments of earthenware building material, 27 fragments of faunal bone, and one fragment of colorless glass.

Feature 29

Feature 29 was an extensive ash layer that was situated in the northeast portion of Area 2 (Figure 6.28; see Figure 6.3). It was encountered outside the triangular reservoir (Features 1B, 10, 12, 31, and 39) but was also evident in one unit overlying this feature. Feature 29 was, therefore, stratigraphically above and more recent than the triangular reservoir. The exposed portion of the feature measured 1.2 m (north-south) × 4.5 m (east-west). However, the feature was not fully exposed because it extended to the north beyond the boundaries of the excavation units. It measured 17 cm at its thickest, and was generally flat in profile. The feature fill was located entirely within Stratum Ib, near the contact with the underlying Stratum Ic. It is likely that this contact represents a historic occupation surface adjacent to the north wall of the reservoir feature, and that these ash lenses are the products of refuse dumping on this surface. It is unknown whether these ash lenses are the result of a single episode of dumping or represent multiple episodes. It is also unknown whether these ash lenses are contemporaneous with the lenses seen throughout the feature fill in the interior of the triangular reservoir. In some excavation units such as EU 206, these ash lenses were isolated during excavation and contained very high densities of cultural materials, particularly Native American ceramics.

Artifacts recovered from Feature 29 included tin-enameled majolica tableware, Native American ceramics, earthenware building material, faunal bone and shell, one olivella shell bead, bottle glass, and metal cans.

Feature 48

Feature 48 consisted of an ash and charcoal deposit identified at 59 cmbd (Datum 7) along the southern wall of EU 264, adjacent to Feature 2 on the north side of the railroad tracks (see Figure 6.1). Feature 48 measured 20 cm (north-south) × 22 cm (east-west) × 3 cm (thick). The feature was irregular in plan and relatively flat in profile. This feature was identified within Stratum Ia, like other similar ash lenses in that area. Feature fill was dark brown (10YR 3/3) ashy sediment.

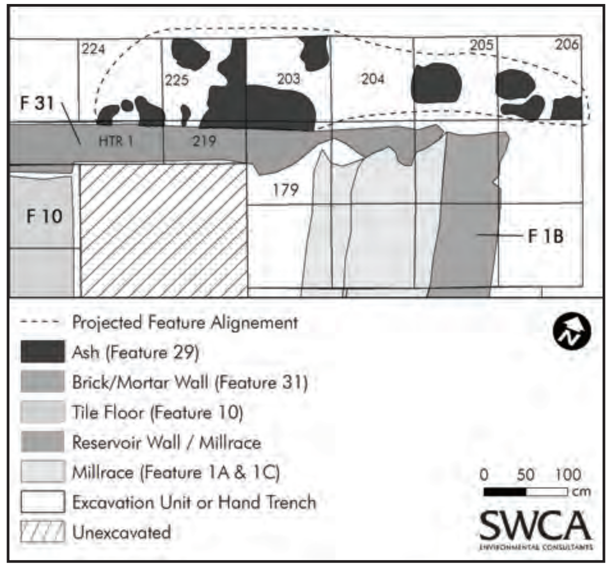

Figure 6.28. Feature 29 and associated excavation units, plan view.

Prepared Surface

Feature 8

Feature 8 was identified within four excavation units in MTR 1, west of the mill. Feature 8 was a surface within Stratum Ic that overlay a cultural stratum containing building material and faunal bone. This feature represents a prepared surface, possibly used for work activities. The feature measured 6 cm thick and was horizontally present across the full 2 × 2 m of the excavation unit boundaries. Feature 8 was not fully exposed. This feature was positioned beneath Feature 7, an ash deposit. Feature 8 sediments were a very dark grayish brown (10YR 3/2) highly compact sandy clay loam with moderately sorted pebble inclusions (0.5–2 cm). The plan shape of the feature is unknown because it was not fully exposed, but the profile shape was flat, which is characteristic of a use surface. In general, artifact densities were lower in this stratum than those seen in strata overlying and underlying it. Furthermore, there is a marked drop in frequencies of both faunal bone and earthenware construction materials (generally larger artifact types) within this stratum. A lack of larger sized artifacts and lower densities of artifacts are characteristics that point to use and maintenance. A well-maintained earthen house floor, for example, is typically kept free from large objects by regular sweeping. Additionally, the upper portion of this lens was highly compacted, which is another characteristic of house floors. Alternatively, this lens may simply represent an unused portion of the site where larger refuse items had not accumulated, as was observed in other areas of the site. Associated artifacts included ceramics, earthenware building material, and cattle bone. This feature was identified at 133 cmbd (Datum 3).

Pipe

Feature 40

Feature 40 is a metal water pipe that was exposed in MTR 1. Mechanical excavation was stopped when the pipe was encountered, and it was further exposed by hand digging. The pipe measured 18 cm in diameter and 1.2 m in length. It was identified at 155 cmbd (Datum 3). The pipe is oriented north-south and continues into the north and south walls of MTR 1. The exposed portion of the pipe comprised two pieces at a female/male insertion. The female end is 19 cm in diameter, and the male segment is 17 cm in diameter. The age of the pipe is unknown. It appeared to not be in use due to its corroded and crushed condition.

The condition of the pipe segment was poor, as it exhibited corrosion, holes, and crushing. The pipe was situated in a previously excavated trench, which was visible in the side walls of MTR1. Artifacts that were displaced during the excavation of the pipe include charcoal, tejas, and faunal remains. These were not collected. This pipe may be the “fine iron pipe” mentioned in an 1886 Los Angeles Times article that describes the burial of Chapman’s Millrace (Los Angeles Times, 14 July 1886; see Chapter 2).

Summary and Conclusion

The data recovery excavation team identified three structural feature complexes located near the center of the excavation area, all of which are associated with water conveyance and distribution: the rectangular reservoir, the triangular reservoir, and Chapman’s Mill and Millrace. The construction sequence and stratigraphic relationships of these three complexes indicates that the rectangular reservoir was built first, followed by the triangular reservoir, and then Chapman’s Mill and Millrace. It is possible that the triangular reservoir is the original millpond for what became Chapman’s Mill. Artifact data from excavations inside the structures indicate that the rectangular and triangular reservoirs were no longer in use and were filled with sediment in the Late Mission period (1800–1816). Archival research indicates that Chapman’s Mill and Millrace was constructed between 1822 and 1825. Archaeological data presented above indicate that Chapman used the two existing reservoirs as a foundation for his mill and millrace, incorporating them into the new structures.

We also identified the Area 1 structure at the west end of the excavation area, which likely represents a granary. This building complex consisted of the cobble foundation of a large adobe building, including one interior wall, two interior tile floors, and two exterior tile floors. The dimensions of the building are similar to granaries known to have been built in 1811 and 1812, and the lack of diagnostic artifacts associated with particular functions reinforces the interpretation of the building as a storage facility.

In addition to the structural features, we identified 25 non-structural features. These include one packed earthen surface, five ash features, one charcoal deposit, five post holes, seven wood posts, five refuse concentrations, and one metal pipe. All of these features are consistent with the use of the area during the Mission period as a garden and location for agricultural and domestic activities such as processing grain and cooking. In addition, more recent features indicate that the area continued to be used as a place to deposit refuse and perhaps keep livestock into the American period.

CHAPTER 7: PLANT REMAINS

James M. Potter

Analysis of plant remains—pollen and macrobotanical remains—from the San Gabriel Mission archaeological site has the potential to illuminate three important functional and behavioral aspects of life at San Gabriel Mission: 1) which foods were cultivated and harvested in the mission garden, 2) which plant foods, especially grains, were stored and milled onsite, and 3) which plant foods were consumed and disposed of in the part of the mission covered by the study area. Plant remains also can inform about local environmental changes, dietary shifts, disposal patterns, cultural differences, preservation issues, and the variety and productivity of cultivated plants at San Gabriel Mission compared to other missions. This section summarizes the results of the plant remains analysis presented in Appendix C (Puseman et al. 2012) and attempts to model the depositional behaviors that would have resulted in the various plant remains recovered. It then explores the plant remains associated with each major feature and compares the assemblages in light of the hypothesized feature functions. The goal is to reinforce interpretations based on multiple lines of evidence. Finally, this section compares SWCA's floral analysis results with historical data on agriculture at San Gabriel Mission and other missions, as well as other archaeological studies from similar cultural contexts, to address some of the important differences that are documented between the San Gabriel Mission archaeological site plant assemblage and those of other missions.

The Sample

In total, 83 macrobotanical samples from six 20 × 20-cm column samples were analyzed from three areas of the site: Area 1 (the granary area on the west side of the study area), Area 2 (the mill and reservoir complex on the east side of the study area), and a midden area north of the railroad tracks (see Figure 4.6). These samples were chosen for plant analysis because they were thought to be data rich and representative of the major activity areas within the study area.

Five pollen samples were collected: three from the column samples, one pollen wash from a milling stone, and one control sample from the modern ground surface. Five samples for phytoliths or starches were taken from a variety of artifacts, including a milling stone, two manos, a steatite bowl, and a *ladrillo*, or brick. The methods of analysis for the plant remains are detailed in Appendix C. Scientific names for the plants discussed here are presented in Tables 7.1 and 7.2., as well as Appendix C.

Fifty plant taxa (identified to at least the level of family) were recovered as macrobotanical remains from the site. The assemblage comprises plants cultivated at the mission, wild weedy plants, and wild plants gathered by the occupants of the mission, most likely Native Americans. Cultivated plants include wheat, corn, grape, watermelon, cherry or plum, fig, pepper, walnut, pecan, alfalfa, and a member of the parsley family, possibly carrot or celery. Pollen samples contained mostly local weedy plants, but one contained pumpkin or squash pollen. Of the cultivated plants, corn is the most abundant and was recovered as pollen, 10 kernels, 13 cupules, and one stem.

Non-domesticated plants reflect some plant collection, but most are probably accidental inclusions of species that grow in disturbed places. Although many of them have recorded uses by indigenous California groups, their low occurrence would not indicate intensive gathering for food or other purposes. These include grasses, sunflower, sorrel, purslane, datura, tobacco, sedge, mustard, goosefoot, and pigweed. Mint or sage seeds, prickly pear, and elderberry were also recovered and likely represent gathered food.

Oak, birch, juniper, pine, willow, elm, maple or box elder, California buckeye, alder, spruce, and Douglas fir were recovered as charcoal. Oak is the most common. These most likely represent fuel sources. The samples also contained redwood, which was a preferred wood for building.

A sedge root phytolith was recovered from the exterior of a steatite bowl fragment (from west of the granary), most likely derived from *Scirpus* sp., *Schoenoplectus* sp., or *Cyperus* sp. *Scirpus* sp. is tule, which we hypothesize was used in the construction of the roof of the structure in Area 1. All of these samples came from an area within the historically mapped mission garden. This study attempts to identify which plants were grown in the garden and which plants were used in other ways. For example, plants may have been left as food refuse, used as construction materials, or deposited as remains from milling and storing grains.

The first section of this chapter summarizes the macrobotanical data presented in Appendix C and compares the Mission period assemblage with assemblages dating after the Mission period, primarily in terms of native versus introduced species. A discussion of the expected assemblage patterns for potential depositional scenarios follows, and compares these patterns with the data recovered from the site.

Plant Remains

Most of the plant assemblage from the San Gabriel Mission archaeological site appears to date to the Mission period and documents the presence of numerous introduced species in the diet at this time. These introduced foods include species in the parsley family (including carrots or celery, or both), mustard, fig, walnut, pecan, wheat, corn, pepper, sesame, and species in the genus *Prunus* (including cherry or plum, or both) (Tables 7.1 and 7.2). Watermelon was grown after the Mission period, as represented by an intrusive refuse pit (Feature 14). Interestingly, the occupants of the site after the Mission period appear to have relied less on introduced foods than people in the Mission period did; this pattern is primarily indicated by the high relative frequency of corn, a non-native species, in the Mission period assemblage. The seed data indicate that 22 percent of the Mission period plant remains represent introduced species, including corn, whereas only 9 percent of the later assemblage comprises introduced species (see Table 7.1). During the Mission period and after, native plant foods such as goosefoot (Chenopodiaceae family) or pigweed (genus *Amaranthus*), referred to as cheno-ams; chokecherries; elderberries; purslane; and pine nuts continued to constitute an important component of the diet. This stands in contrast to patterns seen in other Mission period assemblages, for example, at Santa Cruz Mission and San Fernando Rey de España Mission, where cultivated foods far outweighed native foods in importance (Abdo-Hintzman et al. 2010; Allen 1998).

Depositional Contexts: Sorting the Wheat from the Chaff

The term “garden” generally applies to a plot of cultivated land near a dwelling used to grow vegetables, fruits, herbs, or flowers for household purposes. The term is also used to define public areas and constructed landscapes containing decorative plants and trees; these areas are also known as decorative gardens. Missions also routinely had medicinal herb gardens, orchards, and vineyards. As a rule, orchards and gardens were planted quite near the missions and might be enclosed by high adobe walls or cactus hedges to keep out horses and cattle (Webb 1952:88). For this study, we use a broad definition of garden that could include all of these elements and contrast “garden” with areas away from habitations containing cultivated plants grown on a large scale, which are considered agricultural fields rather than gardens.

Table 7.1. Charred and Uncharred Seeds, Rachis[1], Caryopsis[2], Cupules[3], and Shell Fragments from Flotation Samples from Mission Period and Later Contexts

Common Name	Scientific Name	Count: Mission Period	Count: Later Periods
Native Plants			
Birch	*Betula* sp.	1	0
Clover	*Trifolium* sp.*	7	3
Datura, jimsonweed	*Datura* sp.	16	16
Dicot	Dicot	19	15
Elderberry	*Sambucus* sp.	23	14
Figwort	Scrophulariaceae	3	0
Goosefoot/pigweed	Cheno-am	34	59
Grass	Poaceae	18	11
Ground cherry, tomatillo	*Physalis* sp.*	0	1
Hawthorn	*Crataegus* sp.	2	1
Knotweed	Polygonaceae	0	6
Mallow	Malvaceae	32	23
Manzanita	*Arctostapholos* sp.	1	0
Mint (includes sage)	Lamiaceae	0	9
Nightshade	*Solanum* sp.	4	17
Nightshades	Solanaceae	4	4
Pine	*Pinus* sp.	33	21
Pink, carnation	Caryophyllaceae	1	6
Prickly pear, cholla	*Opuntia* sp.	1	2
Purslane	Portulaceae	12	14
Oak	*Quercus* sp.	1	0
Rush	*Juncus* sp.	0	1
Sandmat	*Chamaesyce* sp.	1	2
Sedge	Cyperaceae	2	0
Sunflower	Asteraceae	6	9
Tobacco	*Nicotiana* sp.	15	6
Wood sorrel	*Oxalis* sp.	1	3
Introduced Plants			
Alfalfa	*Medicago sativa*	0	1
Barley, oat, rice, rye, wheat	Cereal-type Poaceae	9	3
Corn	*Zea mays*	18	2
Fig	*Ficus* sp.	2	3
Grape	*Vitis* sp.*	7	0
Mustard/broccoli/cauliflower/kale	Brassicaceae	2	3
Oat	*Avena sativa*	1	0
Parsley	Apiaceae	3	0
Peruvian pepper	*Schinus* sp.	14	9
Sesame	*Sesamum* sp.	1	0

Table 7.1. Charred and Uncharred Seeds, Rachis[1], Caryopsis[2], Cupules[3], and Shell Fragments from Flotation Samples from Mission Period and Later Contexts

Common Name	Scientific Name	Count: Mission Period	Count: Later Periods
Walnut (includes pecan)	Juglandaceae	3	1
Watermelon	*Citrullus* sp.	0	1
Wheat	*Triticum aestivum*	7	0
California native		**237 (78%)**	**243 (91%)**
Introduced		**67 (22%)**	**23 (9%)**
Total		**304**	**266**

[1]Main axis or stem

[2]Grain or one-seeded fruit characteristic of grasses

[3]Structure surrounding one or more seeds

*Both native and introduced varieties are known

Table 7.2. Charcoal (Charred Wood) from Flotation Samples from Mission Period and Later Contexts

Common Name	Scientific Name	Charcoal Count: Mission Period	Charcoal Count: Later Periods
Native Plants			
Ash	*Fraxinus* sp.	1	0
Birch	Betulaceae	5	1
Buckthorn	Rhamnaceae	24	12
Cactus	*Opuntia* sp.	2	0
California buckeye	*Aesculus californica*	1	0
California laurel	*Umbellularia californica*	13	6
California sycamore	*Platinus racemosa*	7	4
Cone-bearing	Conifer	57	22
Elderberry	*Sambucus* sp.	1	0
Elm	*Ulmus* sp.	1	1
Hawthorn	*Crataegus* sp.	1	0
Maple, box elder	*Acer* sp.	3	1
Oak	*Quercus* sp.	108	54
Rose	Rosaceae	5	4
Rose	*Rosa* sp.	0	2
Sunflower	Asteraceae	11	8
Willow, aspen, cottonwood	Salicaceae	80	25
Introduced Plants			
Cherry, plum	*Prunus* sp.	1	1
Grape	*Vitis* sp.*	1	0

Table 7.2. Charcoal (Charred Wood) from Flotation Samples from Mission Period and Later Contexts

Common Name	Scientific Name	Charcoal Count: Mission Period	Charcoal Count: Later Periods
Peruvian peppertree	*Schinus molle*	3	4
California native		**320 (98%)**	**140 (97%)**
Introduced		**5 (2%)**	**5 (3%)**
Total		**325**	**145**

*Both native and introduced varieties are known

San Gabriel Mission has been described as having several extensive gardens (Webb 1952:87). These gardens were said to have contained oranges, citrons, limes, apples, pears, peaches, pomegranates, figs, and grapes in abundance (Robinson 1897:45). According to the inventory of November 1834, San Gabriel Mission had 2,333 fruit trees in nine orchards (Webb 1952:87).

San Gabriel Mission was also renowned for its expansive vineyards, including the largest of all the mission vineyards, which measured some 170 acres (Webb 1952:96). An 1834 memorandum of San Gabriel Mission's property listed four vineyards containing 163,578 vines. One of these was called the Viña Madre, or the Mother Vineyard. Webb (1952:96) suggests that this was because "it was the mother of all the mission's vineyards." Other missions had vineyards, but none equaled in size the Viña Madre of San Gabriel Mission.

A well-documented archaeological study at the San Gabriel Mission archaeological site took place immediately south of SWCA's study area, in what was likely the northeast corner of the mission garden. As part of this previous study's report, Williams (2005) discusses at length the historical background of mission gardens, and lists the various grains, fruits, vegetables, spices, nuts, decorative plants, and medicinal plants that historical texts indicate were grown in California mission gardens (Table 7.3).

The following sections present the San Gabriel Mission archaeological site plant assemblage in light of Williams' comprehensive list of California mission garden plants, and attempts to distinguish which plant remains were associated with the garden and which were related to other activities and contexts. To do this, we established certain expected patterns of deposition that would indicate these activities and contexts. As listed in Table 7.4, these expected assemblages relate to six activities or contexts: 1) the growing and harvesting of plants in a garden, 2) the consumption of plant foods and subsequent deposition of remaining plants parts, 3) the grinding of plant parts for food, 4) the burning of fields to clear them, 5) the feeding of animals, and 6) the burning of plant remains as fuel. Variation in the expected assemblages is driven by distinctions between burned and unburned plant remains, the different species expected, the various plant parts expected, and material associations. The expected assemblages as listed are not comprehensive or detailed; instead, for each depositional process, the listed assemblage reflects a general expectation and is meant to help distinguish the activities and features that produced the assemblage.

Grains

Williams (2005) notes that grains—barley, corn, millet, oats, and wheat—were cultivated as field crops away from household gardens and orchards. According to him, barley, corn, and wheat were the primary agricultural crops grown throughout California during the Mission period. Engelhardt's (1927a:273–275) history of San Gabriel Mission indicates that wheat and corn were the mission's predominant agricultural crops, and barley consistently composed a much smaller proportion of the overall harvest (Figure 7.1).

Table 7.3. Plants Grown in California Mission Gardens

Grains	Fruits	Vegetables	Spices	Nuts, Other	Decorative Plants	Medicinal Plants
barley, ***corn***, millet, **oats**, ***wheat***	*apples*, apricots, bananas, cantaloupes, **cherries**, *citrons*, coconuts, dates, ***figs***, **grapes**, lemons, *limes*, melons, olives, *oranges*, *peaches*, pears, plantains, **plums**, *pomegranate*, quinces, tomatoes, ***prickly pear (cactus)***, watermelons	artichokes, asparagus, beans, beets, **broccoli**, cabbage, calabash, **carrots**, **cauliflower**, **celery**, chickpeas, cucumbers, lentils, lettuce, onions, peas, potatoes, pimentos, **pumpkins,** radishes, **squash**, red peppers, sweet potatoes	cane, chili, garlic, herbs, **mint**, **mustard**, parsley, **pepper**, rosemary, rue	almonds, **pecans**, **walnuts**, cotton, flax, gourds, hemp, indigo, **tobacco**	acacia, bull mallow, burclover, California Bay, California fan palm, calla lilly, carnations, delphinium, **elderberry**, four o'clock, French marigold, holly, holly hocks, holly leaf cherry, iris, jasmine, larkspur, lavender, lemon verbena, loquat, Madonna lilly, matilija poppy, musk rose, narcissus, nasturtium, oleander, **pinks**, poppies, pennyroyal, **rose of Castile**, sweet pea, sweet scabious, thistles, toyon, virgin's bower, white lilies	anise, **chamomile**, caraway, fennel, iris, lavender, lily, **mint**, **rose**, rosemary, rue, salvia

Source: Williams (2005)

Note: Bolded plants were found in the San Gabriel Mission archaeological site assemblage. Italicized plants are mentioned in historical documents describing San Gabriel Mission's gardens and fields.

Table 7.4. Expected Assemblage per Depositional Process

Depositional Process/Use	Expected Assemblage
Gardening	Pollen or seeds of typically grown fruits, vegetables, nuts, flowers, and/or medicinal plants; remains of fruit trees
Plant Food Consumption	Burned macrobotanical remains, emphasis on edible parts of plant
Grinding or Milling	Cereal/grain pollen associated with grinding tools or features
Field Burning	Burned remains of typically field-burned plants (e.g., corn), all parts of plant
Animal Feeding	Unburned remains of food typically fed to livestock such as corn and alfalfa
Fuel Material	Charred fuel-wood or corn cobs (but few kernels) associated with hearth
Food Storage	Unburned grains associated with storage building and/or vessels, part of plant associated with storage such as corn cobs
Building Material	Unburned wood used for constructing buildings, such as pine or redwood, associated with nails and/or foundation

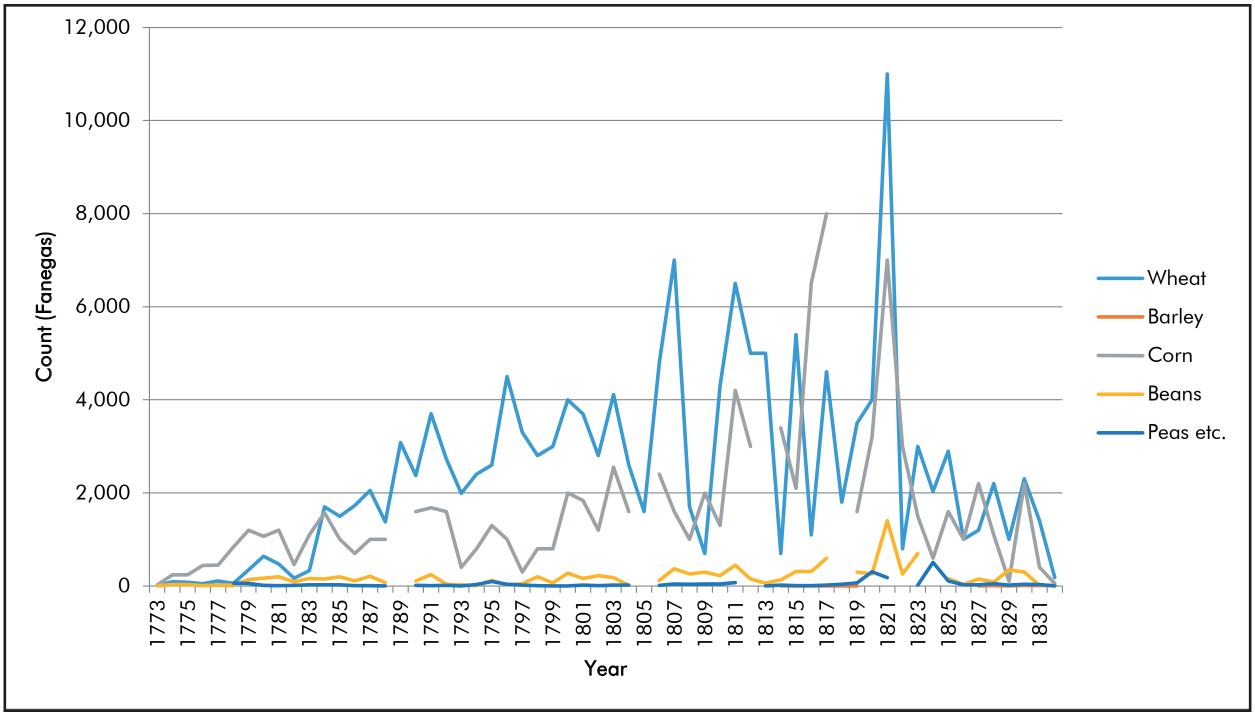

Figure 7.1. Productivity chart for wheat, barley, corn, beans, peas, lentils, garbanzos, and habas (favas) at San Gabriel Mission from 1773 to 1832. Measurements are in fanegas, which equal about 1 2/3 bushels (data from Engelhardt 1927a: 273–275).

The plant assemblage from the San Gabriel Mission archaeological site contains the remains of corn, oats, and wheat. Most oat and wheat remains were likely deposited as refuse or food remains because these macroflora items were recovered charred (see Table 7.4). A charred cereal rachis and a few charred caryopses from the north midden represent common oat and other possible grains that were likely grown at the mission. It is unlikely they were grown in the garden area, however.

Pollen data indicate the presence of cereal grains under two floors (Features 9 and 10) and in association with a milling stone recovered from EU 143. All phytolith samples tested positive for the presence of cereal grains. Some of these may represent activities associated with the mill. However, at least one sample from the fill beneath a floor predates the mill, indicating the presence of barley, oats, rye, or wheat in pre-mill deposits. Again, these were probably not grown in the garden area and most likely represent the remains of the processing of grains grown in fields off-site. One clay ladrillo contained chaff from cereal grain; dendriform phytoliths and papillae in the brick are consistent with wheat. Some of the wheat remains in the assemblage therefore may also relate to brick-making.

Historical records suggest that corn, not wheat, may have been grown primarily for the Native American neophytes. A 1777 report indicates that San Diego Mission received from San Gabriel Mission "twenty-four fanegas of wheat [Englehardt estimates a fanega is 1.67 bushels], twelve for planting and twelve for our own consumption, *also forty fanegas of corn for the Indians*, three fanegas of beans, and a large quantity of onions, garlic, tomatoes, and chile for ourselves, one fifth fanega of barley for sowing, and sixteen dozens of rosary beads for the Indians" (Engelhardt 1920:95; emphasis added). The native diet was based on *atole* (mush or gruel made of corn meal) and *pozole* (a thick soup with whole corn grains) (Engelhardt 1927a:36–37).

Corn is the most prevalent of the grains in the site assemblage and the most likely to have been grown in a garden context. Corn is represented as pollen from two manos and a context beneath a tile floor in Feature 9, as phytoliths associated with a steatite bowl, and as charred macroflora. Whereas the corn pollen associated with the manos clearly represents grinding activities and the phytoliths associated with the bowl were undoubtedly related to consumption, it is less clear what the charred corn parts represent. If they signify food refuse then one would expect the remains to be predominantly cobs and kernels. If they are from post-harvest field burning then one would expect a more varied assemblage of plant parts represented (see Table 7.4). The assemblage comprises mostly kernels and cupules (Table 7.5). Cupules, as the part of the plant that holds the kernels to the cob, are also likely to represent food disposal. Corn cobs and attached cupules may also have been used as hearth fuel, but the lack of burned cob remains suggests this is unlikely. Charred stem fragments and a scutellum (seed coating) are present but uncommon (n = 2). This pattern—an assemblage composed predominantly of kernels and cupules—suggests that burned corn remains primarily represent discarded food refuse that had been charred during cooking (e.g., during open fire cooking). Some of the cupules, particularly those found in association with the granary, may represent cobs that were stored. The interpretation that most of the macrobotanical remains of corn represent discarded food is consistent with the pollen data associated with the manos and the corn remnants found in a steatite bowl fragment. While corn may have been grown in the garden, it appears more likely that the corn remains represent household corn grinding (as represented by the manos), the deposition of charred corn as cooked food bits, and the possible storage of corn.

Table 7.5. Burned Macrobotanical Remains of Corn

Context	EU	Count	Contents
Area 2: triangle reservoir fill	104	4	kernels
		1	cupule
		1	scutellum
Area 2: brick enclosure	145	1	cupule
Area 1: possible granary	263	5	cupule fragments
Feature 14 refuse pit	258	2	kernels
		3	cupules
Area 1: possible granary	292	1	kernel
		1	stem fragment
North midden	291	2	cupules
		3	kernels

Fruits

Fruits documented in Mission-period California gardens are listed in Table 7.3, along with other cultigens. Remains of fruits found in the San Gabriel Mission archaeological site Mission-period assemblage are cherries or plums, figs, grapes, and black elderberries. Evidence of the cherries/plums and elderberries were recovered from Mission-period contexts and from Feature 14, an intrusive refuse pit excavated through post-use fill and the floor of the Area 1 structure. Evidence of the grapes are from the fill just above floor of the reservoir complex. Grapes are represented by charred seeds, and evidence of figs was recovered as uncharred seed fragments. It is difficult to distinguish food uses for garden-grown fruits because the seeds are contained within the fruit and therefore either processing, eating, or cultivating the fruit can result in the deposition of the seed. These remains may therefore represent items grown in the garden or food remains. It is unclear why there are not more grape seeds in the assemblage, given the importance of grapes and wine in the economy of the mission. Perhaps grapes are underrepresented in the assemblage due to the infrequency of grape burning (see The Historical Record and Other Missions section below).

The cherry/plum remains consist of wood charcoal and indicate that these fruits (one or both) were probably grown in the garden or orchard. The elderberry remains are in both seed and charcoal form. The seeds may be from berries either grown in the garden or collected in the wild and disposed of in the pit feature. The wood represented by the charcoal may have also been collected off-site.

Vegetables

A single seed representing either broccoli or cauliflower was recovered. Although not listed in Williams' (2005) study, ground cherry or tomatillo was also recovered as a single seed. These two seeds were recovered from Feature 14. Additionally, squash or pumpkin pollen was recovered from Feature 9, the tile floor next to the granary. This area may have been used to store crops after harvest, and it is likely that squash and pumpkins were grown in the garden.

Spices

Spices present in the assemblage are mint, mustard, and pepper. Peruvian peppertree was associated with both Area 1 and Feature 14, and was recovered as charcoal and charred seeds, both of which indicate that this spice was likely grown in the garden, although the seeds may have also been used as peppercorns. Mustard was recovered in the form of charred seeds; these also may have been either from plants grown in the garden or from use as a spice, either stored or eaten. Mint was recovered as charred seeds, as well, and this is mostly likely related to crop production in the garden because it is the leaves of mint rather than the seeds that are the edible part.

Nuts and Seeds

Pecans, walnuts, pine nuts, and one charred sesame seed compose the nut assemblage. Pecan and walnut remains were recovered from the north midden, both in the form of charred nutshells. These likely represent food remains and discard. Pine nuts were the most common seed type in the entire plant assemblage; they were present in macrobotanical samples from every unit except EU 104. Uncharred pine nuts were present in 42 of the 83 macrobotanical samples; charred pine nut fragments were present in 12 samples. Pine charcoal was present in only four samples. Because it is unlikely that pine trees were grown in large numbers in the garden (see Table 7.4) and because pine nuts were evidently an important food resource consumed on-site, perhaps by Native Americans living at the mission, the data suggest pine nuts were received in trade or collected off-site. Pines are common in the nearby San Gabriel Mountains. The pine charcoal probably represents the remains of fuel wood (see discussion of fuel woods in the Decorative, Medicinal, and Other Plants section below).

Decorative, Medicinal, and Other Plants

This category contains the plants in the assemblage that would not have been grown primarily as food. Some of these are included in Williams' (2005) list of plants grown in Mission-period California gardens (e.g., tobacco, elderberry, rose of Castile, and chamomile) (see Table 7.3), but others are not.

Tobacco was recovered as uncharred seeds in six of seven samples from Feature 14 (the refuse pit), from three samples associated with the granary (EUs 263 and 267), and from all nine samples from the north midden. These may relate to tobacco production in the garden or to relatively recent naturally growing plants. The seeds are unburned, so it is unlikely they are from the smoking of tobacco. In his ethnobotany study of the Cahuilla (an adjacent tribe), Barrows (1900:75) notes that the Cahuilla smoked both wild and cultivated tobacco and that "it was prepared by being pounded up in small stone mortars, especially kept for this purpose, mixed with water, and chewed." This practice might produce an assemblage of uncharred seeds.

Two species of tobacco currently grow in southern California: Indian tobacco (*Nicotiana quadrivalvis*) and tree tobacco (*N. glauca*) (Dale 2000). Both plants grow as weeds in disturbed soils and stream beds. Barrows (1900:74) notes *N. quadrivalvis* and several others (*N. plumbaginifolia*, *N. trigonophylla*, and *N. attenuate)* which "grows plentiful in the territory of the Coahuillas [*sic*]."

Elderberry is listed by Williams (2005) as a decorative plant. But, as discussed above, it was recovered in seed form and may be from berries either grown in the garden or collected in the wild, eaten as fruit, and disposed of in Feature 14. Chamomile is represented by a single charred seed, suggesting that this plant was grown in the garden for tea or that it grew as a weed in the garden or nearby. Charcoal from rose bushes and geranium pollen indicate that these flowers were probably grown in the garden. Charred and uncharred mallow seeds were also present. Several species are widely grown as garden flowers.

Additional plant evidence consists of alfalfa, clover, prickly pear, manzanita, and sage recovered as charred seeds; cholla recovered as charcoal; yucca recovered as protein residue; and cattail recovered as pollen. Pollen samples also contained evidence of common wild plants, including goosefoot, amaranth, datura, and various weeds. Cactus, especially prickly pear, is not unexpected because there was a cactus fence established around the garden (see Figure 2.4). Prickly pear pads, or *nopales*, although not recovered archaeologically, may also have been used as food (Appendix C; Puseman et al. 2012:23).

None of these plants were likely to have been cultivated in the garden. The alfalfa was most likely cultivated in nearby agricultural fields and used as animal feed. The other plants may have been used as food or fuel, or entered the area as invasive weeds, but they were not likely grown intentionally in the garden.

Finally, tree woods in the assemblage are highly diverse and include buckthorn, juniper, redwood, oak, Douglas fir, sycamore, willow, cottonwood or poplar, maple, and birch. All of these were recovered as charcoal. Some of these may have grown in the garden area as decorative plants, but most were probably collected away from the site and brought in to be used as fuel. Oak was particularly important for firewood and timber at San Gabriel Mission, as noted by Fathers Antonio Cruzado and Miguel Sanchez: “The location is very good. It has an oak grove quite close which is very advantageous for obtaining timber and firewood” (Cruzado and Sanchez 1783:34).

Plant Remains Summary

By analyzing the form and context of the various plant remains, it is possible to associate certain plants with certain depositional processes, thereby demonstrating which plants were likely grown in the garden, which were consumed on-site, and which were likely ground or milled, stored, and/or used as fuel, construction material, or animal feed (Table 7.6). Although some overlap occurs, some plants are more likely to relate to one depositional process than another. Plants that were likely grown in the garden include cherry or plum, broccoli or cauliflower, mint, chamomile, rose, and geranium. This indicates that the garden served as a combination vegetable garden, decorative garden, and fruit tree orchard.

Table 7.6. Likely and Possible Plants Associated with Depositional Process

	Depositional Process					
	Gardening	**Plant Food Consumption**	**Grinding or Milling**	**Food Storing**	**Animal Feeding**	**Fuel or Construction Material**
Likely associated plants	cherry, plum, broccoli, cauliflower, mint, chamomile, rose, geranium	corn, pine seeds, pecans, walnuts	corn, wheat, oats	–	–	buckthorn, juniper, redwood, oak, Douglas fir, birch, sycamore, willow, cottonwood, maple, pine
Possibly associated plants	grape, fig, corn, mustard, tomatillo, pepper, elderberry, tobacco	grape, watermelon, fig, mustard, tomatillo, pepper, elderberry, prickly pear, clover	–	pine seeds, pumpkin, squash, corn	alfalfa	–

Plants that were likely consumed as food on-site are corn, pine nuts, pecans, and walnuts. Probable fuel woods and construction materials include a variety of woody plants and trees. Likely ground or milled plants include corn, wheat, and oats. The corn remains appear to represent primarily food refuse and household level grinding, whereas at least some of the wheat remains may relate to the mill. Both grains were probably milled, because Chapman's Mill was adjustable for corn or wheat (Webb 1952:165) and, according to historical records, both wheat and corn were cultivated in large quantities at the mission (Engelhardt 1927a:273–275).

It is possible that a few of the remains represent plants stored in or near the granary, particularly corn, pumpkin or squash, and pine nuts. It is possible that alfalfa was grown in nearby fields and used as animal feed. But it is unlikely that the remains in the garden would reflect intentional burning of agricultural plants or fields.

It is important to note that selective preservation of plant remains is always an issue when discussing depositional processes. It is well known that burned remains are preserved more frequently than unburned remains, while fuel woods are often overrepresented. Foods consumed raw, such as many fruits and vegetables, may be underrepresented. It is likely, for example, that animal feed is underrepresented because feeding animals rarely involved the cooking or burning of plant foods. Garden crop representation is also undoubtedly underrepresented because burning is rarely involved in growing vegetables, fruits, spices, medicinal plants, and flowers. And although pollen generally preserves better than unburned macroflora, pollen analysis often has limitations due to a lack of formation-process controls, including contamination by wind-borne modern and ancient pollens.

Given these caveats, the following section attempts to assign functions to features at the San Gabriel Mission archaeological site based on associated plant remains.

The Functions of Features

The San Gabriel Mission archaeological site comprises a number of complex features contained within the historically mapped mission garden. These features have been assigned particular functions based on their historical contexts and their morphological and technological attributes. This section explores the plant remains associated with each major feature and compares the assemblages in light of the hypothesized feature function. The goal is to reinforce interpretations based on multiple lines of evidence.

Area 1 Structure

An adobe building, tentatively interpreted as a granary based on its dimensions, was located in the western portion of the study area (Area 1). Three exterior walls of the structure were defined: the west wall, the east wall, and the north wall, which was located on the other side of the Union Pacific Railroad tracks. Additionally, an internal wall was encountered during excavation that separated the northern portion of the building from the southern portion. Two outdoor patio floors adjacent to the structure were exposed: Feature 13 on the east side of the structure and Feature 9 on the west side.

Three column flotation samples were taken from within this structure (see Figure 4.6). EU 292 was located north of the railroad tracks in the northeastern portion of the structure. EU 263 was within the eastern portion of the structure. EU 258 was located within Feature 14, an intrusive pit that extended into the floor of the structure, just east of EU 263. Data from this sample postdates the use the structure and dates primarily to the American period (1848–present). This discussion therefore focuses on EUs 263 and 292.

Additionally, pollen samples were recovered from the two tile floors outside the structure, one on the west side and one on the east. Finally, two associated grinding stones were analyzed, one for phytoliths and starches and one for protein residue.

Macrobotanical Remains

Neither the sample from EU 292 nor EU 263 from within the structure contained cereals as might be expected from a grain storage feature. Moderate amounts of corn, pine nuts, and tobacco seeds were found in both samples, though (Table 7.7). All of these plants were likely consumed primarily by Native Americans. Peruvian pepper and black elderberries were present as well, but these most likely represent consumed food remains rather than stored remains (see Table 7.6). The corn remains are primarily cupules, which may represent cobs of corn that were stored in this structure, although this seems unlikely.

Table 7.7. Presence of Macrobotanical Remains of Possible Stored Foods from within the Area 1 Structure

	EU 292	EU 263
Pine nuts	X	X
Corn	X	X
Tobacco	X	X
Peruvian pepper	–	X
Elderberry	–	X

Pollen

Pollen samples were taken from the fill beneath and in between tiles from Features 9 and 13, which were two tiled surfaces adjacent to the eastern and western exterior walls of the structure. Neither pollen sample produced definitive evidence of grain storage, but one of the samples contained the remains of corn and squash or pumpkin (Table 7.8).

Table 7.8. Presence of Pollen Remains of Possible Stored Foods from Tile Floors Outside Area 1 Structure

	Feature 13	Feature 9
Corn	–	X
Pumpkin/squash	–	X

Phytoliths and Protein Residue

Grinding implements associated with the structure yielded residues of grasshoppers, yucca, corn, and possibly wheat. These data, however, are more indicative of processing than storage.

Area 1 Structure Summary

The plant remains recovered from the structure in Area 1 do not directly support a functional interpretation of the structure. However, stored grains tend not to preserve if they are not burned, which usually does not occur unless a catastrophic fire destroys the stored foods. Therefore, it is not unexpected that little to no evidence of storage was recovered in the plant assemblages. Plant evidence recovered from this feature is more suggestive of Native American subsistence—corn, pine nuts, tobacco, and squash or pumpkins—than stored grains.

The Mill

A large milling stone fragment was recovered immediately north of Chapman's Mill and was analyzed for pollen and phytoliths. The pollen record was sparse, but it did include cereal pollen (possibly wheat), indicating that this milling stone was used to grind cultivated cereal grains. According to Puseman et al. (2012), the lack of dendritic epidermal sheet elements indicates that the mill was very efficient, which may account for the paucity of evidence for grains in the assemblage.

Feature 11

Feature 11 is a brick enclosure on the east side of the millrace. The macrobotanical assemblage from this feature (Column sample 145) is highly diverse, and contains uncharred cheno-am seeds, pine nuts, elderberry, tobacco, and charred and uncharred mallow seeds. Corn, charred cereal caryopses (wheat, oat, barley, or rye), and a large variety of hardwood charcoals are also present in the assemblage. The function of this feature is not clear from these remains, but it is likely that the sample reflects Native American consumption and discard given the presence of pine nuts, tobacco, and corn.

Feature 14

Feature 14 is interpreted as an intrusive refuse pit that post-dates the Mission period. It had been excavated into the floor of the Area 1 structure and appeared to contain several depositional episodes, which may contribute to the high diversity of plant remains recovered from it. Pine nuts, charred and uncharred cheno-am, corn, elderberry, fig, watermelon, pepper, tobacco, alfalfa, tomatillo, chamomile, juniper, cherry, and redwood are some of the plants found in association with this feature (see Table 7.1).

The Historical Record and Other Missions

Historical data indicate that wheat and corn were San Gabriel Mission's most important crops in terms of crop yields from 1773 to 1834 (see Figure 7.1). Corn appears to have been more important than wheat until ca. 1783. At that point, wheat became the predominant crop until 1821, when both corn and wheat production dropped precipitously. The plant data recovered from the site do not reflect this pattern. Wheat is virtually absent from the archaeological record of San Gabriel Mission within the study area, whereas corn is relatively abundant.

This pattern is in stark contrast not only to the historical record, but also other mission excavations. For example, the Mission-period archaeological assemblages from Santa Cruz Mission were associated with two adobe buildings (the "Mission Adobe" and the "Angled Adobe") (Allen 1998). Plant remains from deposits dated to the Mission period contained 53 percent wheat and 12 percent corn, proportions that are more in keeping with what the historical documentation (see Figure 7.1) would predict.

Recent excavations at San Fernando Mission (Abdo-Hintzman et al. 2010) targeted its Mission-period granary and midden, and these investigations produced an assemblage containing much more wheat (grains and/or rachis fragments) than corn: Only two small and eroded corn cupules were found at San Fernando Mission, compared with 20 kernels and cupules at the San Gabriel Mission archaeological site. Figure 7.2 displays this pattern, and also shows the relative abundance of pine nuts in the San Gabriel Mission archaeological site assemblage, suggesting that gathered foods, in addition to corn, composed a comparatively large portion of the diet of the residents of San Gabriel Mission.

The large difference seen between the San Gabriel Mission archaeological site cultivated plant assemblage and those of other missions, as well as the historical record, suggests either a sampling issue or a preservation issue. Since much of the recovered sample derives from contexts in association with the mill, we suggest that the dearth of wheat remains is due to poor preservation and a lack of burning of this particular plant and the highly disturbed nature of the deposits in and around the mill. Consequently, the assemblage primarily appears to reflect Native American food consumption of corn and wild or native plants rather than wheat production and processing.

Both San Gabriel Mission and San Fernando Mission saw a precipitous drop in wheat and corn production after 1821, and production levels never recovered after this date (Figures 7.1 and 7.3). Rowntree (1985) has addressed this issue at San Gabriel Mission and has demonstrated that rainfall variation (i.e., drought) does not account for this downturn (Rowntree 1985:Figure 1). He suggests instead that labor pool and population size might be a better predictor of crop yields (Rowntree 1985:17), and he presents data from San Luis Mission in support of this hypothesis (Rowntree and Raburn 1980). Figure 7.4 shows, however, that neither drought nor population variation is correlated with wheat production yields at San Gabriel Mission. Indeed, it is not obvious what caused the massive production decline after 1821. The number of wheat plants cultivated in 1821 and 1822 drops dramatically but rises again after that, and yet yields never quite recover (Figure 7.5). Flood events may have made it difficult to maintain crop harvest yields at times, but no floods are documented in 1821 or 1822. Blights would not affect both corn and wheat at the same time. Political upheaval and the loosening of trade restrictions related to the shift from Spanish to Mexican rule in 1821 and the construction of Chapman's Mill in 1823 may have played roles, but it is not clear how these factors would necessarily affect crop yields. The more likely cause is a regional shift in product demand at this time (perhaps related to the lessening of trade restrictions) and the mission choosing to focus on cattle production rather than cultivated plant production after 1821. This is evident in the huge increase in cattle production at San Gabriel Mission after this date (see Chapter 8: Faunal Remains). This pattern is also evident at San Luis Mission. Regardless of the reason behind the trend, rainfall and population levels do not appear to fully account for it, at least at San Gabriel Mission.

Summary and Conclusions

The plant assemblage from San Gabriel Mission primarily reflects Native American food consumption rather than food storage, food processing, or the growing of plants in a garden, although these activities are certainly evident. The plant portion of the Native American diet appears to have been dominated by corn and gathered foods, including elderberries, pine nuts, and cheno-ams.

The macrobotanical data indicate that cherry, plum, broccoli, cauliflower, mint, chamomile, rose, and geranium were likely grown in the mission garden, and that grape, fig, corn, mustard, tomatillo or ground cherry, pepper, elderberry, and tobacco were possibly grown there, although tobacco was more likely gathered wild. Corn and wheat were likely processed in the area sampled by excavations; corn by hand and wheat by mill. A wide variety of woody plants were harvested and used as fuel or construction material, including buckthorn, juniper, redwood, oak, Douglas fir, birch, sycamore, willow, cottonwood, maple, and pine.

Despite the intense production of wheat at San Gabriel Mission, corn appears to have made up a larger proportion of the diet of mission occupants. This is in contrast to at least two other missions, San Fernando and Santa Cruz, where the archaeological assemblages indicate that wheat dominated the diets of the occupants. Moreover, it appears that Native Americans at San Gabriel Mission were relatively free to collect or trade for plant foods (e.g., pine nuts) far from the mission grounds and that their diet was affected differently by missionization than was the case for Native American residents of other missions.

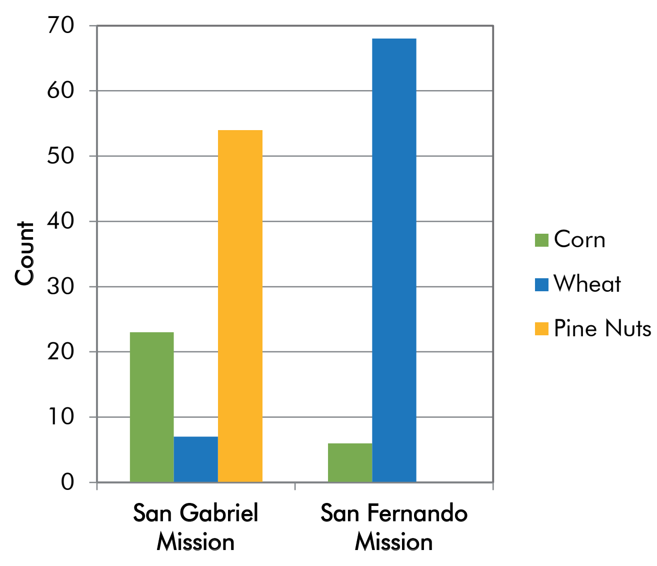

Figure 7.2. Counts of corn kernels and cupules, pine nuts, and wheat rachis and caryopsis from San Gabriel Mission and San Fernando Mission excavations.

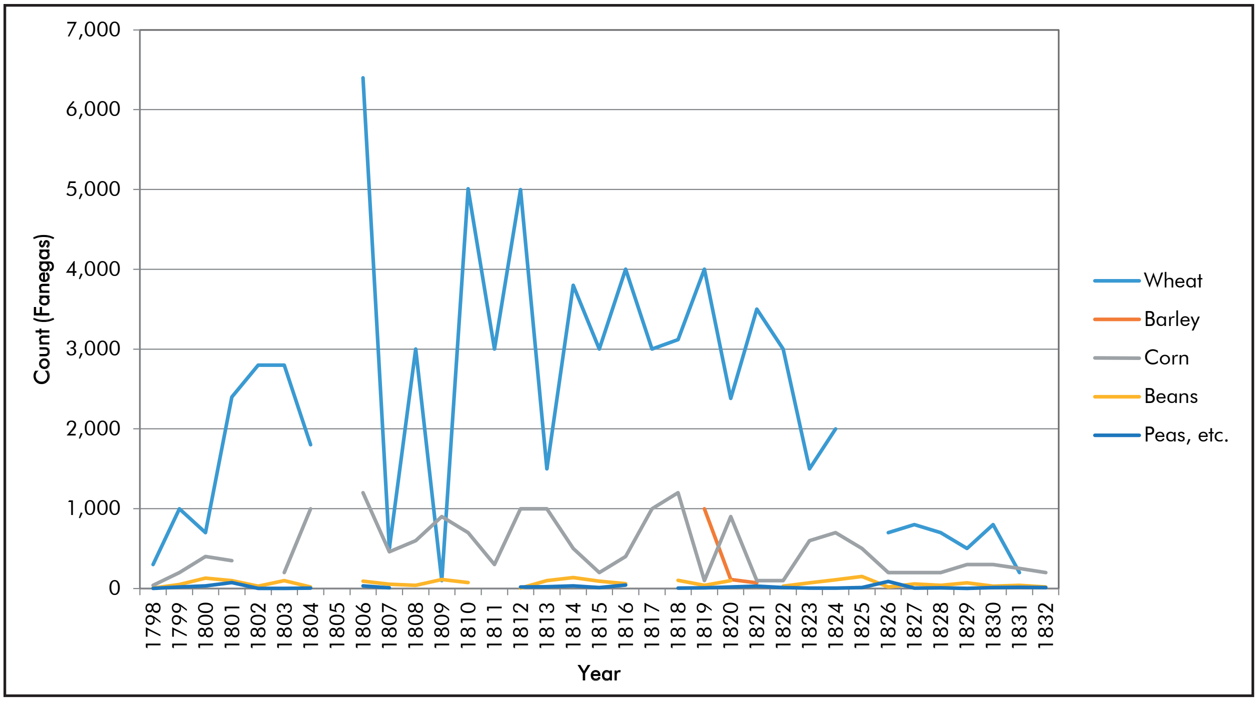

Figure 7.3. Productivity chart for wheat, barley, corn, beans, peas, lentils, garbanzos, and habas at San Fernando Mission from 1798 to 1832 (data from Engelhardt 1927b:97–98). Measurements are in fanegas.

Figure 7.4. Yearly wheat harvest yield ratios for San Gabriel Mission and Palmer Drought Severity Index–identified drought years (from Rowntree 1985:Table 1). Harvest yield ratios are calculated by dividing the amount harvested (in fanegas) by the number of plants planted. Wheat harvest and population data are derived from Engelhardt (1927a).

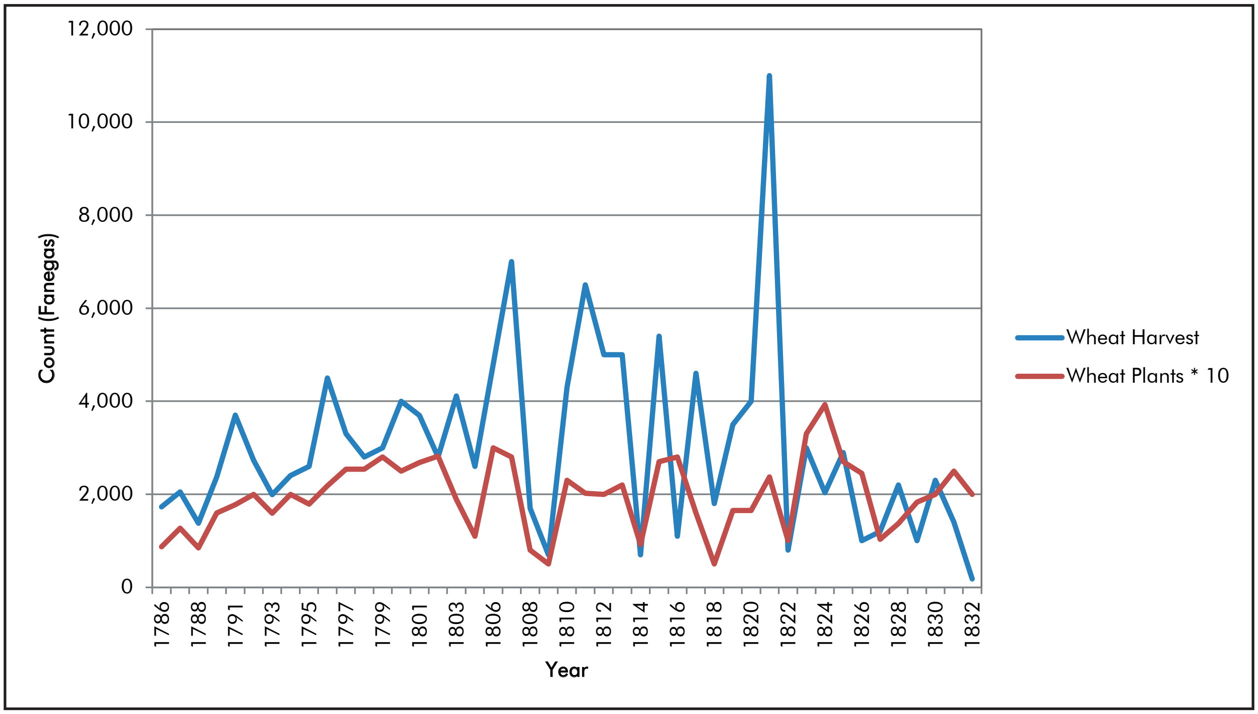

Figure 7.5. Wheat plant and harvest numbers for San Gabriel Mission from 1786 to 1832. (Data from Engelhardt 1927b: 97–98). Harvest measurements are in fanegas.

CHAPTER 8: ANIMAL AND HUMAN REMAINS

James M. Potter, Kim Owens, and Samantha Murray

This chapter summarizes the animal bone, shellfish, and human remains recovered during data recovery. These three classes of remains differ from each other in important ways—representing food remains, ornament and tool fragments, and elements of the human body that held a great importance to mission residents, as well as their modern-day descendants. They are grouped here simply because they are analyzed in similar ways by archaeologists.

The Vertebrate Faunal Remains section of this chapter was prepared by James M. Potter. The Invertebrate Faunal Remains section was prepared by Kim Owens. Samantha Murray prepared the Human Skeletal Remains section.

Vertebrate Faunal Remains

Data recovery excavations at the San Gabriel Mission archaeological site (CA-LAN-184H) resulted in the collection of 79,487 whole and fragmented vertebrate faunal remains—that is, animal bones. Due to the large size of the total assemblage, a sample of 18,459 bones was selected for detailed analysis (23 percent of the total assemblage). This sample was selected judgmentally by excavation unit in order to ensure that each area and significant feature or feature complex was represented in the analyzed assemblage. Fifteen 1 × 1–m sample units are included in the analysis (Table 8.1). All specimens in these sample units were analyzed, and they compose the final tallies presented in Table 8.2. The bone identifications and analysis were conducted at SWCA's Pasadena laboratory by Ryan Glenn and overseen by Michael Tuma.

The largest portion (42 percent) of the vertebrate faunal sample was derived from four 1 × 1–m sample units in Area 2, the area interpreted as containing both a reservoir complex and Chapman's Mill and Millrace. This sample also produced the greatest density of bone material per cubic meter. Areas interpreted as middens also contained high densities of bone (Table 8.1 and Figure 8.1).

Domesticated species in the assemblage are cattle, chicken, dog, horse, sheep or goat, pig, and cat, and they compose by far the greatest percentage of the assemblage—a full 80 percent.

Table 8.1. Site Proveniences for Faunal Samples

Provenience Description	Sample Unit	Number of Specimens	Percentage of Total	Density (number per cubic m)
Area 2 (mill and reservoir complex)	105, 108, 137, 206	7,741	42.0	1,847
South Midden	118, 273, 282	5,432	29.4	1,543
Refuse pit in Area 1 (Feature 14)	149	2,441	13.2	1,066
North Midden	269	2,380	12.9	1,776
Area 1	121, 135, 165, 166, 243, 255	465	2.5	189
Total		**18,459**	**100.0**	**N/A**

This figure does not include indeterminate "very large mammal" bones, which likely represent cattle; had this faunal sample type been included, the proportion of domesticated animals would be even higher. Identified wild species constitute only 1 percent of the assemblage and comprise deer, gopher, hawk, rabbit, sea bass, skunk, squirrel, toad, and tuna (Table 8.2). A small number of indeterminate fish and small bird bones are present in the assemblage, and are also undoubtedly from wild species.

Of the total assemblage, 60 percent of the bones by count (79 percent by weight) were from cattle. The next-most-numerous species represented was dog at almost 10 percent, followed by sheep or goat at almost 9 percent. Other categories, aside from unidentified bone fragments, contributed less than 4 percent each, and most comprised less than 1 percent.

The methods used for the analysis are presented in the next section, followed by a background section that provides a historical context for the mission assemblage. The proportions of animals found in relation to certain areas of the site are compared, and functional and temporal patterns are identified in these data. This is followed by an examination of body part representation and bone modification data in an attempt to interpret behavioral, formation, and depositional processes across the site. A brief comparison with other Mission period archaeological assemblages is then provided. This chapter concludes with a discussion and comparison of Native American and Spanish colonial butchery practices and the continuation of subsistence strategies at the mission, particularly as these relate to the acquisition, preparation, consumption of fauna.

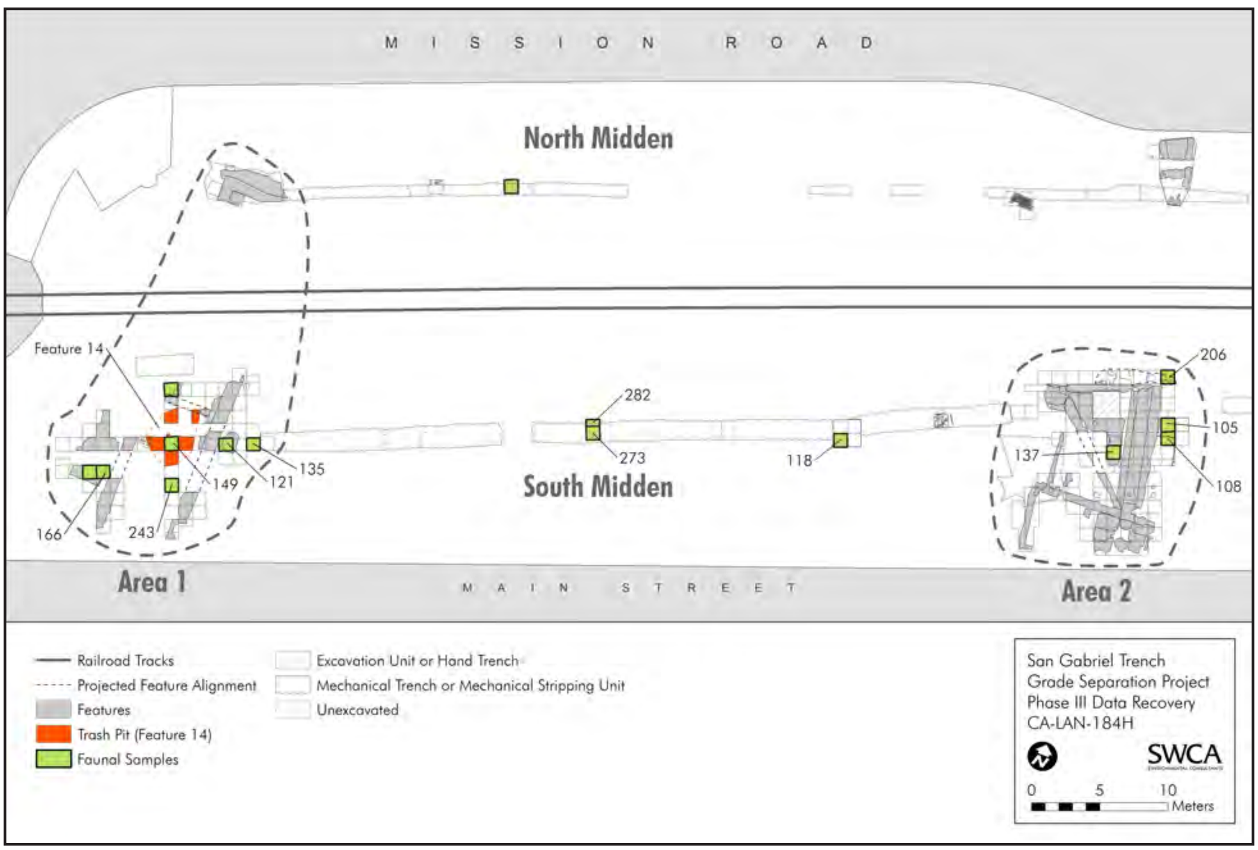

Figure 8.1. Locations of vertebrate faunal samples.

Table 8.2. Taxonomic Breakdown of Analyzed Vertebrate Faunal Assemblage

Common Name	Scientific Name	Number of Specimens	Percentage	Weight (grams)	Percentage
Very Large Mammal					
Indeterminate very large mammal	N/A	1,211	6.6	851.6	3.6
Cattle	*Bos taurus*	11,116	60.2	18,746.0	78.7
Horse	*Equus caballus*	1	0.0	5.0	0.0
Large Mammal					
Indeterminate large mammal	N/A	30	0.2	34.6	0.1
Deer	*Odocoileus* sp.	12	0.1	130.3	0.5
Pig	*Sus domesticus*	14	0.1	15.7	0.1
Sheep or goat	Ovicaprids (*Ovis aries* or *Capra hircus*)	1,597	8.7	2,405.2	10.1
Medium Mammal					
Indeterminate large or medium mammal	N/A	163	0.9	65.4	0.3
Indeterminate medium mammal	N/A	29	0.2	4.0	0.0
Dog	*Canis* sp.	1,795	9.7	790.3	3.3
Small Mammal					
Indeterminate small or medium mammal	N/A	8	0.0	1.8	0.0
Cat	*Felis* sp.	1	0.0	0.1	0.0
Jackrabbit	*Lepus* sp.	1	0.0	1.1	0.0
Rabbit	Leporidae	22	0.1	5.9	0.0
Pocket gopher	Geomyidae	155	0.8	23.6	0.1
Squirrel	Sciuridae	15	0.1	5.1	0.0
Western gray squirrel	*Sciurus griseus*	1	0.0	0.3	0.0
Striped skunk	*Mephitis mephitis*	1	0.0	0.2	0.0
Medium Bird					
Indeterminate medium bird	N/A	18	0.1	4.4	0.0
Chicken	*Gallus gallus*	164	0.9	122.1	0.5
Red-tailed hawk	*Buteo jamaicensis*	1	0.0	0.5	0.0
Small Bird					
Indeterminate small bird	N/A	15	0.1	1.8	0.0
Reptile or Amphibian					
Indeterminate reptile or amphibian	N/A	1	0.0	0.1	0.0
Western toad	*Bufo boreas*	1	0.0	0.3	0.0
Fish					
Indeterminate fish	N/A	2	0.0	1.1	0.0
Bluefin tuna	*Thunnus* sp.	7	0.0	2.5	0.0
Sea bass	Serranidae	3	0.0	1.5	0.0
Unidentified Fauna					
Unidentified	N/A	2,075	11.2	593.0	2.5
Total	**N/A**	**18,459**	**100.0**	**23,813.0**	**100.0**

Methods

Each specimen selected for analysis was identified to the extent possible to specific taxonomic category and skeletal element. Important attributes were recorded for each bone when possible: the portion and side of each element; the degree of fusion in long bones; the sex and age of the animal; any modifications to the bones, including carnivore and rodent gnawing; sawing, chopping and cutting marks resulting from butchery practices; and burning. Fragment size and weight to the nearest 0.1 g were also recorded.

Assignment to a taxonomic category was based on the morphologic characteristics of each individual element. Bones for which specific species could not be determined were cataloged to lowest possible taxonomic distinction, usually animal class (e.g., bird, fish, mammal, reptile, or amphibian). In the case of mammals and birds, body size (e.g., small, medium, large, and very large) was also accounted for. Very large mammals are those comparable in size to cattle; large mammals include deer, pig, and sheep; medium mammals are dog-sized; and small mammals range from rabbits and squirrels to small rodents. Medium birds are roughly chicken-sized, while small birds include perching and song birds.

Cultural Modification

Cultural modifications to bones occur during such activities as butchering, processing, and cooking, and they alter bone characteristics before the bones are discarded. Analysis of cut marks on bones can help us understand cultural, behavioral, and historical differences in how animals are butchered. Spatial distribution of cow bones may help determine where the various steps in cattle hide production were carried out.

To collect pertinent data to address such issues, elements were assessed for the location, type, and degree of butchery marks, particularly on identifiable elements of identifiable taxa. These data allow for reconstructions of butchery behaviors across the site and may provide details about the types of tools used during butchery and the cuts of meat the residents of San Gabriel Mission consumed.

The processing of bone for marrow may be examined through the analysis of bone fracturing and fragment sizes of identified elements from identified taxa. Fragment sizes are expressed as a percentage of the complete element. The roasting of animal carcasses or individual bones may be identified through the analysis of burning evidence on bones. Contextual data will be included in this analysis, as burn marks on bones may also result from secondary burning in refuse pits. The degree of processing was quantified by calculating the proportions of bones bearing butchery and burn marks for all identified elements among these species.

Age

The age of the animal at death was determined based on the stages of epiphyseal fusion of long bones (Silver 1969) and on dental eruption and tooth wear (Grant 1982; Klein et al. 1981; Klein et al. 1983; Payne 1973). In mammals, bone growth occurs at the ends of long bones at a suture between the diaphysis (shaft) and epiphysis (articular end). Younger individuals have epiphyses that have not yet fused to the bone shaft, while these same sutures in older animals can be completely obliterated. The rate of fusion can be determined for individual taxa to establish an approximate age at death of the individual.

Most mammal species have two sets of teeth during their lifetime: deciduous (baby) teeth and permanent teeth that replace the baby teeth in a set sequence, similar to the process of epiphyseal fusion. For juvenile individuals, age at death can be determined based on the sequence of replacement of deciduous teeth by permanent teeth. In adults who have a full set of permanent teeth, the degree of tooth wear is also a reliable method of age determination. These rates of replacement and wear are well documented for Old World domesticated mammals (Deniz and Payne 1982; Grant 1982; Payne 1973).

Taphonomy

In order to make sound and accurate interpretations concerning the characteristics of the faunal assemblage, taphonomic processes that might influence its integrity must be considered. These include processes such as bone weathering, carnivore tooth marks, root etching, and soil discoloration that destroy or otherwise influence the character of the faunal assemblage between the time of deposition and the time of archaeological recovery.

Bone Weathering

Bones weather in recognizable stages according to external conditions relating to the depositional environment. Most bone will completely degrade within 10–15 years if an element is left on the earth's surface and is not properly buried (Behrensmeyer 1978:150). Whether and how quickly a bone breaks down depends on the characteristics of a given depositional environment. For example, moisture content, soil pH, and the amount and type of surrounding soil erosion all influence bone weathering.

Carnivore Tooth Marks

Recording the presence of carnivore tooth marks is critical in determining and ultimately understanding depositional processes of a given assemblage. Given the relatively high proportion of domesticated dog bones in the San Gabriel Mission archaeological site assemblage, it is likely that any evidence of carnivore gnawing or cracking is the result of scavenging by dogs and/or coyotes. The historical accounts do mention other carnivores such as mountain lions and bears, but these are much less common than dogs and coyotes.

Root Etching

Plant roots leave dendritic patterns of shallow grooving on the surfaces of bone and can cause severe weathering. These dendritic furrows are caused when roots in direct contact with the bone's surface are dissolved by naturally occurring acids (Behrensmeyer 1978:154). The presence of root etching can provide evidence about the relative length of time a particular bone has been buried. Roots may also cause breakage or splitting of bone.

Soil Discoloration

Changes in bone surface color can occur from exposure to various environmental and cultural factors. Soil discoloration was recorded on bones when present because it may indicate variable depositional processes or weathering. Specimens left exposed for long periods of time may exhibit less soil discoloration, for example.

Quantification Methods

Two different analytical measures were used to quantify the faunal assemblage from the San Gabriel Mission archaeological site: bone weight and the number of identified specimens (NISP). The NISP is the actual number of specimens identified to a particular taxon. When unidentifiable remains are included in total counts, the term "number of specimens" is used instead. Bone weight is an indicator of species importance with respect to biomass, or the amount of meat provided by the animal, assuming the animals were primarily butchered for meat rather than for hides or tallow (rendered beef fat), for example. Generally speaking, larger animals that yield more meat have larger, more massive bones than do animals that yield less meat. Because of this relationship, bone weight may be used to calculate the relative importance of each taxonomic category. This method also controls for differential fragmentation of species, which the NISP method does not. Each of these methods has advantages and disadvantages, and the use of both in concert ensures that the results are robust and not biased by variable usage or differential fragmentation or processing.

Minimum number of individuals (MNI) was not used for two reasons. The first is the highly fragmented nature of the assemblage and the extremely low MNI values produced because of this. The second reason is that, given the sampling strategy, site-wide MNIs were not meaningful measures because SWCA sampled numerous dissimilar contexts. Context-specific MNIs may be more meaningful than site-wide values, but given the fragmentation of the assemblage, the MNI values produced would reflect the number of individual contexts more than they would reflect the actual numbers of animals represented.

Statistical Analyses

The primary statistical method employed in this analysis is the chi-square test of significance performed on contingency tables. These analyses provide not only summary statistics for the entire table but standardized residuals (standard deviations from expected) for each cell. Standard deviates (or residuals) indicate the importance of the cell to the ultimate chi-square value. They are a kind of z-score that indicate how many standard deviations above or below the expected count a particular observed count is. By comparing these residuals, one can identify the particular cells that contribute most to a chi-square value and better understand the associations in the table. This method also provides statistical significance to each cell's expected value versus the observed value, because 1.96 standard deviations is significant at the 0.05 level (greater standard deviations are more highly significant) if the data are normally distributed. Statistical analyses are always performed on count data (e.g., NISP).

Historical Background on Faunal Exploitation at San Gabriel Mission

At the height of its success, San Gabriel Mission was termed "the Pride of the Missions" (Engelhardt 1927a:v). This was due in part to its flourishing agricultural and wine industry, but even more so to its thriving livestock industry, particularly its cattle herds. Livestock herds at California missions were small until around 1785, and the period between 1795 and 1806 was a period of substantial growth of the herds. Between 230,000 and 400,000 head of cattle were under control of missions from 1821 through 1832 (Burcham 1961; McLaughlin and Mendoza 2009). During the latter part of the Mission period in California (1815–1834), the missions were centers of production for an international trade in tallow and hides (Hornbeck 1982:431–432), and San Gabriel Mission was known as one of the largest production centers for these items.

Spanish colonists first brought Iberian cattle into Alta California from west Mexico and Baja California. These cattle were of medium-sized Andalucían stock, and they varied in color and physical characteristics (Gust 1991). For the initial *entrada* from Baja California to San Diego, the Baja California missions collectively contributed 200 cattle, 50 horses, and 140 mules. Over the following years, additional livestock was brought to Alta California from various places across New Spain (Burcham 1961).

San Gabriel Mission was situated in a fertile, well-watered valley, and therefore the environment and climate were ideal for raising domesticated animals. Father Pedro Font, a chronicler of the Anza Expedition, noted that San Gabriel Mission was within an area supporting vast pasturelands estimated at more than 2,100 square miles. These pasturelands were the most extensive of any California mission, and the number of ranches they supported was correspondingly the highest (Gentilcore 1961). Water from artesian wells and abundant native grasses allowed the rapid introduction of domesticated animals; livestock reproduced and herds expanded at a tremendously fast rate. In 1773, San Gabriel Mission had 128 domesticated animals on record, including cattle, goats, horses, mules, pigs, and sheep. By 1800, the mission had 19,500 animals under its care, most of which were sheep. By 1832, the last date of record, the mission oversaw an estimated 26,342 animals, 16,500 of which were cattle (Engelhardt 1927a:278–279). Allen (1998:46) noted a similar trend for Santa Cruz Mission:

> After about 1798, there were so many animals that the fathers could only estimate their numbers. Occasionally what the missionaries called "beasts" devoured the domestic animals, but the appetites of local predatory animals such as bear and mountain lion could not keep up with the rapidity of reproduction by the livestock.

Goats, horses, and pigs were also present from the early days of the mission, but they were did not bred as intensively as cattle and sheep. Pigs that were brought up from Baja California for the new missions originally came from China by way of the Philippine galleons, and, as Webb (1952:186) describes, had many uses:

> In this new land [pigs] thrived especially well where there was an abundant harvest of acorns to feed upon. These animals furnished the necessary lard without which the Spanish cook is completely lost. Surplus fats were utilized in soap making. The hams and shoulders were hung on huge wooden pegs or giant iron spikes, set high up in the cavernous flues of the kitchen chimneys, and smoked to a turn. Let no one say that the flesh of this animal was not eaten, for sausages and smoked hams were considered great delicacies.

The negative impact of these animals on the landscape was enormous. Cattle and sheep, in particular, severely depleted native grasses and other plants growing in the grasslands, even small trees and bushes. This drove wild animals such as deer to migrate to other areas, in turn forcing the Native American neophytes to rely even more heavily on domesticated foods (Dartt-Newton and Erlandson 2006:419; Hackel 2005; Silliman 2004:154). Neophytes were permitted one- or two-week *paseos*, or retreats, from the missions during which they could collect additional foods, such as pine nuts (see Chapter 7: Plant Remains). This was necessary at times to sustain the Native American population of a given community (Hackel 2005).

Cattle at the California Missions

While it is clear that mission residents included cattle meat in their diet, the primary importance of cattle within the mission economy was not for subsistence (Enright 2010). Rather, its importance derived from the income generated by hides and tallow, and from the use of cattle as working animals in transportation as agricultural pursuits (Bancroft 1890; Gust 1982; Tays 1941). Early explorers from Spain brought cattle herds to the West Indies and Mexico in the sixteenth century. Breeding populations from this stock were driven north into California to serve as foundation stock for the California missions. These animals were comparatively small in size, with thin bodies and slender horns (Burcham 1957; Gust 1982, 2008). Because these animals lived out on the range year-round, their weight would fluctuate seasonally and droughts would sometimes decimate herds. In general, cattle herds thrived in California, growing to an estimated 400,000 head by 1831 (Burcham 1961; Gentilcore 1961; McLaughlin and Mendoza 2009).

Cattle were butchered and processed 2,000–3,000 at a time (Dale 1918:200) at the end of the summer growing season, when they were fattest. A special event known as the *matanza*, an annual slaughter of cattle, entailed several days of butchering by the padres, neophytes, *vaqueros* (cowboys), and miscellaneous ranch hands. The primary purpose of the matanza was to acquire hides and tallow for trade (Gust 1991).

Tays (1941) described the matanza process in detail. The cattle were herded in from the countryside to the mission corrals, where they were roped, tied down, and slaughtered. The carcass was placed on its back and skinned by another set of workers, probably natives. With the skin removed, dismemberment would begin with the removal of fat and meat from the ribs, breast, shoulders, haunches, and back. According to Tays (1941), this tallow or fat was of the best quality and was kept for household or mission cooking. After removing the internal organs, the surrounding fat was designated for use in making soap. Some of the axial skeleton—skull, backbone, and ribs—were used to make household items like spoons, knives, and forks.

At least some of the meat, including that derived from the removed legs, along with excess bones, was discarded during the early Mission period. Because of the demand for provisions among the merchant marine after about 1820, limb meat was dried and traded to visiting sailors. The rest of the meat and connected fat was set aside for trade purposes (Tays 1941). San Gabriel Mission resident Eulalia Pérez reported that hides, fat, loin, tongues, and horns were kept, either for community use or to be sold to ships (Beebe and Senkewicz 2006:109).

In addition to the matanza, cattle and other animals were butchered as needed. Individual cattle were slaughtered once or twice a week for food (Engelhardt 1927a:157; Gust 1982; Tays 1941). The remains from this type of butchering were deposited in midden areas near domestic kitchens or habitations (Gust 1982; Walker and Davidson 1989).

These descriptions allow for expectations of archaeological evidence for taking cattle for tallow and hide production versus taking them for food. Matanzas, which focus on hides and tallow as the target product, would be expected to produce assemblages that showed rapid and consistent processing in a relatively large-scale, non-intensive way, and deposition en masse in a highly concentrated, bone-dominated midden. Cattle taken as-needed primarily for food, on the other hand, would be expected to produce assemblages that are heavily processed, have a high proportion of meat-rich portions such as ribs and appendicular elements, and are deposited in midden areas containing other domestic items, such as pottery (Table 8.3).

Based on ethnographic, experimental, and archaeological observations, Pavao-Zuckerman (2011) derived a set of key signatures for identifying rendered assemblages (i.e., those processed for tallow extraction). Marrow is the most concentrated fat source. But fat cells are also deposited throughout bony matrices, including the cancellous (spongy) portions of the bones. “Indeed, more fat is found in cancellous bone portions than in marrow cavities” (Pavao-Zuckerman 2011:8). Therefore, expectations for a rendered assemblage include 1) a high degree of fragmentation, 2) blunt-force butchering marks, particularly on low-utility elements such as foot and ankle bones, 3) a higher-than-expected frequency of low-utility skeletal elements, 4) a low frequency of burning, and 5) a high frequency of peri-mortem (“green”) fractures. These expectations may be used to distinguish assemblages resulting from tallow and grease rendering from those that represent domestic food remains, regardless of whether a matanza event was the processing context.

Other Animals at California Missions

In addition to cattle, other artiodactyl species such as deer, goats, and sheep were consumed by mission residents. Sheep and goat were common additions to mission herds and were used for mutton, wool, and dairy products (Tays 1941; Walker and Davidson 1989). Wild game, including mule deer, was commonly hunted by

Table 8.3. Archaeological Expectations for Two Cattle Butchering Contexts in California Mission Sites

Butchering Context	Target Product	Quantity of Animals Involved	Deposition	Processing	Portions Targeted
Matanza event	Hides, fat for tallow	Large numbers at once	Concentrated bone middens	Rapid, non-intensive and consistent	Whole animal
As-needed food production	Meat and fat for food	Small numbers of individuals at once	Scattered, mixed-use trash middens	Intensive and inconsistent	Meat bearing portions (e.g., ribs, limbs)

Native Americans before the Mission period, and composed a large portion of the prehistoric diet. Once Native American populations aggregated at the missions, the neophytes were supplied with beef and other domestically raised food by the padres. However, evidence from mission assemblages demonstrates that the neophytes, and possibly the European fathers, supplemented their diets with wild game (Gust 2006; Salls 1993; Tays 1941).

Other wild game found in mission midden deposits includes lagomorph and rodent species. Lagomorphs, or rabbits, were a staple of prehistoric peoples all over the western United States (Akins 1985; Dean 2007; Enright 2010; Landberg 1965; McKim et al. 2007). Cottontails (*Sylvilagus* sp.) tend to live in scrub areas and use subterranean holes for refuge, whereas jackrabbits are generally found in more open environments. Native American hunting techniques included the use of bow and arrow, snares, traps, and communal drives (Hudson and Blackburn 1982).

Bird remains are commonly found at most Mission period sites, but little is known about use of birds at the missions. The most common birds found are chicken (*Gallus gallus*). These birds were present from the earliest mission days, as evidenced by architectural remains of chicken coops, by faunal remains at Mission period sites, and by descriptions of poultry in travelers' journals (Gust 2006; Webb 1952). Other birds found in mission deposits include ducks, geese, ravens, and turkeys (Salls 1993; Walker and Davidson 1989). Carnivore species found in California include canids (dogs, coyotes, and wolves), bears, foxes, mountain lions, and bobcats. In general, none of these species was exploited as a major source of food by either the Native American neophytes or the padres during the Mission period. Accounts of early mission life make it clear that coyotes, mountain lions, and bears were considered pests known to feed off of mission livestock. Bear, coyote, and mountain lion hunts were undertaken to rid areas of these predators (Storer and Tevis 1955; Tays 1941). Once killed, the carcass would either be left, skinned, or brought back to the mission. Hides might be kept and brought back to the mission with the skin and paws (and foot bones) of the animals still attached. Bear meat and tallow were sometimes kept and consumed as a delicacy (Storer and Tevis 1955).

Dogs were the only domesticated animal for most Native American peoples before contact with Europeans, and they aided in hunting, guarding settlements, and transportation. When the Spanish arrived in the New World, European dogs interbred with native dogs. The breeds brought by the Spanish were generally large mastiff and greyhound types, and they were common at most missions and the later ranchos throughout California (Derr 2004; Schwartz 1997). Dogs played an important role in guarding livestock against coyotes, wolves, and other predators. Mission records of 1817 describe shepherd dogs:

> Such were the dogs that helped guard the drying adobes and ladrillos [Figure 8.2], the fields and orchards, and, particularly, the horses, cattle, and sheep. That they were most valuable to the vaqueros and herdsmen is readily gathered from [Richard Henry] Dana's account, for the livestock, especially the young, were preyed upon by the coyotes, mountain lions, and other wild animals which prowled about the pastures. Moreover, wherever there are Indians, there are always dogs, their faithful and trusted companions. (Webb 1952:186)

The missions also kept domesticated cats, primarily to control pests. When Anza and his company were returning to Mexico in 1776, they were asked by the padres of San Carlos Mission in Carmel to deliver two cats to San Gabriel Mission because San Gabriel Mission was overrun with mice (Webb 1952:187).

Historical Records of San Gabriel Mission

Engelhardt (1927a:278–279) lists the recorded counts of livestock by year from 1773 to 1832, and includes frequencies of cattle, goats, horses, mules, pigs, and sheep. Figure 8.3 plots the frequencies of cattle, goats, pigs, and sheep

Figure 8.2. Ladrillo with dog or coyote paw prints recovered from San Gabriel Mission. Catalog Number 06098.01.

based on Engelhardt's data, highlighting some important trends. First, sheep were the dominant species at the mission until 1810. After 1810, sheep counts remained consistently between about 10,000 and 15,000 head, while cattle grew in numbers well above this, becoming the most important animal resource at the mission in terms of raw numbers. Cattle production peaked in 1828 with 26,300 head recorded. This suggests that archaeological deposits dating before 1810 should contain more sheep than cattle remains, whereas deposits dating between 1810 and 1832 should contain more cattle remains. A second notable pattern is the predominance of sheep over goats after 1785. This suggests that most of the remains identified as sheep or goat are more likely to be from sheep rather than goat if they are associated with post-1785 deposits. When the totals for all years are summed, cattle represent 50 percent of the total livestock recorded at the mission from 1773 to 1832; sheep compose almost 48 percent; goats compose less than 2 percent; and pigs compose less than 1 percent (Table 8.4).

The implications of these livestock records for the San Gabriel Mission faunal assemblage are not entirely clear. The mission's livestock served many functions in addition to supplying food. Sheep supplied wool for weaving, and, after 1822, cattle provided an increasingly important source of revenue through the sale and trade of hides and tallow (Hornbeck 1982:54–55). If it can be assumed that faunal remains primarily represent food, these record-derived percentages, as presented in Table 8.3, can be used to establish a baseline for the expected proportions of each species in the archaeological assemblage.

Spatial Variation in Taxonomic Distributions

Domesticated Animals

As indicated in Table 8.1, Area 2 produced the greatest number of faunal bones and bone fragments (n = 7,741), exhibited the greatest density of bone per cubic meter in the study

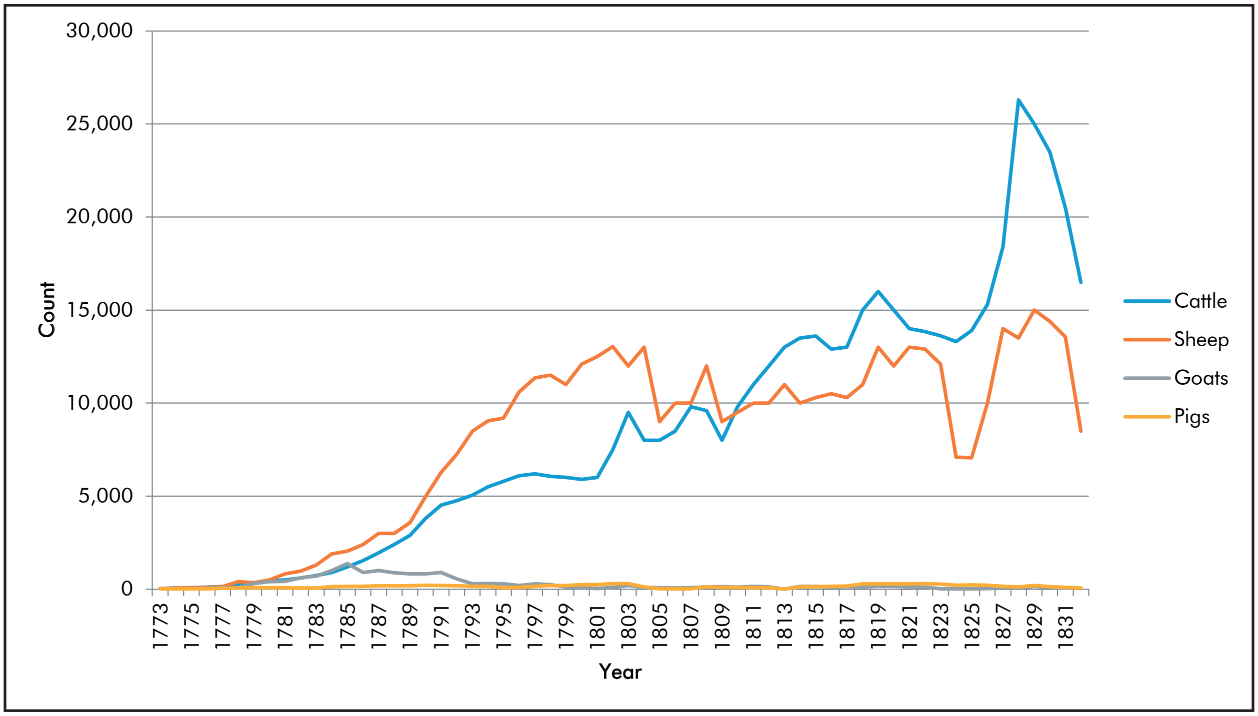

Figure 8.3. Counts of cattle, sheep, goats, and pigs at San Gabriel Mission by year from 1773 to 1832. (Based on data from Engelhardt 1927a.).

area, and contained relatively high proportions of cattle and sheep bones (Figure 8.4). When a chi-square analysis is performed on these data, these animals are represented in far greater proportions than expected in this area of the site, and their associations are statistically significant (Table 8.5). This is not the case for other domesticated species.

The assemblage recovered from the South Midden also contained significant proportions of cattle, but sheep and other domesticated fauna, with the exception of horse, were negatively associated with this provenience. Horse, though present, was not statistically significant in its association with this provenience (see Table 8.5).

Like Area 2, the North Midden contained significant amounts of cattle and sheep. Area 1, on the other hand, also contained significant numbers of cattle and chicken bones.

Table 8.4. Total Counts of Cattle, Sheep, Goats, and Pigs at San Gabriel Mission from 1773 to 1832

Species	Count	Percentage of Total
Cattle	507,704	50.07
Sheep	481,731	47.51
Goat	15,897	1.57
Pig	8,626	0.85
Total	**1,013,958**	**100.00**

Source: Engelhardt (1927a).

Finally, the Feature 14 refuse pit contained a large number of dog bones (dog is present in other contexts but in very small quantities) and, to a lesser extent, chicken and pig bones. In contrast to all other proveniences, Feature 14 did not contain significant numbers of cattle bones. Although only 12 pig bones were associated with this feature, this represents 86 percent of the total pig bone assemblage, far more than would be expected if these bones were distributed randomly among the units.

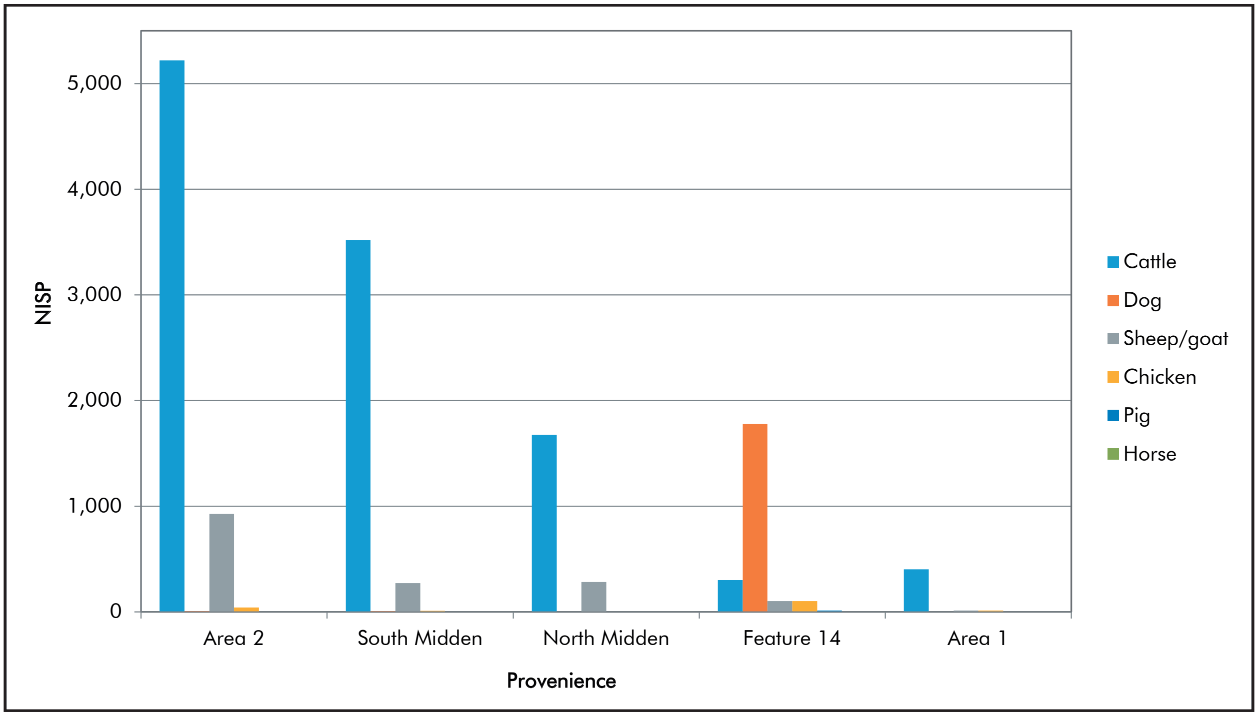

Figure 8.4. NISP of domesticated animals in sample units across site CA-LAN-184H. Based on proveniences defined in Table 8.1.

Table 8.5. Standard Deviations from Chi-Square Analysis Performed on Domesticated Animal Bone Count Data from Various Spatial Contexts

Site Area	Cattle	Dog	Sheep/Goat	Chicken	Pig	Horse
Area 2	20.65*	-38.26	13.59*	-4.32	-3.19	-0.85
South Midden	27.85*	-26.31	-8.61	-6.013	-0.99	1.68
North Midden	10.82*	-17.51	5.37*	-5.05	-1.46	-0.39
Feature 14	-76.04	103.91*	-10.75	16.31*	7.23*	-0.43
Area 1	8.94*	-7.8	-5.13	3.36*	-0.64	-0.179

Note: +/- 1.96 standard deviations significant at the 95-percent confidence level (chi^2=11,532.17, df=20, p=0.000).

* Indicates a statistically significant positive association.

Wild Animals

Wild animal remains are distributed variably across the site as well, although not as disproportionately as domesticated animal remains. The most abundant wild species is pocket gopher (Figure 8.5), but this species is only significantly associated with Area 2 (Table 8.6), and it is very likely intrusive to the site. Sea bass is present in small quantities in the South Midden. Bluefin tuna and rabbits are relatively abundant in the North Midden. One cat bone was recovered from Feature 14; this could be from either a wild or domestic species. And both Feature 14 and Area 1 have high relative frequencies of squirrel bones. Other wild species represented include deer, skunk, hawk, and toad.

Spatial Variation Summary

Bones from fauna identifiable to species were distributed unevenly across the site proveniences. The results of the chi-square analysis of residuals indicate that Area 2 (containing the mill, millrace, and reservoir complex) had a higher-than-expected proportion of cattle, sheep or goat, and pocket

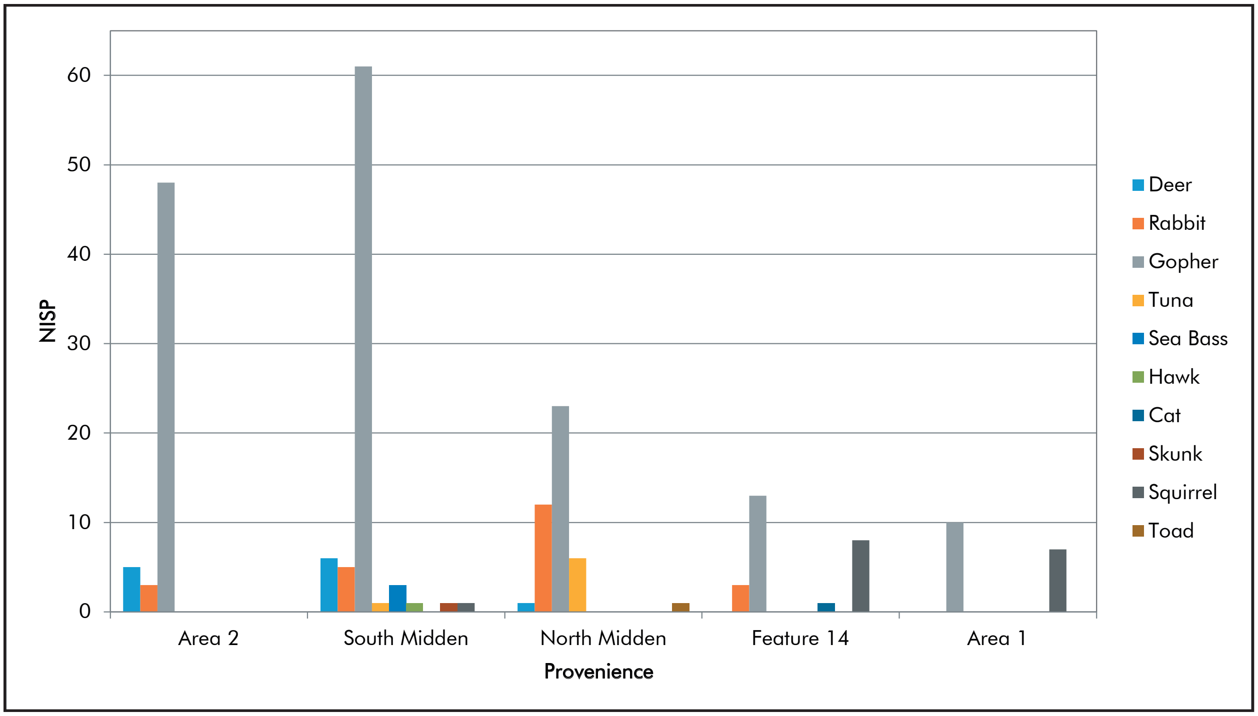

Figure 8.5. NISP of wild animals in sample units.

Table 8.6. Standard Deviations from Chi-Square Analysis Performed on Wild Animal Bone Count Data from Various Spatial Contexts

Site Area	Deer	Rabbit	Gopher	Tuna	Sea Bass	Hawk	Cat	Skunk	Squirrel	Toad
Area 2	1.32	-1.44	2.89*	-1.57	-1.01	-0.58	-0.58	-0.58	-2.42	-0.58
South Midden	1.04	-1.49	1.64	-1.21	2.32*	1.33	-0.75	1.33	-2.56	-0.75
North Midden	-1.00	4.17*	-2.71	4.48*	-0.85	-0.49	-0.49	-0.49	-2.04	2.03
Feature 14	-1.27	0.26	-2.14	-0.96	-0.62	-0.35	2.79*	-0.35	5.05*	-0.35
Area 1	-1.03	-1.46	-1.09	-0.77	-0.50	-0.29	-0.29	-0.29	5.60*	-0.29

Note: +/- 1.96 standard deviations significant at the 95-percent confidence level (chi^2=127.22, df=36, p=0.000).

* Indicates a statistically significant positive association.

gopher remains. The pocket gopher remains were probably intrusive, the result of post-occupation burrowing. The lack of burning on these bones further supports this interpretation (see below, Comparing Species). Adjacent to this area, toward the center of the site, the South Midden contained significant numbers of cattle bones, as well as higher-than-expected numbers of sea bass remains. Area 1 sample units (excluding Feature 14) contained higher-than-expected numbers of cattle, chicken, and squirrel bones.

Feature 14 in Area 1 contained higher-than-expected proportions of chicken, dog, and pig bones. This feature is stratigraphically later than other features in Area 1 and represents deposits that post-date the Mission period. The unique character of the faunal assemblage may relate to the function of the feature as a refuse pit and also temporal variation in domesticated faunal use at the site. Squirrel remains associated with this feature appear to be intrusive (see below, Comparing Species).

The North Midden sample units contained higher-than-expected numbers of bluefin tuna and rabbit bones, including jackrabbit. Like the millrace and reservoir complex assemblage, the North Midden assemblage also consistently exhibited a statistically significant quantity of sheep or goat bones.

Species Element Analysis

This section describes the skeletal elements for economic species represented by relatively large samples and compares body part representation and any cultural modifications evident. All domesticated species are included; of the wild species, only deer is included.

Cattle

Of the 11,116 bones identified as cattle, 1,892 (17 percent) were categorized as adult and 131 (1 percent) were categorized as juvenile. The rest are unidentifiable to age. The juvenile to adult ratio for cattle is 0.07, meaning that 7 percent of the assemblage identified to age is categorized as juvenile, while 93 percent is adult.

All major body parts are represented in the cattle bone assemblage, including feet, legs, axial elements, and head (Table 8.7). Rib fragments are by far the most numerous elements, however, composing 74 percent of the total cattle assemblage. All of the remains are highly fragmented, but ribs are particularly fragmented—of 8,185 rib elements identified, no complete or nearly complete ribs were recovered. And although ribs make up 74 percent of the total cattle bone count, they compose only 36 percent of the assemblage by weight, even though complete ribs are some of the heaviest bones in the skeleton.

A relatively small percentage (5 percent) of the cattle assemblage exhibits burning (Table 8.8). Most of the burning is evident on long bone fragments. These elements are highly fragmented and therefore not identifiable to a particular long bone. These bones may have been targeted for intensive processing for marrow extraction.

Cut marks are present in very low frequency (n = 67; 0.6 percent), but the highest relative frequencies appear for limb and rib bones. Chop and cut marks on these body parts generally result from meat removal.

Table 8.7. Cattle Element Counts and Percentages

Element	Total Count	Percentage of Total
Phalanx	39	0.4
Carpal or tarsal	22	0.2
Metacarpal/ metatarsal	37	0.3
Tibia	68	0.6
Femur	11	0.1
Pelvis, sacrum, acetabulum	32	0.3
Vertebra	80	0.7
Rib	8,185	73.6
Radius	82	0.7
Ulna	3	<0.1
Humerus	6	0.1
Scapula	30	0.3
Skull	256	2.3
Mandible	113	1.0
Tooth	253	2.3
Unidentified long bone	1,858	16.7
Unidentified bone	41	0.4
Total	**11,116**	**100.0**

Sheep or Goat

Of the 1,597 bones identified as sheep or goat (or ovicaprids), 641 (40 percent) were categorized as adult and 71 (4 percent) were categorized as juvenile. The rest are unidentifiable to age. The juvenile to adult ratio for sheep or goats is 0.11, meaning that 11 percent of the assemblage identified to age is categorized as juvenile, while 89 percent is adult.

All major body parts are represented in the sheep or goat bone assemblage, including feet, legs, axial elements, and head (Table 8.9). Rib fragments are the most numerous elements, composing 39 percent of the total sheep or goat assemblage. Many of the remains are highly fragmented, but ribs are particularly fragmented. Of the 617 rib elements identified, none are complete or nearly complete. And although ribs make up 39 percent of the total sheep or goat bone count, they compose only 21 percent of the assemblage by weight.

Table 8.8. Counts and Percentages of Burned Cattle Bones

Element	Total Count	Number Burned	Percentage Burned
Phalanx	39	4	10.3
Carpal or tarsal	22	1	4.5
Metacarpal/metatarsal	37	0	0.0
Tibia	68	0	0.0
Femur	11	0	0.0
Pelvis, sacrum, acetabulum	32	0	0.0
Vertebra	80	1	1.3
Rib	8,185	410	5.0
Radius	82	1	1.2
Ulna	3	0	0.0
Humerus	6	0	0.0
Scapula	30	0	0.0
Skull	256	0	0.0
Mandible	113	0	0.0
Tooth	253	2	0.8
Unidentified long bone	1,858	156	8.4
Unidentified bone	41	1	2.4
Total	**11,116**	**576**	**5.2**

Table 8.9. Sheep or Goat Element Counts and Percentages

Element	Total Count	Percentage of Total
Phalanx	30	1.9
Carpal or tarsal	47	2.9
Metacarpal/ metatarsal	46	2.9
Tibia	10	0.6
Patella	2	0.1
Femur	9	0.6
Pelvis, sacrum, acetabulum	21	1.3
Vertebra	190	11.9
Sternum	1	0.1
Rib	617	38.6
Radius	16	1.0
Ulna	2	0.1
Humerus	19	1.2
Scapula	78	4.9
Skull	85	5.3
Mandible	90	5.6
Maxilla	1	0.1
Tooth	63	3.9
Unidentified bone, long bone	270	16.9
Total	**1,597**	**100.0**

Only 43 sheep or goat bones (2.7 percent) exhibit burning (Table 8.10), and most of the burning appears on foot bones (e.g., carpals, tarsals, phalanges, astragali, and calcanei). Evidence of damage from processing (e.g., cut, chop, and saw marks) is even more rare. Only 19 sheep bones (1.2 percent) have evidence of cut marks.

Dog

Of the 1,795 bones identified as dog, 1,184 (66 percent) were categorized as adult and 45 (3 percent) were categorized as juvenile. The rest are unidentifiable to age. The juvenile to adult ratio for dogs is 0.04, meaning that 4 percent of the assemblage identified to age is categorized as juvenile and 96 percent is adult.

Table 8.10. Counts and Percentage of Burned Sheep or Goat Bones

Element	Total Count	Number Burned	Percentage Burned
Phalanx	30	4	13.3
Carpal or tarsal	47	0	0.0
Metacarpal/ metatarsal	46	4	8.7
Tibia	10	0	0.0
Patella	2	0	0.0
Femur	9	0	0.0
Pelvis, sacrum, acetabulum	21	0	0.0
Vertebra	190	1	0.5
Sternum	2	0	0.0
Rib	617	24	3.9
Radius	16	0	0.0
Ulna	2	0	0.0
Humerus	19	0	0.0
Scapula	78	0	0.0
Skull	85	0	0.0
Mandible	90	0	0.0
Maxilla	1	0	0.0
Tooth	63	2	3.2
Unidentified bone, long bone	270	8	3.0
Total	**1,597**	**43**	**2.7**

All major body parts are represented in the dog bone assemblage, including feet, legs, axial elements, and head (Table 8.11). Rib fragments are the most numerous elements, composing 30 percent of the total dog assemblage. Many of the remains are highly fragmented, especially ribs. Of 531 rib elements identified, only two are complete or nearly complete. Ribs constitute 30 percent of the total dog bone count, but they compose only 13 percent of the assemblage by weight.

Only 64 dog bones (3.6 percent) exhibit burning (Table 8.12), most frequently on limb elements (femora and tibiae) and axial elements (vertebrae and sternebrae). One bone—a proximal humerus—exhibits evidence of cutting; it represents less than 0.001 percent of the total dog assemblage.

Table 8.11. Dog Element Counts and Percentages

Element	Total Count	Percentage of Total
Phalanx	45	2.5
Carpal or tarsal	13	0.7
Metacarpal/ metatarsal	52	2.9
Tibia	13	0.7
Patella	5	0.3
Femur	12	0.7
Pelvis, sacrum, acetabulum	18	1.0
Vertebra	111	6.2
Sternum	24	1.3
Rib	531	30.0
Radius	1	0.1
Ulna	9	0.5
Humerus	14	0.8
Scapula	63	3.5
Skull	107	6.0
Mandible	182	10.1
Maxilla	20	1.1
Hyoid	3	0.2
Tooth	136	7.5
Unidentified bone, long bone	436	24.3
Total	**1,795**	**100.0**

Other Domesticated Species

Pig

Pigs are represented by three teeth, two metacarpals, and nine unidentifiable fragments. Three of these elements are complete or nearly complete. All of the elements are from a juvenile. No burning or cut marks are evident.

Table 8.12. Counts and Percentage of Burnt Dog Bones

Element	Total Count	Number Burned	Percentage Burned
Phalanx	45	6	13.3
Carpal or tarsal	13	0	0.0
Metacarpal/ tarsal	52	1	1.9
Tibia	13	2	15.4
Patella	5	0	0.0
Femur	12	3	25.0
Pelvis, sacrum, acetabulum	18	2	11.1
Vertebra	111	14	12.6
Sternum	24	3	12.5
Rib	531	15	2.8
Radius	1	0	0.0
Ulna	9	1	11.1
Humerus	14	1	7.1
Scapula	63	1	1.6
Skull	107	8	7.5
Mandible	182	5	2.7
Maxilla	20	1	5.0
Hyoid	3	0	0.0
Tooth	136	1	0.7
Unidentified bone, long bone	436	0	0.0
Total	**1,795**	**64**	**3.6**

Chicken

Chickens are represented by 164 elements (Table 8.13). All, except one humerus, were categorized as adult. Evidence of burning is present on 65 elements (40 percent of the assemblage), and only one bone, the adult humerus, exhibits cut marks.

Table 8.13. Chicken Element Counts and Percentages

Element	Total Count	Percentage of Total
Phalanx	6	3.7
Metacarpal/ metatarsal	13	7.9
Tibiotarsus	12	7.3
Femur	2	1.2
Pelvis, sacrum, acetabulum	11	6.7
Vertebra	3	1.8
Sternum	8	4.9
Rib	25	15.2
Radius	1	0.6
Humerus	2	1.2
Coracoid	4	2.4
Furculum	2	1.2
Skull	20	12.2
Unidentified bone, long bone	55	33.5
Total	**164**	**100.0**

Deer

Deer are represented by 12 elements: one antler, scapula, femur, pubis, ilium, phalanx, and rib; three metacarpals, and two metatarsals. At least one adult and one juvenile are represented. Two metatarsals and one metacarpal are nearly complete. No burning is evident in the deer assemblage.

Comparing Species

Comparisons of the predominant animals in the assemblage—those represented by at least 100 bones—reveal stark differences. Figure 8.6 shows the distribution of body parts for cattle, dogs, and sheep/goats. The cattle assemblage is heavily dominated by rib fragments, whereas the other two animals are more evenly represented by other body parts, including the feet, vertebrae, scapulae, and skull and mandible bones. The cattle assemblage is also unique in the degree to which it was processed. The frequency of fragmentation, burning, and cutting of cattle bones is far higher than for other large and medium-sized mammals, such as sheep and dogs (Table 8.14). As noted above, most of the burning on cattle bones occurred on long bone fragments. These elements are highly fragmented and therefore not identifiable to a particular long bone. These elements may have been targeted for intensive processing for marrow extraction. Cut marks appear mostly on foot and ankle bones and in the pelvic area. Cut marks on foot elements may be related to hide processing (i.e., separating the hide from the feet), whereas marks in the pelvic area generally result from meat removal. Cattle bone deposition therefore appears to relate to three activities: 1) hide processing as indicated by cut marks on foot and ankle bones, 2) marrow extraction as indicated by long bone fragmentation and burning, and 3) consumption of meat as indicated by cut marks on ribs and in the pelvic area.

Sheep/goats are the next most heavily processed animal type in the assemblage (see Table 8.14), and also have the highest juvenile to adult ratio, suggesting that young lambs or kids were culled for meat consumption. Evidence of burning is most pronounced on foot bones, perhaps from roasting. However, the relative rarity of burning evidence on sheep/goat bones suggests they were mostly prepared in pots, perhaps as stews, rather than over open fires. Cut marks, particularly those on ribs and limb bones, also indicate processing sheep/goats for meat.

Of the large and medium-sized mammals, dogs exhibit the least processing, supporting the interpretation that dogs were not consumed as food and were instead mostly disposed of post-mortem as whole or partial carcasses in the Feature 14 refuse pit.

Chickens exhibit the most complete or nearly complete elements, the most evidence of burning, and very few cut marks. These patterns suggests that chickens were not just kept for egg production but were also eaten, that their bones were not purposefully broken or cut (bird bones do not contain marrow and they do not need to be re-sized fit into a pot), and that roasting on a fire was the preferred cooking method for chicken.

Table 8.14 also includes gophers, rabbits, and squirrels, which are possibly post-occupation, intrusive species that burrowed into the site and died. Expectations for intrusive animals are 1) a high juvenile-to-adult ratio because the young are generally present in underground dens and would not be sought as food; 2) a relatively low proportion of burned elements, because they were not cooked; and 3) less fragmentation and fewer cut marks than would be seen on animals processed as food. The elements representing each of these three animals meet these expectations, with the exception of a higher-than-expected proportion of burned rabbit elements (n = 2). Gophers and squirrels appear to have been intrusive. Rabbits are also likely to have been intrusive, although they may have been eaten occasionally (see above, Other Animals at California Missions).

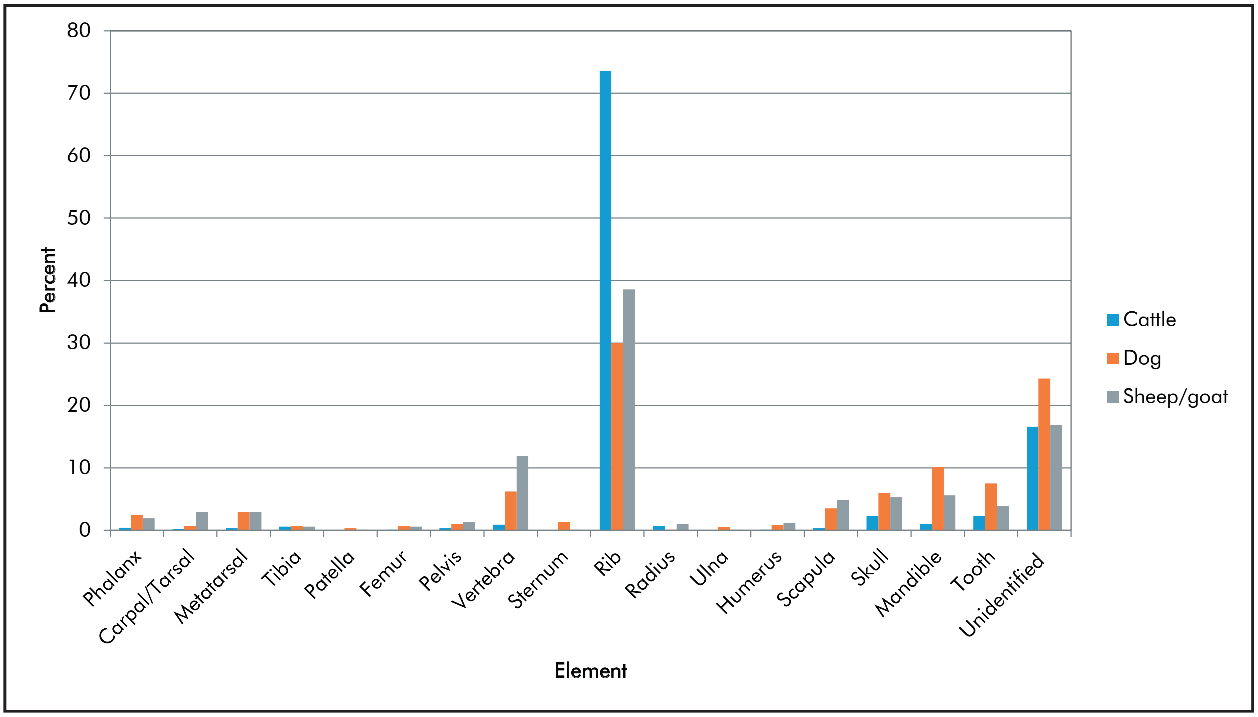

Figure 8.6. Percentages of cattle, dog, and sheep/goat elements.

Table 8.14. Percentages of Complete, Burned, and Cut Bones and Juvenile-to-Adult Ratios for Most Common Taxa and Possible Intrusive Species

Species	Percentage of Elements at Least Half Complete	Percentage Burned	Percentage Cut	Juvenile-to-Adult Ratio
Cattle	0.4	8.1	0.6	0.07
Sheep or goat	5.6	2.7	1.9	0.11
Dog	7.1	3.6	0.1	0.04
Chicken	11.0	40.0	0.6	0.06
Gopher	16.8	0.6	0.0	1.40
Rabbit	52.2	6.7	0.0	7.70
Squirrel	43.8	0.0	0.0	9.10

Processing Marks

Cultural modifications to bone from butchery and food processing were observed on 94 elements in the analyzed assemblage. These 94 elements exhibit 101 processing marks, including marks made with a chopping implement, such as a butcher knife or axe used to cut both flesh and bone, and cut marks made with a finer knife or cutting implement that was used to separate soft tissue (e.g., muscle or ligaments) from bone (Table 8.15). The majority of the bones with processing marks are from cattle (n = 67, 71.3 percent) and sheep or goat (n = 19, 20.2 percent). Other animals exhibiting processing marks were chicken (n = 1), deer (n = 1), dog (n = 1), and unidentified vertebrates (n = 5). Axial elements (ribs and vertebrae) and limb bones are the most common processed elements and together account for 43.6 percent (n = 44) and 39.6 percent (n = 40), respectively, of the 101 observed processing marks in the assemblage. Rib bones were chopped and cleaved (n = 20) with an implement similar to a butcher's knife, and cut (n = 24) with a finer implement during removal of soft tissue from the bones. Limb bones were chopped or cleaved (n = 23) and cut (n = 17) in similar proportions. Most of the vertebrae exhibiting cultural modification were chopped and cleaved (n = 7), rather than cut (n = 1). Feet elements were chopped and cut in roughly equal proportions with five chopped or cleaved and four cut.

Table 8.15. Location and Type of Processing Marks Observed on San Gabriel Faunal Assemblage

Element	Chopped or Cleaved	Cut	Total
Feet	5	4	9
Limbs	23	17	40
Ribs	20	24	44
Vertebrae	7	1	8
Total	**55**	**46**	**101**

Processing marks, then, are predominately the result of chopping the carcass into smaller pieces using a butcher's knife and cutting soft tissues from the bone using a smaller knife or flaked stone tool. This pattern is consistent with one expected from Spanish colonial butchery technology. Simmons and Turley (1980) note that common knives used for butchery include the machete, which was originally intended as a weapon but became widely used as a multipurpose tool, and the peasant knife, or *cuchillo de cintura*, which was carried in a belt or sash. St. Clair (2004) notes that axes were sometimes used to divide the carcass and to break appendicular bones above or below joints and at the center of the long bone shaft. Knives with wooden handles were then used to cut tendons and muscle. Importantly, ribs were often cut transversely multiple times, which resulted in great fragmentation and shattering (St. Clair 2004). High degrees of rib fragmentation, as noted in the San Gabriel Mission assemblage, also resulted from the common Spanish practice of removing the *fresada*, that portion of meat that covers the ribs, with an axe. Gust (1991) describes this practice at the Ontiveros Adobe, and Lucido (2013) describes it as possibly occurring at the Royal Presidio of Monterey.

Non-Cultural Taphonomic Factors

Just over half (52 percent) of the total assemblage exhibits weathering, which occurs from the effects of exposure to sun, wind, water, soil, and plant roots. Weathering is most prevalent on bones that are left in the open and not buried quickly after the animal is deceased, so the high percentage of weathered bones in the assemblage suggests carcasses were left in the open for long periods before being buried. Cattle bones parallel this pattern, with 50 percent exhibiting weathering (Table 8.16). Similarly high percentages of deer, dog, pig, and sheep bones are weathered. Interestingly, chicken bones appear to have been deposited soon after they were eaten, mostly in the Feature 14 refuse pit, signaling a temporal shift in site use or activities. The bones of intrusive animals, particularly gophers and squirrels, have little evidence of weathering, presumably because these animals perished underground.

Tooth marks, by contrast, are relatively rare on bones in this assemblage, with nearly 12 percent of the total assemblage exhibiting carnivore tooth marks. Most of these marks appear on the unidentifiable elements, suggesting that gnawing by carnivores contributed to the breakdown of the assemblage. Both root marks and soil discoloration are common in the assemblage. The effects of these factors on

Table 8.16. Percentages of Bones Exhibiting Weathering, Tooth Marks, Root Marks, and Soil Discoloration

Species	Weathering	Tooth Marks	Root Marks	Soil Discoloration	Total NISP
Total assemblage	52.3	11.6	82.5	98.3	18,459
Cattle	50.5	7.7	89.0	98.3	11,116
Sheep	25.2	3.0	23.9	96.4	1,597
Dog	42.2	0.4	40.9	99.2	1,795
Chicken	1.8	0.6	22.6	87.8	164
Deer	50.0	0	83.3	100.0	12
Pig	64.3	0	0	85.7	14
Gopher	2.6	0	12.3	63.2	155
Rabbit	17.4	4.3	78.3	100.0	23
Squirrel	0	0	31.2	100.0	16

the preservation and formation processes of the assemblage are unclear, however. The relatively high proportion of rib elements and the low proportion of foot elements in the cattle and sheep/goat assemblages suggest that non-cultural taphonomic factors did not substantially affect body part representation in the record, because ankle and foot bones are denser and therefore tend to be preserved better than high-utility elements such as ribs and vertebrae (Lyman 1994). If weathering and gnawing had adversely affected the preservation of the assemblage, one would expect the inverse of observed pattern, i.e., more phalanges and carpals and fewer ribs and vertebrae.

The relatively low percentage of root marks on pig and chicken remains may indicate the late date of their deposition compared to other species. The remains of both of these species were primarily associated with the Feature 14 refuse pit (see Table 8.5).

Comparisons with Other Missions

Archaeological Data

The San Gabriel Mission archaeological site's faunal assemblage is heavily dominated by cattle remains. Of the 18,459 bones and bone fragments analyzed, 60.2 percent are identified as cattle, and an additional 6.8 percent are categorized as "indeterminate large mammal" and "indeterminate very large mammal," and these are probably mostly from cattle, as well. Although this may seem like an extraordinarily large proportion of cattle, it is well in line with other assemblages of this time period. For example, the San Fernando Mission assemblage is about 70 percent large mammal or very large mammal remains (Table 8.17), and, although only 0.2 percent was identified specifically to cattle, the author speculates that the large and very large mammal remains are most likely cattle (Enright 2010). The similarity of the combined percentages (identified plus unidentified) among the two site assemblages (see Table 8.17) suggests similar proportions of cattle are represented in each.

Important differences are seen between the assemblages, as well. The first difference relates to the presence of the Feature 14 refuse pit, which was dug into the site after the Mission period and which contained significant amounts of chicken, dog, and pig remains (see Table 8.4). These animals are represented in higher proportions in the San Gabriel Mission assemblage solely because of this feature. The second difference is the relatively high proportion of sheep or goat remains at San Gabriel Mission (8.65 percent) compared to that of San Fernando Mission (0.07 percent) (Table 8.17).

Other interesting comparisons among the two site assemblages relate to the prevalence of burning. The San Fernando Mission assemblage is much more heavily burned, with 75 percent of that assemblage showing evidence of burning compared to 8 percent of the San Gabriel Mission assemblage showing burning. What could produce such dramatically different patterns in the cattle assemblages?

Enright (2010) suggests that the burned cattle bones in the San Fernando Mission assemblage are the result of refuse from the matanza, or annual cattle slaughter (see the Cattle in the California Missions section above) being reused in the mission ovens as a source of fuel. Enright notes that many of the bones appear to have been burned over and over again, and then eventually cleaned out when heavily calcined and used up as a fuel source.

The San Gabriel Mission assemblage does not appear to derive from matanza activities. It is not clear where that event was held at this mission. In addition to the lack of an archaeological signature that matches the San Fernando Mission example, none of the early historic images of San Gabriel Mission depict corrals, where mass-slaughtering activities are thought to have occurred at missions. Instead, that the assemblage considered here appears to have resulted from the less concentrated processing of cattle for meat, marrow, tallow, and hides. After the animal was butchered and portions were consumed, the mostly unburned bones were scattered across this portion of the mission community, perhaps acting as fertilizer in the garden. They were evidently not used as fuel, at least in this area.

Historical Data

Cattle predominated at other missions, but historical data suggest this was particularly true for San Gabriel Mission. Figure 8.7 presents the recorded numbers of cattle from 1773 to 1832 at eight missions, as reported by Engelhardt (1927a). It shows cattle to have been more prevalent at San Gabriel Mission than at most missions. This trend began very early in its establishment and continued throughout the Mission period.

Sheep, on the other hand, grew steadily in number and outnumbered cattle at San Gabriel Mission during its first years of operation, but after about 1800 the number of sheep remained somewhat steady until 1832 (Figure 8.8). This was also a trend at other missions, such as San Fernando Mission (although far fewer sheep were under its care), San Juan Capistrano Mission, and San Francisco Mission. San Luis Rey and San Diego Missions, by contrast, continued to grow their sheep herds after 1800. San Luis Rey Mission stands out in both cases because it started its herds later than many other missions but soon overtook all of them in both cattle and sheep production.

These historical data are good starting points for comparisons among the missions in terms of domesticated animal *production*. The archaeological record, though, is primarily a record of *consumption*, and these two aspects of the economy—production and consumption—are not always in sync. For example, both the San Gabriel Mission and San Fernando Mission archaeological assemblages should contain more sheep if consumption and deposition paralleled production. In the case of San Fernando Mission, a very specific series of depositional processes—*matanza*-related slaughters and the burning of cattle bones for fuel—appears to have skewed the record heavily toward cattle. At San Gabriel Mission, sheep are present in the study area, but are lower in number than expected from the historical record (Engelhardt 1927a) (see Table 8.4).

Table 8.17. Percentages of Select Domestic Animal Types from San Gabriel Mission and San Fernando Mission, by specimen count

	San Gabriel Mission	San Fernando Mission*
Cattle/Horse	66.79	98.73
Sheep or goat	8.65	0.07
Pig	0.08	–
Indeterminate Large Mammal (Sheep/Goat/Pig/Deer)	0.16	0.67
Dog	9.72	0.14
Domestic fowl (chicken)	0.89	0.01

* Data from Enright (2010:A-6).

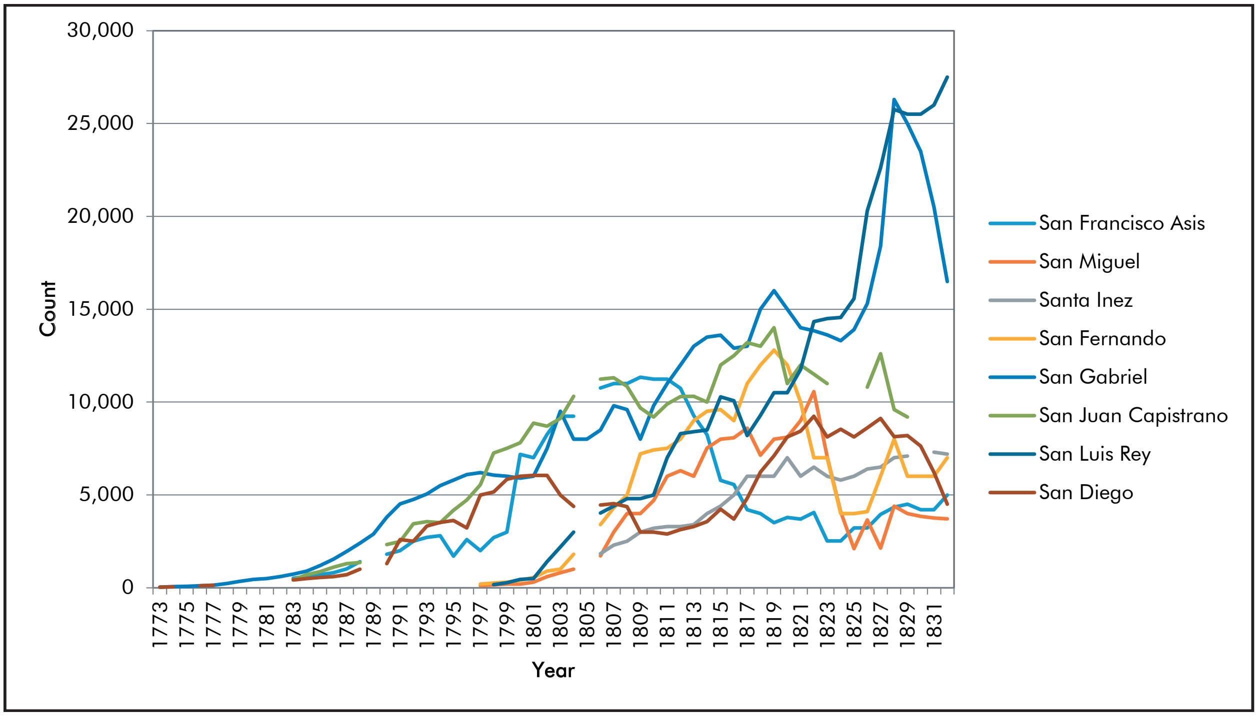

Figure 8.7. Historical counts of cattle at eight missions, 1773–1832. (Source: Engelhardt 1927a.)

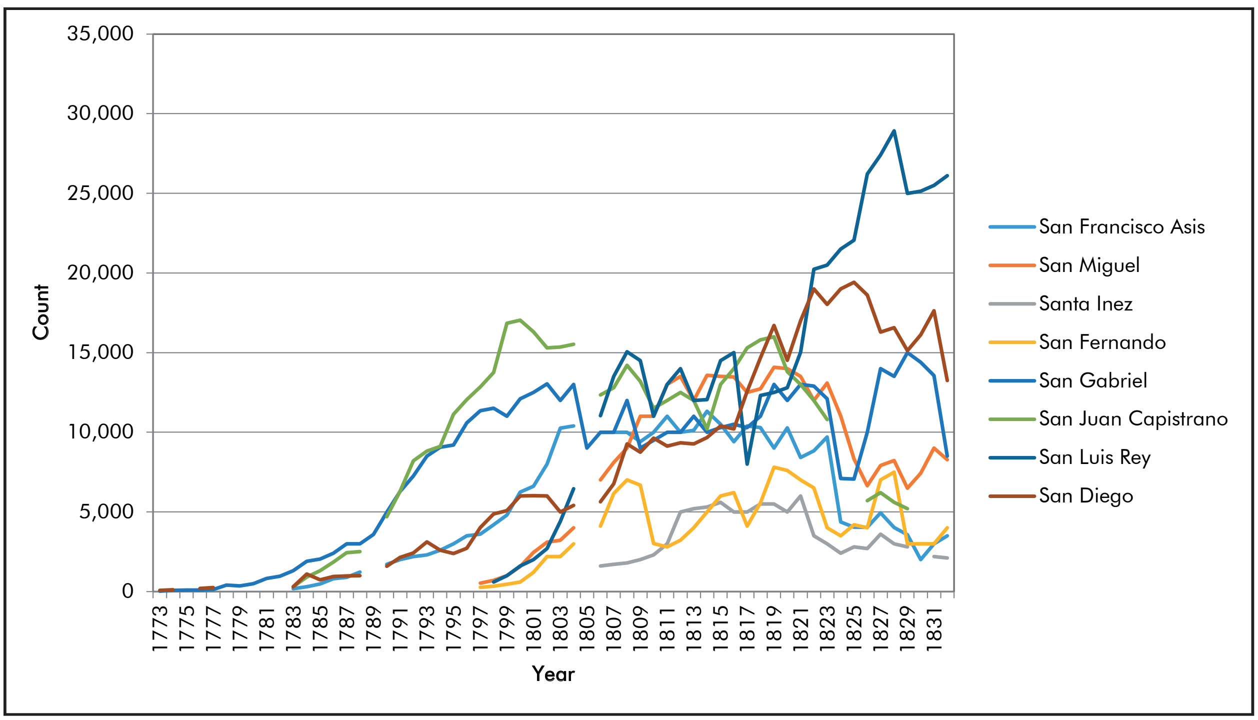

Figure 8.8. Historical counts of sheep at eight missions, 1773–1832. (Source: Engelhardt 1927a.)

As indicated above, age data for sheep suggests culling of lambs for meat, but adult sheep were probably kept as long as possible for wool, and they appear not have been slaughtered and processed for food to the same degree as cattle were. This was certainly the case later in the American period, as evidenced by the recovery of several pair of sheep shears from Feature 14 (Figure 8.9). Cattle remains, by contrast, represent intensive processing and deposition of bones related primarily to food consumption. In this example provided by the San Gabriel Mission and San Fernando Mission archaeological assemblages, the archaeological record complements the historical record in a unique and important way.

Invertebrate Faunal Remains

Data recovery excavations at the San Gabriel Mission archaeological site (CA-LAN-184H) recovered 646 invertebrate faunal remains consisting of whole and fragmentary shellfish. Marine shells account for 645 of the specimens. The one non-marine specimen is an unidentifiable terrestrial snail that was likely deposited after the accumulation of the midden material. Of the 645 marine shells, 11 different taxa were recovered.

Methods

Due to the small size of the invertebrate assemblage, all recovered specimens were analyzed. Analysis included identification to the lowest taxon, NISP, and presence or absence of burning. Identification was completed using the SWCA comparative collection and relevant field guides. Specimens that were too fragmentary or weathered to be identified to genus and species level were assigned to class. For example, shell that exhibited morphological traits such as curvature typical of gastropods, axial or spinal ribs, columella, and apexes was assigned to the gastropod class. Shell that exhibited morphological traits such as growth rings, curvature, and thickness typical of bivalves was assigned to the bivalve class. Artifacts made from shell, including beads and ornaments, are analyzed separately in Chapter 9.

Species Analysis

The assemblage includes a wide variety of marine gastropods, or snails, and pelecypods, or bivalves. Only 6 percent (n = 39) of the total shell assemblage is unidentifiable. These fragments are too small or weathered for positive identification to the class, genus, or species level.

Figure 8.9. Sheep shears recovered from Feature 14. Catalog Number 07990.01.

The marine snails make up of 39 percent (n = 253) of the specimens collected by count and 50 percent (362.50 g) by weight (Table 8.18). Of the 253 specimens identified, two are too fragmented to be assigned to a finer taxa. Gastropoda represent the largest class of mollusks, and there are over 250 species found in southern California's intertidal zone (McLean 1969).

The marine bivalves constitute 55 percent (n = 354) of the specimens collected during data recovery at Mission San Gabriel by count and 48 percent (350.24 g) by weight. Of the 354 specimens identified, 25 were too fragmented to be assigned to finer taxa. Pelecypoda represent the second largest class of mollusks, and over 400 species exist in the intertidal zone of southern California (Allen 1990:166).

Among the gastropods, the dominant species is abalone, accounting for 38.1 percent of the identified specimens. Kellet's whelk, slipper shell, and keyhole limpet occur in lower quantities. It is likely that these less frequently occurring species are bycatch—unintentionally collected animals that did not represent significant dietary contributions. Abalone, on the other hand, may have contributed to diet and had a variety of uses in addition to subsistence. These uses include utilitarian forms such as bowls, as well as uses for ceremony and adornment, such as pendants and beads. A chipped and ground green abalone shell recovered from the San Fernando Mission, for example, provides potential evidence for the non-food use of this genus in a nearby, contemporary context (Abdo-Hintzman et al. 2010:46). More clear evidence was found at San Antonio Mission, where two whole abalone shells that were recovered archaeologically were thought to have been used as asphaltum containers, as was the practice prior the Mission period in that region (Hoover and Costello 1985:77). Ornaments made from abalone have been found at a large number California missions (e.g., Abdo-Hintzman et al. 2010; Gibson 1976; Hoover and Costello 1985:74).

Table 8.18. Abundance of Marine Invertebrate Specimens Recovered

Common Name	Scientific Name	NISP	% NISP	MNI
Snails	**Gastropoda**			
Kellet's whelk	*Kelletia kelleti*	1	0.2%	1
Slipper shell	*Crepidula* sp.	2	0.3%	1
Keyhole limpet	*Fissurella volcano*	2	0.3%	1
Black abalone	*Haliotis cracherodii*	186	28.8%	5
Abalone	*Haliotis* sp.	60	9.3%	–
	Unidentified Gastropod	2	0.3%	1
	Total Gastropod	**253**	**39.0%**	**9**
Bivalves	**Pelecypoda**			
Spiny cockle	*Trachycardium quadragenarium*	8	1.2%	–
California mussel	*Mytilus californianus*	10	1.5%	–
Mussel	*Mytilus* sp.	15	2.3%	–
Oyster	*Ostrea* sp.	2	0.3%	–
Speckled scallop	*Argopecten aequisulcatus*	145	22.4%	2
Scallop	*Argopecten* sp.	30	4.6%	–
California Venus	*Chione californiensis*	7	1.1%	6
Venus	*Chione* sp.	17	2.6%	3
Pacific Littleneck Clam	*Leukoma staminea*	1	0.2%	1
Pismo clam	*Tivela stultorum*	94	14.6%	3
	Unidentified Bivalve	25	3.8%	1
	Total Bivalve	**354**	**54.5%**	**16**
	Indeterminate Marine Invertebrate	**39**	**6.0%**	
	Grand Total	**646**	**100.0%**	**25**

Among the bivalves, speckled scallop is the most prevalent species in the collection, representing 43 percent of the identified specimens. Spiny cockle, mussels, oysters, Venus clams, littleneck clams, and Pismo clams occur in lower quantities in the collection. The majority of these species can likely be attributed to dietary contributions, and they were commonly collected by Native Californians prior to contact with Europeans. Mussels and Pismo clams were also used for adornment by Native Americans during the Mission period in the forms of both tubular and disk beads (Gibson 1976; Hoover and Costello 1985:74).

All of the invertebrate species identified are native to southern California and are found within the supra- to sub-littoral zone. Bivalves identified at CA-LAN-184H inhabit muddy to sandy beaches within the mid- to sub-littoral zone, while the identified marine snails are found on rocky substrates within the supra- to mid-littoral zone (Battogliotti 1990). All of these species are commonly found along the coast less than 25 miles from San Gabriel Mission, between the Port of Los Angeles to the south and Santa Monica to the west. The types of shell in the collection include many of the same species found in inland and coastal prehistoric collections in the Los Angeles region. Historical-period collections found in the Los Angeles region tend to display a heavy focus on one or two large, edible species such as abalone, mussel, clam, and scallop. The assemblage from San Fernando Mission, for example, was primarily mussel (more than 80%), with smaller quantities of abalone, clam, purple olive snail (*Olivella*), and crab (Abdo-Hintzman et al. 2010:86). The dominance of mussel shells may reflect the rocky shore habitats that Excavations at the Ortega Vigare adobe, located immediately south of the study area at San Gabriel Mission, yielded nine whole abalone (*Haliotis cracherodii*) shells, along with fragments of oyster, Venus clam, and scallops (Marshall 1982:56). Thus the San Gabriel collection is interesting in its relatively long list of identified species. The varieties that dominate, however, are typical of nearby, contemporary sites.

Human Skeletal Remains

Two isolated human bones were encountered during the course of archaeological data recovery at the San Gabriel Mission archaeological site (CA-LAN-184H), (Table 8.19). Both bones were found in secondary contexts, evidently having been displaced from their original burial locations. Given the later discovery of the first mission cemetery during construction monitoring in February 2014 (report forthcoming), it is possible that these two isolated bones were displaced from the mission's original cemetery, which was active from 1775 to 1803. They may have been displaced by activities associated with the construction of Chapman's Millrace in the mid–1820s.

The first bone, a third metatarsal (foot bone) from the right side, was discovered in Excavation Unit (EU) 129 at level 100–110 cm below Datum 3. The bone was discovered in the narrow space between the west wall of Feature 1A (the west wall of Chapman's Millrace) and the west wall of Feature 12 (a reservoir). The deposits from which the bone was recovered represent post-abandonment fill within the southern and downhill end of the triangular reservoir (see Chapter 5, Site Stratigraphy), consisting of displaced site midden in a secondary context. As a consequence, it was clear at the time of excavation that this bone did not represent an element of an intact human burial, but rather a bone that had been moved to this location from its primary context. No other human remains or potential burial goods were recovered in this area.

The second bone, a maxillary second molar (an upper rear tooth) from the left side, was discovered in EU 282 at level 140–150 cm below Datum 12, in an analysis unit located near the center of the site in Section 4 of Mechanical Trench 1. Like the foot bone, this bone was found in a secondary midden context, and no other human remains or potential burial goods were recovered in the immediate area.

Based on the size and ossification of the metatarsal, and the occlusal wear of the tooth, both the foot bone and tooth appear to be from

Table 8.19. Human Remains

Catalog Number	PD Number	EU	Level (cm below datum)	Description	Measurements Taken (mm)	Percent Complete
4148	5313	129	100–110	Metatarsal 3 (right side)	Total length = 70.3	100%
11587	7353	282	140–150	Maxillary 2nd molar (left side)	Mesiodistal dia. = 9.17 Buccolingual dia. = 8.59 Crown height = 4.52	50% (no root)

adult humans. Sex could not be determined for either specimen. Based on coloration and context, both appear to be historic in age, and they are consistent with expectations for mission period remains. There is no evidence of ancestry and the remains cannot be confidently affiliated with any one particular ethnic group. Furthermore, there is no way to determine whether these bones come from the same individual or two separate individuals, therefore no MNI is provided. Both bones were handled with respect and given to mission community descendants for reburial with both Native American and Catholic ceremony.

Summary

Data recovery excavation at San Gabriel Mission yielded a wide variety of vertebrate and invertebrate faunal remains, as well as a small number of human remains. Domesticated animals in the sample are cattle, chickens, dogs, sheep/goats, horses, pigs, and a possibly domesticated cat. A full 80 percent of the animal bone assemblage, by count, derives from domesticated animals identified to species. Wild species within the animal bone assemblage comprise deer, gopher, hawk, rabbit, sea bass, skunk, squirrel, toad, and tuna. A small number of unidentified fish and small bird bones in the assemblage are also undoubtedly from wild species. The proportion of wild species in the animal bone sample is minimal (1 percent). Of the total animal bone sample, 60 percent are from cattle. The next most numerous species represented is dog at 10 percent followed by sheep/goat at 9 percent. Other categories, aside from unidentified bone fragments, contributed less than 4 percent each, and most contributed less than 1 percent.

The invertebrate assemblage consists almost entirely of wild marine shellfish, and it is dominated by abalone, speckled scallop, and Pismo clam. Abalone was used for food, containers, and adornment during the Mission period, but there is no direct evidence for shell ornament manufacture at San Gabriel Mission in the study area. Numerous shell beads were recovered, and these are discussed in Chapter 9, Artifacts. The quantity of shellfish that was recovered is quite small in comparison to domestic animal species, and it is clear that these were not an important source of food for mission residents.

The remains from the Feature 14 refuse pit are unique in the sample in that they contain higher-than-expected proportions of chicken, dog, and pig. This feature is stratigraphically later than other features in Area 1 and represents a deposit that dates after the Mission period. The unique character of the faunal assemblage may relate to the function of the feature and also variation in domesticated faunal use at the site over time.

The cattle assemblage is dominated by rib and long bone fragments, whereas sheep and dog remains are more evenly represented by other body parts, including the feet, vertebrae, scapulae, skull, and mandible bones. The pattern exhibited by the cattle assemblage suggests that the primary goal of butchering was for procurement of meat for food rather than procurement of tallow and hides through the matanza events (see Table 8.4 for various expectations of each). The cattle assemblage is also unique in the sample because of the degree to which it was processed. Evidence of fragmentation and burning is far more prevalent in cattle bones than it is in bones of other large and medium-sized mammals such as sheep and dog. Most of the burning on cattle bones occurred on long bone fragments. These elements were highly fragmented and therefore not identifiable to a particular long bone. The long bones may have been targeted for intensive processing for marrow extraction. Chop and cut marks appear primarily on limb and rib bones, and are generally the result of meat removal.

Sheep/goat is the next most heavily processed animal type in the assemblage. Sheep or goats also have the highest juvenile-to-adult ratio, suggesting that young lambs or kids were culled for meat consumption. Evidence of burning is most pronounced on foot bones, perhaps from roasting. However, the relative rarity of burning evident on sheep bones suggests they were mostly prepared in pots, perhaps as stews, rather than in open fires. Cut marks, particularly those on ribs and limb elements, also indicate processing for meat.

Of the large and medium-sized mammals, dogs exhibit the least processing, supporting the interpretation that dogs were not consumed as food and were instead mostly deposited as whole or partial carcasses in the Feature 14 refuse pit. These may have been pets or working animals that were disposed of in the refuse pit after they died.

Chickens exhibit the most complete or nearly complete elements, the most evidence of burning, and very few cut marks. These patterns suggests that chickens were not just kept for egg production but were also eaten, that their bones were not purposefully broken or cut (bird bones do not contain marrow and they do not need to be re-sized to fit into a pot), and that roasting on a fire was the preferred cooking method for chicken.

Gophers, squirrels, and perhaps rabbits appear to be post-occupation introductions to the site, intrusive animals that burrowed into the archaeological deposits and perished. As expected for intrusive animals, the assemblage exhibits high juvenile-to-adult ratios, a relatively low proportion of burned elements, and less fragmentation and fewer cut marks than would be seen in animals processed as food.

Non-cultural taphonomic factors are present in the assemblage. Weathering is seen on 50 percent of assemblage, carnivore gnaw marks are rare, root etching is common, and soil discoloration is common. These factors do not appear to have affected the preservation of the assemblage as much as cultural factors, such as intentional breakage and burning of bone elements.

Sheep are better represented in the archaeological assemblage at San Gabriel Mission than at San Fernando Mission, but are less common than expected based on historical records. This suggests that at both sites the archaeological deposition of animal bones represents a specific series of depositional processes that were largely independent of the production levels of these animals for a market economy. For example, cattle bones at San Fernando Mission appear to have been used as fuel, and therefore burned cattle bones are common in that assemblage, whereas at San Gabriel Mission the cattle remains represent the deposition of bones related primarily to food consumption.

Only two human bones were encountered during data recovery, and there was no indication that these were associated with intact burials within the study area. Discoveries subsequent to the data recovery discussed here suggest that they may have been displaced from intact Mission-period burials elsewhere on the San Gabriel Mission archaeological site. It is possible that early mission burials were disturbed by later mission construction activities, which redeposited remains from those burials in the mission garden.

Conclusions

The presence of deer, tuna, sea bass, abalone, speckled scallop, Pismo clam, and other wild species indicates that the Mission San Gabriel community exploited a wide range of environments through hunting and fishing. The tuna, sea bass, and marine shellfish in the sample are indicative of access to coastal resources, which is corroborated by historical accounts of maritime commerce via the port at San Pedro. It is unsurprising that the ox carts that brought the mission's hides and tallow to the port and returned with imported goods from around the world also carried the occasional fish and shellfish. The quantities of these items documented during data recovery demonstrate that the ocean and its shores were not an important source of food for mission residents. Instead, cattle were the clear focus. The collection is typical for what would be expected at either an inland site or coastal site from this period. The distance to the Port of Los Angeles was approximately 40 miles inland from the mission. Travel on foot could be accomplished in one day, or a day and a half. Closed shellfish in an open container such as a burlap bag can live up to several days at low temperatures. It is doubtful that transport of shellfish to the mission could be accomplished on warm days without spoilage. However, some of the invertebrate shells were likely transported as raw material for ornaments and tools, without their perishable contents, rather than as food.

The remains of cattle compose a much greater proportion of the San Gabriel Mission faunal assemblage than any other animal, and cattle appear to have been a major source of meat, tallow, and hides. This is typical of Mission-period sites in California, and has been noted at a number of other missions, including San Antonio Mission (Langenwalter and McKee 1985), Santa Cruz Mission (Walth 1990), Santa Clara Mission (Garlinghouse 2009), San Fernando Mission (Enright 2010), San Juan Bautista Mission (Farris 1991), and Santa Buenaventura Mission, where beef composed 80–90 percent of the meat diet of neophytes (Romani and Toren 1975).

Butchering patterns of cattle in this Native American–dominated assemblage (see Chapter 11, Spatial Analysis, for the spatial correlation between faunal remains and Native American ceramics) compared favorably with Spanish colonial butchering practices, a pattern also noted by Lucido (2013) at the Royal Presidio of Monterey, California, and by St. Clair (2004) in her re-analysis of fauna from San Juan Bautista Mission. In both cases, no substantive difference was found between butchery cut marks produced by colonial metal implements and Native Californian lithic tools. The one pattern that may show a Native American butchering style is long bone breakage for marrow for food. Smashing the shafts of long bones was a technique used by prehistoric hunter-gatherers to access and extract bone marrow, a pattern noted by Garlinghouse (2009) at Santa Clara Mission. It is possible that at San Gabriel Mission, as at Santa Clara, the relatively high frequency and intensity of breakage of cattle long bones signals a continuation of prehistoric bone processing techniques applied to domesticated cattle.

To say that missionization affected the diet of Native Americans is an obvious understatement. But variation among the missions in how diet changed is evident in the overall cuisines of Native Americans (not just what they ate but how it was prepared) and in the continuation of former aspects of subsistence that survived at least into the initial years of missionization. At San Gabriel Mission, this may be evident in the processing techniques used on domesticated fauna, in the types and amounts of wild plants gathered (see Chapter 7, Plant Remains), and in the stone tools used (Chapter 9, Artifacts).

CHAPTER 9: ARTIFACTS

John Dietler, Sara Dietler, Aaron Elzinga, Sara Ferland, Heather Gibson, Nicholas F. Hearth, Alex Kirkish, James M. Potter, and Michael Tuma

This chapter describes the methods and results of analyses conducted on artifact assemblages recovered from San Gabriel Mission. The artifacts recovered from the San Gabriel Mission archaeological site have the potential to address questions regarding the function and chronology of the site. In addition, they can help shed light on the social and economic lives of the mission's Native American community, particularly regarding diet and health, status and role in the mission community, ethnicity, and responses to missionization.

A total of 286,652 artifacts were collected during Phases I, II, and III (Table 9.1), in addition to 79,487 animal bones, 646 shells, and two human bones (see Chapter 8, Animal and Human Remains). Artifacts were classified according to material: ceramic, glass, metal, faunal, leather, textile, flaked stone, ground stone, wood, plastic, rubber, earthenware building materials, asphaltum, and mineral. A basic level of cataloging was conducted for all artifacts collected. In addition, more detailed analyses were conducted for selected samples of artifacts, including certain categories of material (all stone, bone, and shell artifacts; complete bottles; Mission-period glass; diagnostic personal items; and samples of building materials), regardless of which unit they were collected from. These were selected for their research value and, in some cases, because of their relatively small sample size. Detailed analysis was also conducted for the complete contents of 15 excavation units thought to be representative of major site activity areas. The remaining items—non-diagnostic bulk metal, glass, and building materials—were subject only to cataloging. Chapter 4 provides a description of laboratory methods employed for the different categories of material (see Table 4.5). Analytic methods employed for select classes of artifacts are included in this chapter.

In addition to their material of manufacture, artifacts selected for analysis were classified according a standardized set of functional artifact groups (Table 9.2) based on South (1977) and Van Wormer (1996).

Major artifact categories are discussed below, organized primarily by material type (stone, bone, glass, metal, ceramic), as well as by select categories of artifacts chosen for analysis (gunspalls, beads, earthenware building material). The ceramic vessel assemblage is described and results of analysis are presented in Chapter 10. The Ground Stone section of the chapter was prepared by James Potter, Aaron Elzinga, John Dietler, and Sara Dietler. The Flaked Stone section was prepared by Dr. Potter, Mr. Elzinga, and Dr. Dietler. The Gunspalls and Strike-a-lights section was prepared by Nicholas Hearth, Michael Tuma, and Dr. Potter prepared the Bone Artifacts section. The Beads section was prepared by Alex Kirkish, Heather Gibson, and Ms. Dietler. Both the Glass Artifacts and Metal Artifacts sections were prepared by Dr. Gibson and Sara Ferland. Dr. Gibson also prepared the Functional Artifact Groups section.

Table 9.1. Summary of Artifact Assemblage by Material*

Material	Artifact Count, Phases I/II	Artifact Count, Phase III	Total Artifact Count (Phases I, II, and III)	Percent of Assemblage
Asphaltum	–	13,634	13,634	4.76%
Ceramic†	1,704	10,703	12,407	4.33%
Earthenware building material	4,402	87,436	91,838	32.04%
Faunal artifacts (bone and shell)‡	18	142	160	0.06%
Glass	8,610	30,385	38,995	13.60%
Leather	–	304	304	0.11%
Metal	1,393	36,665	38,058	13.28%
Mineral	–	108	108	0.04%
Plastic	–	91	91	0.03%
Rubber	–	132	132	0.05%
Stone	16	5,224	5,240	1.83%
Textile	–	71	71	0.02%
Wood	–	1,789	1,789	0.62%
Other (mortar, cement, composite, etc.)	67	83,757	83,824	29.24%
Unidentifiable	–	1	1	0.00%
Total	**16,210**	**270,442**	**286,652**	**100%**

* Botanical, charcoal, and sediment samples are not included here; their analysis is discussed in Chapters 6 and 7.

† Count of all ceramic artifacts is included here. Ceramics from vessels are described in Chapter 10; non-vessel ceramic artifacts are discussed in this chapter.

‡ Only bone and shell artifacts are included here; unmodified bone and shell are discussed in Chapter 8.

Stone Artifacts

Stone artifacts recovered from the study include ground stone and flaked stone artifacts, as well as gunspalls and strike-a-lights. A total of 37 ground stone items were recovered and analyzed, including manos, pestles, a hoe, metates, and bowls. In addition, a total of 121 lithic artifacts were recovered and analyzed including 90 pieces of debitage, two cores, six bifaces, four modified flakes, three projectile points, and 16 gunspalls or strike-a-lights.

Ground Stone

A total of 37 ground stone items, including fragmentary and complete specimens, were recovered during excavations at San Gabriel Mission. These include one millstone, three mano/hammer stones, five manos (three two-hand manos and one one-hand mano), six metates, five bowls, three mano/pestles, and 14 fragments of indeterminate ground stone. In addition, two ground stone items—a hoe and a fragment of indeterminate ground stone—were donated to the project by a local resident who found them near the project site. This section presents analysis of all 39 ground stone items, including definitions of the artifact types, methods of analysis, and results of the analysis. The analysis emphasized discerning the items' uses and intensity of use rather than their technological attributes.

Ground Stone Analysis Methods

The ground stone analysis presented here followed the methods and techniques developed and presented by Adams (2002) and Kovlet and Eisele (2000). For each artifact, several attributes were recorded, including material type, whether the item was intentionally shaped prior to use, the number of surfaces used, the location and type of use-wear, the degree of wear, the presence of pecking and battering, and the item's dimensions. Additionally, protein and organic residue were

Table 9.2. Functional Artifact Groups

Artifact Group*	Subgroups	Examples of Artifacts
Architecture	Building materials, fasteners, window/door related	Window glass, nail, brick, tile, mortar, construction hardware, bracket, hinge, key, lock
Coins	–	Coin, token
Consumer	Bottles, containers, closures	Wine bottle, beer bottle, liquor bottle, sauce bottle, condiment bottle, extract bottle, medicine bottle, flask, jar, can, crown cap, lid, stopper
Faunal	–	Animal bone, shell
Furniture	–	Hinge, knob, pull, lock, upholstery, inlay
Garment	Garment materials, fasteners	Buckle, button, eyelet, snap, cufflink, rivet, hook and eye, suspender part, corset busk, sequin, lace, thimble, fastener, pin, clasp, shoe part, chaps, glove, lace, fabric, clothing embellishment
Household	–	Lamp part, candlestick holder, chimney glass, fuse, light bulb, batteries, stove part, safety pin, straight pin, clothes pin, scissors, needle, thimble, clothing iron
Industry	Automotive, locomotive	Head/tail light, brake, cable, gasket, spike, insulator, cordage
Kitchen	Tableware, food preparation, utensils, dietary	Ceramics, crockery, pitcher, cup, plate, saucer, bowl, jug, pan, pot, glassware, stemware, fork, knife, spoon, ladle, butchered bone, stove part
Lithics	–	Flake, debitage, core, shatter, projectile point, ground stone, shattered stone
Munitions	–	Shot, bullet casing, bullet slug, shotgun shell, gunflint, gun part, musket ball
Personal items	Beads, health and hygiene related, jewelry, tobacco and drug related, religious, toys and games	Bead, key, mirror, eye glasses, watch, smoking pipe, comb, toothbrush, inkwell, marble, gaming piece, dice, doll, ball, musical instrument, earring, necklace, ring, chain, pendant, broach, cross, religious medallion, rosary
Tools	Agricultural, carpenter, gardener, mason, fishing gear, livery	Hoe, rake, spade, awl, hammer, shovel, saw, wrench, fish hook, fishing weight, bit, bridle parts, saddle parts, reins, whip, horseshoe, shears

*After South (1977) and Van Wormer (1996)

taken and analyzed. See Appendix C for a discussion of residue analysis methods. Degree of use-wear was characterized in terms of light, medium, and heavy.

- Tools with light use exhibit light polish, with some of the higher points of the rock surface ground down to facets. These facets are characterized as discrete areas surrounded by unground surfaces. About 25 percent of the utilized tool surface displays wear.
- Tools with moderate use-wear exhibit medium polish with connected facets. As much as 50 percent of the utilized tool surface displays wear.
- Tools with heavy wear exhibit high to very high polish with facets connected in a continuous plane. Most (i.e., 75 percent or more) of the utilized surface is ground, with only a few pits or depressions on the unground surface remaining.

Ground Stone Artifact Types

The following section provides an overview of the common ground stone artifact types and the methods used to analyze them. Uncommon artifact types are discussed individually in the Ground Stone Results section.

Mano

Manos are handheld grinding implements used mostly in conjunction with a basal stone (i.e., metate) to crush and grind both plant and animal materials. Material type, various dimensions (i.e., length, width, and thickness), overall shape, the number of ground surfaces, and degree of wear were recorded. Manos can be divided into two major size categories, including small one-hand manos and large two-hand manos.

Metate

Metates are the basal stones used in conjunction with manos for crushing and grinding activities, and are most often made from very coarse-grained and vesicular lithic material types. Basic measurements (i.e., length, width, and thickness) were recorded, overall shape and texture of the piece and of the ground surface was documented, and the degree of wear was noted.

Pestle

Pestles are stones, usually cylindrical in shape, employed together with a mortar to pound, crush, or grind various plant and/or animal materials. Pestles and mortars are typically associated with processing larger seeds such as acorns. Conversely, manos and metates are thought to have been used to process small seeds. That being said, mortars and pestles were likely used to process a variety of organic and inorganic materials.

Along with measurements such as length, width, and thickness, the shape of pestles in plan-view and cross-section was noted; lithic material types were also identified. The location(s), degree, and type of use-wear was recorded. Whether a pestle was expediently or strategically shaped was also noted.

Bowl/Mortar Fragments

Stone bowls were routinely used as cooking vessels and/or storage containers, while mortars were typically employed in conjunction with pestles to pound, grind, and crush various materials. Lithic material types for bowl/mortar fragments were identified; the portion of the bowl/mortar (e.g., wall, rim, or base) and any utilized surfaces were described in terms of shape and stage of use.

Indeterminate Ground Stone Fragments

Pieces of stone thought to be derived from hand stones, metates, or other ground stone items that could not be positively identified as a particular type of formal ground stone artifact, due to damage or small fragment size, were classified as indeterminate ground stone. Fragments with evidence of ground and/or polished surfaces were documented by recording morphological (length, width, thickness, and weight) and ground surface attributes. Lithic material type, type of wear present, and degree of wear were identified if possible.

Material Types

Eight material types were identified in the ground stone assemblage. These are described in Table 9.3.

Ground Stone Results

The ground stone assemblage from the San Gabriel Mission archaeological site contains 39 artifacts, including three one-hand manos, one hoe, five stone bowls, three mano/hammer stones, six metates, three pestle/manos, one millstone, and two two-hand manos (Table 9.4). Archaeologists recovered 37 of these items, and two were donated to the project by a local resident. About half of these artifacts were made from granite (n = 19, comprising 49 percent of the assemblage); schist was the next most common material (n = 6, or 15 percent), followed by basalt (n = 4, or 10 percent). Specimens of quartzite, sandstone, siltstone, steatite, and coarse-grained volcanic material are also present in the assemblage. Most of these materials would have been available within a short walk from the mission, either from primary outcrops in the San Gabriel Mountains to the north or in secondary cobble sources in local stream beds. A significant exception to this generalization is the schist and steatite, which is not found locally in qualities suitable for making stone bowls and other shaped ground stone objects. Although high-

Table 9.3. Ground Stone Material Types

Material	Description
Basalt	A fine-grained extrusive volcanic, usually dark gray to black in color with a matte luster. Basalt has good conchoidal fracture properties and flake edges are strong. Vesicular basalt is pitted with cavities.
Granite	A coarse-grained intrusive volcanic rock with moderate to high silica content. This material will fracture conchoidally, although less readily than fine-grained materials, and is primarily used for ground stone tools.
Quartzite	Sugary/granulated matrix, usually opaque to semi-translucent. Commonly obtained as rounded river cobbles, quartzite has good conchoidal fracture properties, and flake edges are markedly stronger than chert or obsidian.
Sandstone	A medium-grained sedimentary deposit cemented with clay or silica. This is a highly variable material due to the process of its genesis. It was usually used for ground stone tools.
Schist	A soft, coarse-grained soft metamorphic rock found in forms including, Talc, mica, and glaucophane schist, usually silver in color with micas clearly distinguishable to the naked eye. Schist carves well and was frequently used for beads, ground stone bowls, and ollas. This material is also called soapstone in the archaeological literature.
Siltstone	A fine-grained sedimentary rock, finer grained than sandstone. Frequently light brown to yellow in color; it was used for ground stone bowls and pestles.
Steatite	A soft, fine to very fine-grained metamorphic rock. The felt-like variety of talc schist is usually dark gray to black in color. Although having poor conchoidal fracture properties, it is resilient when subjected to repeated heating and cooling events; it carves and polishes well and was commonly used for bowls, shaft straighteners, or beads. This material is also called soapstone in the archaeological literature.
Volcanic	General category that includes basalts, rhyolites, feldspars, and other volcanic rocks.

quality schist is found at the Sierra Pelona source near Palmdale, the schist material found at San Gabriel Mission is coarse-grained, silver-colored, micacious, and platy, and consistent with material originating from Santa Catalina Island (Rosenthal and Williams 1992).

Manos are the most numerous identified ground stone artifact type, comprising 28 percent of the assemblage. These include one-hand and two-hand varieties, as well as manos used as hammer stones (or vice versa) and manos that appear to have been used also as pestles. The most numerous of these are manos with evidence of battering on the end from secondary use as hammer stones (n = 3), one-hand manos (n = 3), and manos that were also used as pestles (n = 3). Granite was a preferred material for most manos (n = 8).

The six metates represented are made of basalt, granite, and sandstone. Five bowls are represented as well, and these are primarily of schist. No mortars were identified. The one hoe in the assemblage is of basalt, and several of the indeterminate ground stone items may have functioned as abraders, based on microscopic use-wear analysis.

Most of the assemblage consists of fragmented artifacts, reflecting the discard of implements that no longer functioned. The only whole artifacts were the basalt hoe, one of the mano/hammer stones, and two pestle/manos.

None of the mano/hammer stones and only one of six metates exhibited intentional shaping prior to use (Table 9.5). The stone items most consistently shaped are bowls, the hoe, and two-hand manos. This suggests a lack of energy invested in shaping an object except when it was necessary for its function and fairly expedient technology. Pecking was also relatively uncommon, occurring on 10, or approximately 25 percent, of the analyzed items. And the artifacts exhibiting pecking were those most often intentionally shaped, such as two-hand manos and those artifacts requiring a rough grinding surface such as metates. The working surfaces for five of the manos were ground flat, or nearly so, indicating pairing with slab metates. Two of the manos (one incomplete and one complete) display convex utilized surfaces, suggesting use with a stone bowl and/or basin-type metate.

Table 9.4. Ground Stone Artifact and Material Type Summary

Material	Hoe	Bowl	1-hand Mano	2-hand Mano	Mano/ Hammer Stone	Pestle/ Mano	Metate	Millstone	Indeterminate	Total
Basalt	1	–	–	1	–	1	1	–	–	4
Granite	–	1	2	1	2	2	3	–	8	19
Quartzite	–	–	1	–	–	–	–	–	1	2
Sandstone	–	–	–	–	–	–	2	1	–	3
Schist	–	4	–	–	–	–	–	–	2	6
Siltstone	–	–	–	–	–	–	–	–	1	1
Steatite	–	–	–	–	–	–	–	–	1	1
Volcanic	–	–	–	–	1	–	–	–	–	1
Unknown	–	–	–	–	–	–	–	–	2	2
Total	**1**	**5**	**3**	**2**	**3**	**3**	**6**	**1**	**15**	**39**

Table 9.5. Frequency of Intentional Shaping by Item

Shaping	Hoe	Bowl	1-hand Mano	2-hand Mano	Mano/Hammer Stone	Pestle/ Mano	Metate	Millstone	Indeterminate	Total
Absent	–	–	3	–	3	1	5	–	5	17
Present	1	5	–	2	–	2	1	1	6	18
Indeterminate	–	–	–	–	–	–	–	–	4	4
Total	**1**	**5**	**3**	**2**	**3**	**3**	**6**	**1**	**15**	**39**

Most of the artifacts, particularly the manos, exhibit bifacial wear meaning that two sides were used as grinding surfaces (Table 9.6). The exceptions were artifacts on which bifacial use is not generally common, such as bowls and metates. Use on the margins (sides) of artifacts was also common.

Most wear evident in the assemblage can be considered moderate or heavy (Table 9.7). Most of the items exhibiting light wear were indeterminate ground stone items. This pattern indicates that although shaping of ground stone was generally expedient, the items were used intensively prior to discard.

The intensity of usage of these items prior to discard is also evident in the number of ground surfaces on these items (Table 9.8). Most have more than one ground surface, particularly the various manos.

Battering was evident on the hoe, two-hand manos, manos used as hammer stones, and pestle/manos (Table 9.9). In addition, one metate exhibited evidence of battering. Whereas most artifacts were used intensively, reuse of items for multiple functions was evident primarily on manos and pestles that were also used as hammer stones (Table 9.10).

Residue Analyses

Adhering substances were present on six ground stone artifacts (Table 9.11). Four items were stained with asphaltum, but the nature of the residue varied substantially, ranging from incidental staining on a metate, to thinly coated bowl fragments, to a thoroughly asphaltum-stained mano/hammer stone. While the bowl fragments may have been coated with asphaltum to adhere decorations (like beads) or functional attachments (like baskets), the mano/hammer stone, which shows evidence of burning, may have been used to heat a container filled with asphaltum in the same way that stones are used to heat water for cooking purposes.

Nine ground stone artifacts were analyzed microscopically for residues, using Fourier transform infrared spectroscopy (FTIR), phytolith and starch analyses, protein residue analysis, and pollen analysis. The results of these analyses revealed that the site's ground stone was used to process and contain a wide variety of plants and animals (Appendix C). These included the two staple, imported plant crops, wheat and corn, as well as mammal meat on the bone and native resources such as yucca, cattail, or wapato (arrowroot) roots, grasshopper, and fish (see Chapters 7 and 8). These results provide additional evidence for the varied diet of the mission's residents, including both native/wild and imported/domesticated foods. The residue results also indicate that ground stone tools were not specialized implements; rather, they were used for a variety of food processing tasks.

Noteworthy Ground Stone Artifacts

Millstone

Perhaps the most interesting item in the site's ground stone collection is a wedge-shaped fragment of a millstone (Catalog Number 05669.01; Figure 9.1). Measuring 17.5 × 13.9 cm and 12.1 cm thick, this sandstone artifact is a small fragment of what would have been a large, flat cylinder. At its broadest, the millstone is estimated to have had a diameter of 69 cm. The lateral edge is beveled so that one face would have had a smaller diameter than the other. Although both sides lack furrows, pecking on the larger face (see Figure 9.1, left) is likely indicative of resharpening, suggesting that this was the grinding surface. Because the central opening of the stone is not present, it is not possible to determine whether this represents the upper or lower stone.

The millstone was analyzed for the presence of phytoliths and pollen, confirming its function in grinding domesticated grains. The presence of Cerealia pollen indicates that the millstone was used to grind cultivated cereal grains. The broken dendriform phytoliths present on the millstone provide further evidence that grass grains were ground to flour using the stone. The absence of chaff fragments from the stone's surface is interesting, suggesting that the grains were hulled and processed to a high degree before grinding with the stone, or that the milling was particularly efficient at breaking up all of the chaff elements (Appendix C).

Table 9.6. Type and Location of Wear by Item

Wear Location	Hoe	Bowl	1-hand Mano	2-hand Mano	Mano / Hammer Stone	Pestle / Mano	Metate	Millstone	Indeterminate	Total
Bifacial	1	–	3	1	1	–	2	–	7	15
Bifacial and 1 margin	–	1	–	1	1	–	1	–	–	4
Bifacial and 2 margins	–	–	–	–	–	2	–	–	–	2
Edges	–	–	–	–	–	1	–	–	–	1
Unifacial	–	4	–	–	1	–	3	1	6	15
Indeterminate wear	–	–	–	–	–	–	–	–	1	1
None/NA	–	–	–	–	–	–	–	–	1	1
Total	**1**	**5**	**3**	**2**	**3**	**3**	**6**	**1**	**15**	**39**

Table 9.7. Wear Degree by Item

Wear	Hoe	Bowl	1-hand Mano	2-hand Mano	Mano / Hammer Stone	Pestle / Mano	Metate	Millstone	Indeterminate	Total
Light	–	–	1	–	1	1	–	–	8	11
Moderate	–	–	2	–	2	–	4	–	3	11
Heavy	–	5	–	2	–	2	2	1	3	15
None/NA	1	–	–	–	–	–	–	–	1	2
Total	**1**	**5**	**3**	**2**	**3**	**3**	**6**	**1**	**15**	**39**

Table 9.8. Number of Ground Surfaces by Item

Ground Surfaces	Hoe	Bowl	1-hand Mano	2-hand Mano	Mano / Hammer Stone	Pestle / Mano	Metate	Millstone	Indeterminate	Total
0	1	–	–	–	–	–	–	–	2	3
1	–	4	–	–	1	1	4	–	7	17
2	–	–	3	2	1	2	2	1	6	17
3	–	1	–	–	1	–	–	–	–	2
Total	**1**	**5**	**3**	**2**	**3**	**3**	**6**	**1**	**15**	**39**

Table 9.9. Number of Battered Surfaces by Item

Battered Surfaces	Hoe	Bowl	1-hand Mano	2-hand Mano	Mano / Hammer Stone	Pestle / Mano	Metate	Millstone	Indeterminate	Total
0	–	5	3	–	–	–	5	1	15	29
1	–	–	–	2	1	1	1	–	–	5
2	1	–	–	–	2	1	–	–	–	4
3	–	–	–	–	–	1	–	–	–	1
Total	**1**	**5**	**3**	**2**	**3**	**3**	**6**	**1**	**15**	**39**

Table 9.10. Use and Re-Use by Item

Use Type	Hoe	Bowl	1-hand Mano	2-hand Mano	Mano / Hammer Stone	Pestle / Mano	Metate	Millstone	Indeterminate	Total
Primary	1	5	3	1	–	–	6	1	10	27
Resurfacing	–	–	–	–	–	1	–	–	–	1
Reuse	–	–	–	1	3	2	–	–	–	6
Indeterminate	–	–	–	–	–	–	–	–	5	5
Total	**1**	**5**	**3**	**2**	**3**	**3**	**6**	**1**	**15**	**39**

Table 9.11. Ground Stone Residue Analyses and Results Data

Catalog Number	Description	Microscopic Residue Analyses				Microscopic Residue Analysis Results	Macroscopic Residue Description
		FTIR	Phytolith/ Starch	Protein	Pollen		
05471.01	Mano/pestle	–	X	–	–	Wheat and corn	–
05669.01	Millstone	–	X	–	X	Cereal grains	–
06224.01	Bowl	–	–	–	–	–	Asphaltum around rim; possible adhesive for beads or basketry
06785.01	Bowl	X	–	–	–	Cooked cattail or wapato roots; cooked meat on the bone	Carbonized residue inside; blackened exterior
06787.01	Metate	X	–	X	–	Mammal marrow fat, plant fats	–
08049.01	Mano	–	–	X	–	Grasshopper and yucca	–
09211.01	Metate	–	–	X	–	Negative	–
11588.01	Bowl	–	–	X	–	Anchovy, trout, salmon	–
11714.01	Mano/pestle	–	X	–	–	Corn	–
12509.01	Mano/hammer stone	–	–	–	–	–	Asphaltum coats 70% of surface. Possible tarring function.
14720.01	Indeterminate Ground stone	–	–	–	–	–	Asphaltum thinly coats interior of possible bowl fragment
15458.01	Bowl	–	X	–	–	Corn	–
22007.01	Metate	–	–	–	–	–	Caliche or cement adheres to one face. Possible reuse as a building material
25193.01	Metate	–	–	–	–	–	Asphaltum; two small stains

Figure 9.1. Millstone (two views). Catalog Number 05669.01.

Recovered just 3 m (9.8 feet) north of the foundation of Chapman's Mill (Feature 20; see Chapter 6), this is likely one of the two stones used to grind grain in that facility in the 1820s and 1830s. As discussed in Chapter 2, several millstones have been described, photographed, and displayed around San Gabriel Mission. The material of those millstones are described as granite and volcanic tufa, making them an imperfect match for this stone. The dimensions of the recovered millstone—12.1 cm thick and 69 cm in diameter—are also smaller than the 30 cm thickness and 107 cm diameter reported by Hiram Reid (1895:22). It is possible that the millstones were replaced at some point in the mill's history, exchanging this smaller sandstone millstone and its mate for a pair of larger granite stones.

Mexican-style Manos and Metate

Three ground stone artifacts stand apart from the remainder of the assemblage in material, form, or both. These include fragments of a vesicular basalt basin metate (Catalog Number 06787.01), a vesicular basalt two-hand mano (Catalog Number 08049.01; Figure 9.2), and a granite two-hand mano (Catalog Number 12633.01). Each of these is more heavily shaped than the other metates and manos in the collection, and vesicular basalt is not found locally. These traits are characteristic of traditional Mexican grinding equipment. In contrast, Native American-made ground stone manos found in southern California were typically made with locally available materials (Catalina schist being a major exception); many are unshaped, and most manos are a size appropriate for one-handed use. The two-hand manos in this collection bear striking resemblance to the mano held by Jacinta Serrano in the circa 1887 photograph taken at San Gabriel Mission (Figure 9.3). A metate fragment that is very similar to the one described above was recovered from an early historic context in Old Town, San Diego, alongside metates made from local materials (Sampson and Braedeen 2006).

Hoe

This implement, made of basalt (Catalog Number 06022.01; Figure 9.4), is bifacial and approximates the waisted shape of a double-headed axe or hoe, with a relatively flat profile, rounded ends, and two rounded notches at the center of its long axis. This is one of two items that were not recovered through archaeological means; it was discovered in the yard of a resident who lives approximately one block south of the study area, and the resident donated the artifact to the project. Microscopic analysis identified the degree of use-wear as medium to heavy, and the presence of all forms of use-related wear. The area around the grooves or notches of the implement displays wear consistent with being hafted; polishing wear seems to be

Figure 9.2. Two-hand Mano. Catalog Number 08049.01.

Figure 9.3. Portrait of Jacinta Serrano, circa 1887. Courtesy of the University of Southern California, on behalf of USC Libraries.

more intensive near the center of the tool faces, although this kind of wear might also be the result of the manufacturing or maintenance process. The most telling use-wear pattern is the several flake scars originating from the lateral edges of the implement. Initiation of flake removals appears to have originated close to the bifacial edge, extending toward the center of the implement, and occurs on both faces. This flake scar pattern suggests use in a chopping activity; this, and the overall shape of the tool suggests that the implement may have been used as a hoe in gardening activities. This tool form does not have clear prehistoric antecedents in Southern California. It may reflect influences from Mexico.

Figure 9.4. Basalt hoe. Catalog Number 06022.01.

Ground Stone Summary

The ground stone assemblage from San Gabriel Mission contains 39 artifacts. This relatively small group of artifacts is most notable for its diversity, spanning eight major artifact types made from eight distinct raw materials. Hand stones comprise approximately one-third of the assemblage, including one- and two-hand manos, and manos that have also been used as pestles and hammer stones. The site yielded shaped and unshaped metates, bowls, a millstone, and a hoe. About half of the ground stone artifacts were made from granite, but schist and basalt items are also relatively numerous. Residue analyses indicate that grinding implements were used to process an impressive variety of foods, including wheat, corn, fish, mammal meat, bone marrow, yucca, cattail, wapato (arrowroot) roots, and grasshoppers.

Most of the assemblage may be considered expedient in terms of energy that went into its manufacture. None of the mano/hammer stones and only one of metates exhibited intentional shaping prior to use, indicating a lack of energy invested in shaping objects. Pecking was also relatively rare. The intensity of usage of these items prior to discard is evident in the amount of wear and number of ground surfaces on these items. Most have more than one ground surface, particularly the manos. All the manos in this collection show evidence of extensive use-wear on one or more surfaces. Utilized surfaces for most of the manos were ground flat, or nearly so, indicating pairing with slab metates. Two of the manos (one incomplete and one complete) display convex utilized surfaces, suggesting use with a stone bowl and/or basin-type metate.

Less expediently made ground stone items recovered at the site include the Mexican-style two-hand manos and metate, and the basalt hoe. At the upper end of energy expenditure in the manufacturing process is the sandstone mill stone. Precisely shaped and measuring nearly 70 cm (27.5 inches) in diameter, this artifact represents a substantial labor investment. These items differ from the rest of the assemblage because their roots, in terms of morphology, lay outside of California.

Flaked Stone

In total, 121 flaked stone artifacts were recovered from the San Gabriel Mission archaeological site. Most of the assemblage consists of debitage (74 percent), including unmodified flakes and shatter. Smaller numbers of cores, bifaces, modified flakes, projectile points, and gunspalls were also recovered (Table 9.12). Chert makes up the majority (60 percent) of the flaked stone assemblage in terms of raw material. Also included in this analytical category is flaked glass, which was functionally equivalent to flaked stone. Although included in this summary table, gunspalls are discussed in a separate section below.

The purpose of this analysis was to obtain behavioral information related to technological strategies and the organization of technology by examining the evidence of material procurement, tool design and manufacture, tool use, maintenance, and tool discard (Andrefsky 1994, 2009; Carr 1994; Flenniken and Raymond 1986; Nelson 1991). This section outlines the methods used in analyzing the flaked stone items and presents the results of the analysis.

Flaked Stone Analysis Methods

This analysis recognized bifaces, projectile points, modified flakes, cores, and debitage as major types of artifacts. Material type, maximum dimensions, production technology, and both macroscopic and microscopic use-wear patterns were recorded. Measurements were recorded using digital calipers, a 10× hand lens, and a stereoscopic microscope with up to 30× magnification when appropriate.

Raw Materials

Ten raw material types are present in the San Gabriel Mission flaked stone assemblage, and these are listed, along with their descriptions, in Table 9.13.

Flaked Stone Artifact Types

Bifaces and Projectile Points

Bifaces are defined as artifacts displaying a generally lens-shaped cross-section with continuous flake removals on opposite surfaces by means of percussion or pressure. Bifaces are without diagnostic basal elements (i.e., hafting elements such as tangs, notches, or stems/bases). Bifaces may have functioned as cores, knives, or projectile points. Projectile points are bifaces retaining diagnostic hafting elements.

Table 9.12. Lithic Artifact and Material Type Summary

Material	Core	Biface	Modified Flake	Debitage	Projectile Point	Gunspall / Strike-a-light	Total
Basalt	–	–	–	1	–	–	1
Chalcedony	–	–	1	15	–	1	17
Chert	2	5	1	57	1	7	73
Flint	–	–	–	3	–	7	10
Jasper	–	–	–	2	1	–	3
Metasediment	–	–	–	3	–	–	3
Glass	–	1	2	–	–	–	3
Quartz	–	–	–	2	1	–	3
Quartzite	–	–	–	4	–	1	5
Volcanic	–	–	–	3	–	–	3
Total	**2**	**6**	**4**	**90**	**3**	**16**	**121**

Table 9.13. Flaked Stone Materials

Material	Description
Basalt	A fine-grained extrusive volcanic, usually dark gray to black in color with a matte luster. Basalt has good conchoidal fracture properties and flake edges are strong.
Chert	Fine-grained to cryptocrystalline silicate found in large bedded deposits and in secondary deposits as rounded and amorphously configured cobbles/nodules. Good conchoidal fracture. Exhibits large variations in color. Identified sources include the Monterey and Franciscan formations.
Flint	Fine-grained to cryptocrystalline silicate found in large bedded deposits and in secondary deposits as rounded and amorphously configured cobbles/nodules. Essentially synonymous with chert, the term flint is used here to distinguish material originating in England and France.
Glass	Amorphous (non-crystalline) silicate manufactured primarily from sand. Glass exhibits excellent conchoidal fracture properties, forming sharp edges but relatively brittle artifacts.
Chalcedony	Fine-grained cryptocrystalline silicate that forms in individual nodules. Colors are diverse, but chalcedony remains high in silica content. Chalcedony has good conchoidal fracture properties that are markedly improved through heat-treatment processes. A tan variety is the most common in the San Gabriel assemblage.
Jasper	Fine-grained cryptocrystalline silicate distinguished from chert by its colors of yellow, green, brown, or red. Often found in mass or vein deposits. Veins of translucent chalcedony and bands of differing colors are common.
Quartz	A colorless, transparent rock-forming mineral with vitreous luster composed of silicon dioxide, with good conchoidal fracture properties. Quartz ranges from crystalline to milky in appearance.
Quartzite	Sugary/granulated matrix, usually opaque to semi-translucent. Commonly recovered as rounded river cobbles, quartzite has good conchoidal fracture properties, and flake edges are markedly stronger than chert or obsidian.
Metasedimentary	A sedimentary rock with evidence of metamorphism.
Volcanic	A general category that includes basalts, rhyolites, feldspars, and other volcanic rocks.
Unknown/Other	Visually unidentifiable material, usually due to weathering

Basic biface attributes in this collection were measured and described in terms of technological reduction stage following Hintzman (2006:Appendix F.1). Biface reduction stages were divided into early, middle, and late percussion reduction; later stages include items in early and late-stage pressure reduction.

Modified Flakes

Modified flakes include both formed and simple flake tools. Formed-flake tools can be characterized by a relatively refined degree of intentional modification of margins through percussion and pressure. However, the modified flakes identified in this assemblage consist solely of artifacts whose margins were not substantially altered through technological retouch and closely correspond to the original edge shape of the flake. The modified flakes recovered from the San Gabriel Mission archaeological site have been altered primarily through use, rather than by intentional shaping, and are thus considered simple flake tools.

For modified flakes, basic measurements such as length, width, and thickness were collected, and lithic material type(s) were identified. Additionally, attributes such as edge shape were recorded. Flake surfaces and edges modified through use were macroscopically examined and a sample of three artifacts was selected for microscopic evaluation to identify use-related damage.

Cores

A core is a mass of stone shaped entirely by percussion that exhibits at least two negative flake scars large enough to have supplied flakes suitable as blanks for flake tool production. Cores are characterized as unidirectional, bidirectional, multidirectional, or bifacial based on the number and placement of platforms from which flake removals were initiated. The types of core reduction strategies identified can provide information about the goals of production and the behaviors used to exploit certain lithic materials.

Debitage

Debitage consists of flakes, flake fragments, and shatter resulting from core reduction and the production, use, and maintenance of flaked stone tools.

Typical lithic flakes include core reduction flakes, bifacial reduction (or pressure) flakes, and bipolar flakes. Core reduction flakes have a conchoidal initiation, a bulb of force, a platform, and dorsal flake scars. Pressure flakes are produced during the final stages of the production of a bifacial tool or during tool re-sharpening and are generally small and have ground, absent, or crushed platforms. Bipolar flakes result from placing the core or cobble of suitable raw material on an anvil stone and striking it with another stone. These flakes typically have evidence of force, such as crushing, on both ends of the flake. Shatter is a term used for cubical or irregularly shaped chunks that lack a bulb of force, platforms, or point of flake initiation.

All individual pieces of debitage were submitted to a detailed technological analysis, which recorded such attributes as flake size, presence or absence of cortex, degree of dorsal surface complexity, platform and termination type, and material type. Dorsal surface complexity was captured in the following categories: early or late cortical, early cortical, late cortical, complex cortical, simple interior, complex interior, pressure, or fragmentary (Table 9.14). Terminations were categorized as feathered, hinged, stepped, or overshot. And platforms, when possible, were characterized as single or multi-faceted, rounded, or abraded.

Flaked Stone Results

Raw Materials

Most (85 percent) of the flaked stone items from the San Gabriel Mission archaeological site are made from cryptocrystalline silicates, this broad group contains a diverse array of chert, flint, chalcedony, and jasper source materials. The remaining flaked stone artifacts are volcanic (including basalt), metasedimentary, quartz, quartzite, glass, and unidentified. Only two raw materials could be identified with a specific formation—Monterey chert and Franciscan chert, both of which are available in the Los Angeles Basin. Chert is the most common material, and among the 57 chert debitage artifacts, eight distinct chert varieties were observed. These cherts include gray (n = 16), tan (n = 14), Monterey (n = 8), brown (n = 8), black (n = 3), white/cream (n = 3), pink (n = 2), red (n = 1), and other (n = 2). The great diversity of cherts present, along with the other raw materials, indicate that raw materials for flint knapping were

Table 9.14. Flake Reduction Stage Types

Reduction Stage Type	Description
Early Cortical	More than 50 percent cortex present
Late Cortical	Less than 50 percent cortex present
Complex Cortical	Cortical flake with 3 or more dorsal flake scars
Simple Interior	No cortex present; 1–2 flake dorsal flake scars
Complex Interior	No cortex present; 3 or more dorsal flake scars
Fragmentary	Less than 50 percent of flake present; some flake attribute present

brought to the site from a variety of sources. It is interesting to note the absence of obsidian, which was a popular trade item from the southern Sierras prior to the Mission period. Three flaked glass artifacts are present—a biface and two modified flakes. The substitution of glass as a raw material for items traditionally made with stone is common at California mission sites.

Bifaces

Six bifaces were identified in the assemblage. Five of the bifaces are edge fragments of chert (Figure 9.5), representing middle stage percussion-reduction, and lacking formal hafting elements (e.g., stems, tangs, and notched bases). One biface, made from colorless glass, appears to be a failed attempt at projectile point production (Catalog Number 01384.01; Figure 9.6).

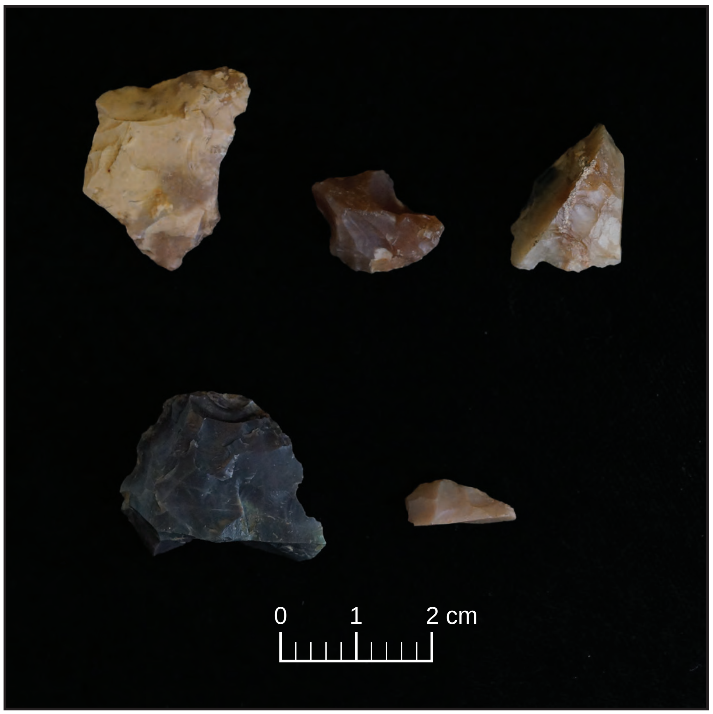

Figure 9.5. Chert bifaces. Catalog Numbers 06428.01, 05369.01, 07951.01, 01090.01, and 14719.01 (clockwise from top left).

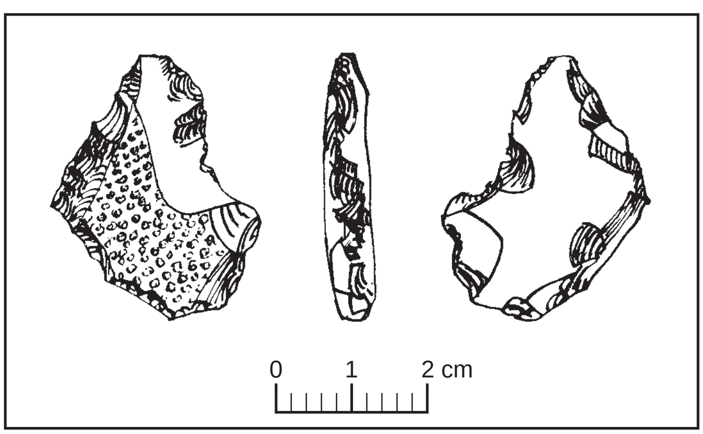

Figure 9.6. Glass biface. Catalog Number 01384.01.

Data on these items are presented in Table 9.15. All of these items displayed evidence of edge damage and micro-scarring, which are indicative of use. One is a possible knife fragment.

A Franciscan chert biface, Catalog Number 07951.01, was sent to Paleo Research Institute for FTIR and protein residue analysis. The protein analysis of sample yielded negative results to all tested antisera. The FTIR results were broad, indicating residue from fats/oils/lipids and/or plant waxes (Appendix C).

Projectile Points

Three projectile points were recovered from San Gabriel Mission (Table 9.16; Figures 9.7–9.8). Two were complete points, and one is nearly complete, missing only the tip. Two are made from cryptocrystalline silicate material (chert or jasper), and one is quartz. All of these are small, triangular, and roughly made arrowheads. Two were typed as Cottonwood Triangular points, representing one of the most common styles in the Los Angeles Basin during late prehistory and the early historical period. The third projectile point is similar in overall shape, but the presence of notches along both lateral margins, producing a serrated appearance, places the point in the Desert Side Notched type (Justice 2002:367–388).

Although the latter type is most common in the Mojave and Colorado desert regions of California, they have been reported in coastal southern California as well. These point types are typical of southern California mission sites. A data recovery project at San Buenaventura Mission, for example, recovered 30 projectile points; of these, 12 were simple triangles (Cottonwood) and 10 were serrated triangles (Desert Side Notched) (Greenwood 1976:11).

Two of the projectile points were tested for protein residue (Catalog Numbers 04613.01 and 05416.01). Neither produced positive results (Appendix C).

Modified Flakes

The four modified flakes were analyzed in detail, including use-wear analysis (Table 9.17). These were made of chert, chalcedony, and glass (Figure 9.9), and all exhibit microscarring from use on at least one edge. These artifacts are fairly consistent with one another in terms of overall size, regardless of material. This suggests that glass flakes were used in a similar manner to those of stone.

Cores

The two cores in the flaked-stone collection are of chert and they exhibit evidence of multidirectional or random flake removals (Table 9.18; Figure 9.10). Other than raw material, they are quite different from each other. One is a small core that displays an intensive (exhaustive) level of reduction (Catalog Number 05393.01). The other is a large cobble that displays a limited level of reduction and retains a large most of its cortex (Catalog Number 02377.01). This artifact indicates that lithic material was procured from secondary geologic sources. Cores employed for the production of usable flakes may have been brought to the site as tested cobbles like the large core and further reduced using a simple, multidirectional flake-core technology until they were exhausted, like the small core.

Debitage

A significant proportion of the debitage was identified as interior flakes (Table 9.19). Most of these were late (or complex) interior flakes, indicative of the final stages of tool production. Only 13 pieces of debitage were identified as cortical and 11 as shatter. As would be expected with interior flakes of high quality materials (e.g., cryptocrystalline silicate), most flake terminations are feathered and most platforms are single-faceted (Table 9.20). The relatively small number of pressure flakes indicates that the finishing and resharpening of flaked tools, including bifaces and projectile points, did not occur with any great frequency in the study area.

Table 9.15. Biface Data

Catalog Number	Weight (g)	Length (mm)	Width (mm)	Thickness (mm)	Biface Stage	Material	Material Description	Cortex	Use-wear
01090.01	3.6	26.9	19.5	7.1	Edge	Chert	Unknown	Absent	Microscars
01384.01	5.8	35.2	26.7	6.4	Indeterminate	Glass	Colorless	N/A	Microscars
05369.01	1.5	17.7	13.5	7.1	Indeterminate	Chert	Honey colored	Absent	Crushing
06428.01	2.2	21.9	15.2	8.9	Edge	Chert	Tan with cream and black mottling	Present	Multiple
07951.01	5.9	27.1	19.4	9.9	Finished	Chert	Franciscan	Absent	Absent
14719.01	0.5	14.4	6.1	5.3	Edge	Chert	Unknown	Absent	Multiple

Table 9.16. Projectile Point Data

Catalog Number	Weight (g)	Length (mm)	Width (mm)	Thickness (mm)	Basal width (mm)	Point Type	Portion	Point Shape	Basal Edge Shape	Basal Notching	Stem Shape	Material	Comments
04631.01	0.4	13.2	10	2.6	6.25	Desert Side Notched	Complete Haft Element	Corner or Basal notched	Slightly Concave	Present	No Stem	Red Jasper	Tip missing (perverse fracture). Item displays serrated lateral margins. Pressure flaking extends into center on one face only; flaking on other face extends just past margin.
05416.01	0.6	17	9.5	4.1	7.1	Cottonwood Triangular	Complete Point	Corner or Basal notched	Slightly Concave	Present	No Stem	Monterey Chert	Macroscopic edge damage along lateral margins (crushing, stepping) and near tip (microscarring). Lateral margins are convex; tip appears dulled.
07370.01	0.4	15	11.1	2.4	4.9	Cottonwood Triangular	Complete Point	Corner or Basal notched	Slightly Concave	Present	No Stem	Crystalline Quartz	Tip displays damage (microscarring). Base may have been reworked after previous fracture.

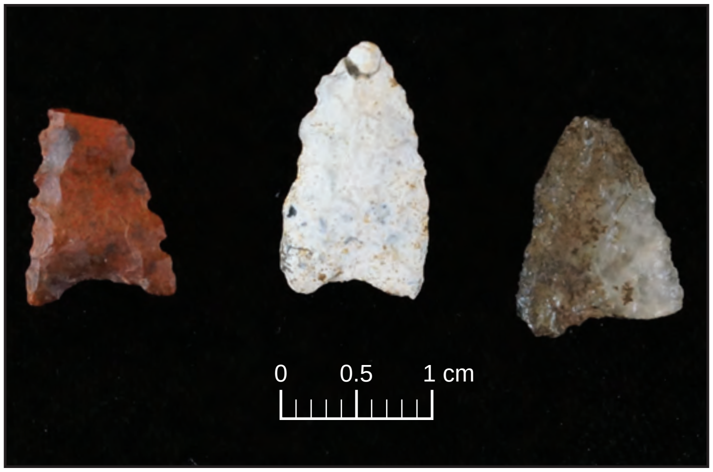

Figure 9.7. Projectile points. Catalog Numbers 04631.01, 05416.01, and 07370.01 (left to right).

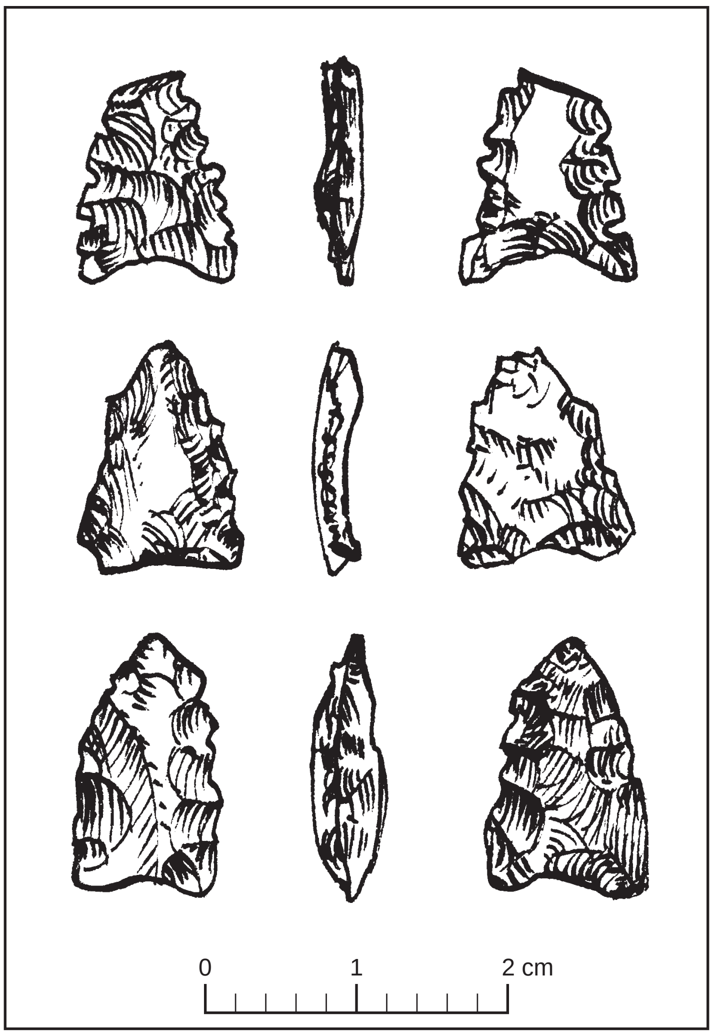

Figure 9.8. Projectile points. Catalog Numbers 07370.01, 05416.01, and 04631.01 (top to bottom).

Table 9.17. Modified Flake Data

Catalog Number	Weight (g)	Length (mm)	Width (mm)	Thickness (mm)	Material	Description	Cortex	Use-wear
05944.01	2.8	33.3	15.2	6.7	Chalcedony	Chalcedony	Absent	Microscars
06829.01	1.8	22.2	17.0	6.5	Chert	Light-brown	Absent	Microscars
18065.01	0.3	14.3	7.5	3.8	Glass	Olive	N/A	Microscars
18623.01	8.2	26.6	22.4	6.0	Glass	Aqua	N/A	Microscars

Table 9.18. Core Data

Catalog	Weight (g)	Length (mm)	Width (mm)	Thickness (mm)	Core Type	Material	Cortex	Use-wear	Comment
02377.01	627.6	117.9	65.8	69.3	Random/ expedient core	Tan chert	Present	Absent	At least four large flakes were removed; unprepared core (i.e. expedient). Cobble base; 50% cortex.
05393.01	8.8	23.7	22.5	18.9	Multi-directional	Tan chert	Absent	Absent	Exhausted core; intensive crushing along platform edges; some microscarring (e.g., stacked stepping, scalar).

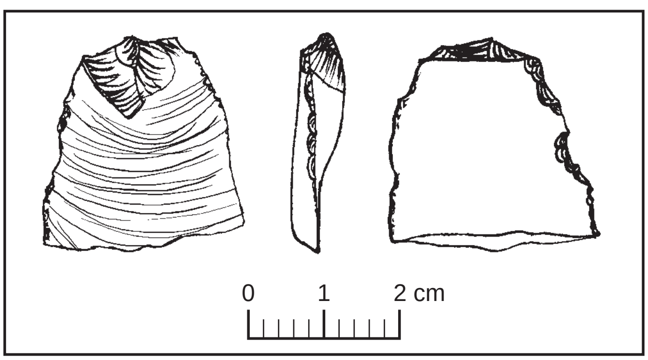

Figure 9.9. Modified glass flake. Catalog Number 18623.01.

Figure 9.10. Chert cores. Catalog Numbers 02377.01 (top) and 05393.01 (bottom).

Table 9.19. Flake and Shatter Reduction Stage Frequencies

	Reduction Stage / Flake Type							
	Early Cortical	Late Cortical	Complex Cortical	Simple Interior	Complex Interior	Pressure	Fragment	Total
Flake	6	3	4	9	43	3	12	80
Shatter	–	–	–	–	–	–	11	11

Table 9.20. Flake Termination and Platform Frequencies

	Termination					
Platform	**Feathered**	**Hinged**	**Stepped**	**Overshot**	**Indeterminate**	**Total**
Single-facet	24	3	5	1	4	37
Multi-facet	12	2	1	–	2	18
Rounded	1	–	–	–	–	1
Abraded	–	2	–	–	–	2
Indeterminate	13	1	2	–	6	22
Total	**50**	**8**	**8**	**1**	**12**	**79**

Flaked Stone Summary

The flaked stone assemblage from the San Gabriel Mission archaeological site, although small, exhibited distinct patterning. Most of the assemblage (82 percent) consisted of fine-grained cryptocrystalline silicate material (chert, chalcedony, jasper, and flint). The English and French flints (discussed in detail below) and glass were imported from some distance, and no substantial sources of stone appropriate for flaking are known in the immediate vicinity of San Gabriel Mission. Thus, all flaked stone materials recovered from the mission may be considered non-local to some degree, although it is likely that the distances lithic materials were conveyed varied by resource type. Many of the cherts, including Monterey chert, likely derive from near-local sources, that is, lithic sources not in the immediate environment, yet not distant or exotic. In the case of chert, the type of cortex present on debitage and the original configuration of cores indicates procurement from secondary geologic sources. Combined with the high frequency of debitage and the presence of modest numbers of cortical flakes, it is probable that most of these materials were exploited from near-local sources.

The high relative frequency of cryptocrystalline silicates indicates that these were the preferred materials for the production of stone tools at San Gabriel Mission. This is not surprising, as these are some of the most popular flaked stone materials worldwide (Andrefsky 1998). If local lithic resources were available in any great quantity, then we would expect those materials to be targeted, regardless of the quality of the material (e.g., Dietler 2004). Given the apparent absence of a sizeable local source of material suitable for flaked stone tool making, it appears that the mission's residents imported a relatively small quantity of high quality materials. The wide array of color varieties represented in the chert suggests that these materials were acquired from a diversity of sources. Rather than targeting specific outcrop sources or trading partners, they appear to have been collected from secondary sources such as alluvial-derived nodules or as float material in desert pavements.

Much of the debitage consists of late interior flakes, most of which exhibit single-facet platforms; most of these are relatively small, complete flakes with little or no cortex. These data indicate the use of a simple flake-core reduction technology and the practice of an expedient, multidirectional reduction strategy. However, the relative paucity of cortical flakes, shatter, and cores in the assemblage suggest that initial core reduction occurred off-site, perhaps indicating long-distance acquisition of many of the artifacts and initial preparation at these distant sources. Chert was also exploited for the production of bifacial tools and projectile points; however, because no bifacial cores and only three pieces of debitage were derived from bifacial reduction, these tools may have been produced in another portion of the mission, or off site.

In contrast to the finer grained materials like chert, quartzite and basalt materials appear to have only been exploited as part of a simple flake-core reduction technology for the purpose of producing simple flaked tools. No basalt or quartzite cores were identified, and there is not a high frequency of quartzite and basalt debitage. Given these larger average flake sizes and the absence of cortex on flakes made of quartzite and volcanic materials, it is possible that these materials were brought to the site as ready-to-use flakes. Crystalline quartz was apparently exploited to a small degree for the production of projectile points, although no quartz biface reduction debris or cores were identified.

Very little biface thinning debitage was identified. Only complete and broken projectile points were recovered. Multiple types of edge damage on biface fragments can be observed, suggesting that bifaces were brought to the site at late stages of reduction, and they likely served primarily as multi-purpose tools. It is also possible that, given the presence of some biface thinning flakes, some bifaces served as sources of flakes for the production of projectile points. However, only three pressure flakes representing biface production are present in the assemblage.

The analysis of core data reinforce the interpretation that chert was exploited from local or near-local sources using an expedient flake-core technology and multidirectional reduction strategy. The intensity with which chert was reduced could suggest a great need for usable flakes, or else it may reflect the small size of the available raw material in its unmodified state.

In sum, bifacial and flake-core technologies were practiced at the San Gabriel Mission archaeological site to exploit chert and other cryptocrystalline materials from near-local sources, and a simple flake-core technology was preferred for the production of tools made of more durable materials like quartzite and basalt. All lithic materials were predominantly exploited for the production and use of expedient flake tools, as well as gunspalls (see below). Chert also appears to have been used rather intensively, occasionally resulting in heavily reduced multidirectional cores.

Gunspalls and Strike-a-Lights

Excavations at San Gabriel Mission resulted in the recovery of 16 gunflints, or gunspalls. The term gunspall is a more general term for the flaked stone component of flintlock firearms, encompassing examples made of flint, as well as other materials, including chert and quartz. When a flintlock weapon was fired, the gunspall would strike the metal frizzen, causing the gunpowder to explode. Strike-a-lights are made from similar materials and are used to make sparks when abraded against an iron or steel striker. This section discusses gunspalls and strike-a-lights from the San Gabriel Mission archaeological site, addresses the technologies and materials used to make them and their physical attributes, presents analytic methods and results—including chronological placement—and concludes with a discussion of the implications of the results on our understanding of the economy of San Gabriel Mission.

Inhabitants of San Gabriel Mission are known to have received gunspalls from supply cargo ships originating in San Blas, Mexico (Perissinotto 1998). The best-known European sources for these were Brandon, England, and Loir-et-Cher and Indre, France. Other potential sources for gunflints manufactured in Europe include the Netherlands (White 1975) and Italy (Woodall et al. 1997). If the supply of European gunflints was low, Spanish soldiers in the Americas would use local sources for gunspalls, as has been documented at the Presidio La Bahía in Texas (Bruseth et al. 2004), outside of the Santa Barbara Presidio in California (Formica 2008), and at other colonial contexts in North America (e.g., Kelley 2011; Luedtke 1998). Archaeological assemblages can thus include gunspalls of both European and local materials, depending on the availability of European sources.

In and around Brandon, England, gunflint workers quarried specific varieties of subsurface flint nodules, and used a percussion blade-core technology to knap as many as four or five flints per percussion blade (Skertchly 1879:31). Like the English, French knappers used a percussion blade-core technology, although the reduction technique differed from that of the English due to available raw material and resulting core morphology. Other European gunflint manufactories had their own production techniques, each resulting in technologically distinct spalls and flints. See White (1975) for a more complete discussion of the history and regional variations of European-based manufacture.

Gunspalls made by Native Americans or Spanish soldiers using local stone were different from their European counterparts, displaying more variation in their production techniques, as well as in raw materials. Local gunspall manufacture, if undertaken by Native Californians, may have incorporated elements of the indigenous stone working traditions. Bifacial, flake-core, and bipolar flake core technologies would have yielded less regularly shaped gunspalls than did the percussion blade-core technologies used by the French and English.

Identification of gunspalls and strike-a-lights can be difficult because they can resemble traditional Native American flaked stone tools, such as scrapers. In a context like the San Gabriel Mission, key attributes used to identify gunspalls and strike-a-lights are step-termination flakes and crushing

(Kenmotsu 1990). The repeated striking of gunspalls against a metal frizzen, or strike-a-lights against a knife blade, leaves overlapping hinge and step flake terminations on the stone. With repeated use, the edge is crushed. Resharpening the gunspall can prolong its use, but it can become too small to use because resharpening removes material from the gunspall. Skill is required to resharpen a gunspall without removing too much material.

Identification of the source of the stone used to make an eighteenth/nineteenth-century gunspall can be made based on the color of the material. Flint from Brandon, England is black, gray, or brown. French gunflints are tan to honey-brown colored. Although Luedtke (1999) notes that black flints are present in France and lighter-colored flints are found in England, the gravels to which she refers have not been documented in archaeological gunflint assemblages. In both cases, distinctive inclusions aid in the macroscopic identification of the flints from these two sources. The technology of production discussed above also aids in the identification of the origin of the gunflints because each flint and manufacture technique, as detailed below, is distinctive.

Strike-a-lights are the historic precursors to gunflints (Clarke 1935). Similar to gunflints, the identification of strike-a-lights requires recognition of wear patterns and material characteristics. Like gunflints, strike-a-lights need a sharp edge to contact with the steel to make sparks, and they have the same material constraints as gunspalls. The use of a strike-a-light on a thin piece of steel to generate sparks creates a notch on the stone if a new margin is not used for each strike. Repeated use in the same area will also crush the margin of the piece if the piece is not resharpened after use. Strike-a-lights can be made through blade or flake core reduction, or using recycled gunspalls.

Gunspall Analysis Methods

The analysis uses basic descriptive information for each gunspall and strike-a-light artifact, making use of standard terminology for gunflint analyses (Hintzman 2006; Luedtke 1999; Skertchly 1879). The "Original Use and Reuse" column in Table 9.22 describes the form of the artifact at the time of its initial manufacture. The original use was determined by matching the size of the gunspall with flintlock weapons of the period, after Luedtke (1999). When the piece was either too fragmentary to accurately determine the weapon for which it was intended, or when the gunspall was not made on a blade, the generic term *gunspall* is used. Use and reuse as a strike-a-light was identified by the presence of an incurving notch flaked into a margin or margins of the artifact (Austin 2011:Figure 8).

Manufacture technology refers to how the gunspall was made. European manufacturers used a percussion blade core technology (Skertchly 1879), and the English used longer blades that yielded more gunflints per blade. Other technologies used to make gunspalls include flake core technology. These technologies include a single direction flake core (similar to Kamminga 1982), bipolar core (Flenniken 1981), and bifacial technology. When the artifact does not retain enough characteristics to ascertain the type of parent core, the term *untyped flake core* was entered into the table.

Terminology used in describing the morphology of gunspalls and strike-a-lights includes:

- *Portion* refers to where on the artifact use and reuse was evident. For gunflints made on blades in England or France, the terms defined by Luedtke (1999:72, Figure 1) and Skertchly (1879:46, Figure 25) were used.
- *Edge* refers to the portion of the gunflint that was designed to hit the frizzen.
- *Back* refers to the portion of the gunflint that would be opposite the edge when it was placed in the cock.
- *Sides* refer to the portion of the gunflint roughly perpendicular to the edge and back.
- *Backing* or *ribs* refer to the number of dorsal arrises, or dorsal blade ridges; having two arrises is called double-backed. A single arris gunspall is called single-backed.

- *Knot* is a remnant Hertzian cone on the dorsal side of the gunflint from its removal from the parent blade.
- *Margin* refers to the edge of either the flake or the biface.

Gunspalls not made with blade technology were described using standard lithic technology terms (Inizan et al. 1999). The terms edge and back (two critical terms for describing gunflints made on blades), do not appropriately describe the morphological characteristics of gunspalls made employing other technological traditions.

Each artifact in the collection was examined macroscopically with a 14× lens to identify the technology of production, use-wear, material inclusions, and to source the material. A material type collection of English flints was used to source material where appropriate. Measurements were taken with digital calipers and recorded in millimeters. The weight of the artifacts was recorded in grams using a digital scale.

Gunspall Results

The analysis revealed a fascinating variety of gunspalls and strike-a-lights (Tables 9.21 and 9.22). Just under half (n = 7, or 43 percent) of the artifacts derive from European sources (Figure 9.11), while the majority are made from presumably local (Figure 9.12) chalcedony, chert, and quartzite. Monterey chert was the most commonly utilized local material, making up almost half of the local assemblage. The non-flint raw materials present generally mirror those found in the lithic assemblage as a whole (see Flaked Stone above), indicating that these were produced at the mission. The modifications evident on the gunspalls and the presence of three flint flakes (see Flaked Stone above) indicates that local knappers also performed maintenance activities on gunspalls at the mission.

Six examples were intact enough to indicate the weapon in which they were fitted, based on European sources. Of these, five were an appropriate size for use in a musket, while one was sized for a pistol. Seven of the gunspalls (43 percent) had been reused as a strike-a-light. None of the artifacts were used as a strike-a-light without first being used as a gunspall.

As expected, all of the European gunflints were manufactured using percussion blade core technology, while the local gunspalls were made using a variety of techniques. These included flake core (n = 6), bifacial (n = 2), and bipolar (n = 1) technologies, representing a wider variety of reduction techniques than is seen in the lithic assemblage as a whole. This variation suggests that knappers from different backgrounds produced the local gunspalls. It is likely that Native Californians produced some of the gunspalls, but it is also possible that Native Americans from other regions and people of European descent who lived at the mission also participated in the production of these important items.

Table 9.21. Gunspall and Strike-a-Light Material and Form Summary

Material	Gunspall	Gunspall and Strike-a-Light	Musket	Musket and Strike-a-light	Pistol	Total
English flint	–	–	–	2	1	3
French flint		1	1	2	–	4
Local chalcedony	1	–	–	–	–	1
Local chert (Monterey)	3	1	–	–	–	4
Local chert (tan)	1		–	–	–	1
Local chert (white)	1	1	–	–	–	2
Local quartzite	1	–	–	–	–	1
Total	**7**	**3**	**1**	**4**	**1**	**16**

Table 9.22. Gunspall and Strike-a-Light Data

Catalog Number	Original Use and Reuse	Origin and Material	Manufacture Technology	Use-Wear	Portion	Length (mm)*	Width (mm)*	Thickness at Back (mm)*	Length of Bevel (mm)*	Weight (g)
02735.01	Pistol	English flint	Percussion blade core	Step fractures	Edge, 1 side	14.6–23.1	23.2–23.4	5.4–6.0	3.9–6.5	4.4
11440.01	Musket, strike-a-light	English flint	Percussion blade core	Step fractures, crushing	Edge, 2 sides	10.1–12.1	20.9–21.6	9.3**	7.9–9.9	3.4
17201.01	Musket, strike-a-light	English flint	Percussion blade core	Step fractures, crushing	Edge, 2 sides, back	15.9–20.0	14.6–16.9	6.6–7.3	**	2.9
05816.01	Musket, strike-a-light	French flint	Percussion blade core	Step fractures, crushing	Edge, back, 1 side	32.4–38.8	18.6–23.0	6.1–8.8	7.2–9.2	10.7
13015.01	Musket	French flint	Percussion blade core	Step fractures, crushing	Edge, back	31.9–33.9	22.6–25.5	7.4–7.7	7.1–6.7	8.4
05385.01	Musket, strike-a-light	French flint	Percussion blade core	Step fractures, crushing	Edge, back	15.5–30.0	13.7–25.2	5.9**	8.4–9.8	5.4
13619.01	Gunspall, strike-a-light	French flint	Percussion blade core	Step fractures, crushing	Edge, back, 1 side	14.1**	23.5–25.6	**	6.5–7.7	3.7
17853.01	Gunspall	Quartzite	Untyped flake core	Step fractures, crushing, polish	2 margins, dorsal side	14.9–17.5	15.7–17.7	5.5–7.7	6.0–7.3	3.2
08414.01	Gunspall	Chert (white)	Bipolar flake core	Step fractures, crushing	1 margin	18.4–25.6	29.0–29.5	9.6–13.1	1.6–4.6	11.6
08769.01	Gunspall	Chalcedony	Untyped flake core	Crushing, polish	2 margins, dorsal side	13.5–15.5	17.9–21.5	6.7–8.4	7.6–9.2	3.6
07725.01	Gunspall	Chert (tan)	Untyped flake core	Step fractures, crushing	1 margin	12.0–18.0	15.6–17.7	4.7–7.6	3.3**	2.3
18548.01	Gunspall, strike-a-light	Chert (white)	Bifacial	Step fractures, crushing	3 margins	23.9–24.2	14.8–19.5	7.3–8.3	3.9–4.7	5.4

Table 9.22. Gunspall and Strike-a-Light Data

Catalog Number	Original Use and Reuse	Origin and Material	Manufacture Technology	Use-Wear	Portion	Length (mm)*	Width (mm)*	Thickness at Back (mm)*	Length of Bevel (mm)*	Weight (g)
04155.01	Gunspall	Chert (Monterey)	Untyped flake core	Step fractures, crushing	2 margins	17.7**	12.4**	8.8**	5.7**	1.8
11409.01	Gunspall, strike-a-light	Chert (Monterey)	Single direction flake core	Step fractures, crushing, polish	4 margins, dorsal side	12.1–23.5	17.0–19.5	11.4**	4.4–6.7	5.1
05309.01	Gunspall	Chert (Monterey)	Bifacial	Step fractures, crushing	Three margins	17.8**	30.4–33.2	9.2–11.0	9.0–9.6	8.1
18426.01	Gunspall	Chert (Monterey)	Untyped flake core	Step fractures, crushing	Three margins	17.4**	14.3**	10.6**	8.7–10.9	3.1

*Minimum and maximum values; **Incomplete/underestimated measurement due to damage or reuse

Figure 9.11. English and French gunflints and strike-a-lights, proximal end of blade oriented to top. Top row, left to right: Catalog Numbers 02735.01, 11440.01, and 17201.01. Middle row, left to right: Catalog Numbers 05816.01 and 13015.01. Bottom row, left to right: Catalog Numbers 05385.01 and 13619.01.

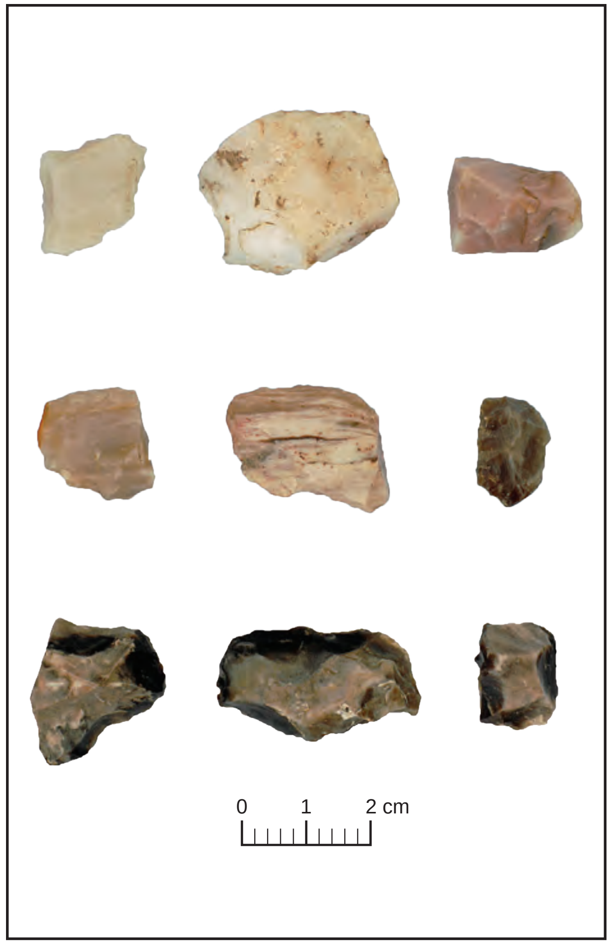

Figure 9.12. Local material gunspalls and strike-a-lights, portion of heavy use as gunspall to top. Top row, left to right: Catalog Numbers 17853.01, 08414.01, and 08769.01. Middle row, left to right: Catalog Numbers 07725.01, 18548.01, and 04155.01. Bottom row, left to right: Catalog Numbers 11409.01, 05309.01, and 18426.01.

Dating the gunspalls from the San Gabriel Mission is difficult for a number of reasons. Primary among the problems is that studies of European gunflints from collections at North American sites tend to be focused primarily on sites in the eastern United States. Because European-made gunflints were used in the east for hundreds of years, chronological variation can be better assessed there than at western sites like San Gabriel Mission. The utility of applying a chronology from the eastern United States has not been critically assessed for Spanish mission sites in the western United States. Also, a date derived from a small sample may not be representative of broader patterns. While the San Gabriel Mission assemblage includes just seven European gunflints, shipments of several thousand imported gunflints have been reported in Spanish requisitions from Santa Barbara Presidio (see below) and recovered from single-event archaeological deposits (Hornerkamp and Harris 2005). The temporal assignment of gunspalls based solely on material, morphological, and technological characteristics of manufacture has been determined to be problematic (Hamilton 1968:117; Kenmotsu 1990:99; White 1975).

Nonetheless, some chronological inferences can be drawn from the historical record. The presence of both English and French gunflints at San Gabriel Mission indicates a likely date range for the imported specimens of 1780 to 1850 (Kent 1983:31; Witthoft 1967). Supply requisitions for Santa Barbara Presidio indicate that 3,000 *piedras de chispa* (literally "stones of spark") were sent from San Blas, Mexico on February 10, 1796, with another shipment of 2,000 sent on February 18, 1810 (Perissinotto 1998:261, 359). While the ships' manifests did not state the country in which these gunflints were made, these dates provide evidence for the importation of gunflints to the region in the late eighteenth and early nineteenth centuries.

Gunspall Summary

The origin and manufacture techniques represented by the San Gabriel Mission gunspall and strike-a-light assemblage include English percussion blade, French percussion blade, and local technologies made from Monterey chert, quartz, and other cryptocrystalline silicates.

The presence of imported European gunflints and strike-a-lights indicates some access to international trade, although the presence of locally-made gunflints and strike-a-lights indicates that imports were not sufficient to meet local needs. Materials for gunflints and strike-a-lights found at San Gabriel Mission are similar to the international and locally available materials seen in the assemblages recovered from near the Santa Barbara Mission (Formica 2008; Hintzman 2006). Also, the technological variation found at San Gabriel is similar to other North American contexts in which Native Americans made gunspalls using their own lithic traditions due to limited access to European-made gunflints (Kelly 2011; Luedtke 1998). The access to imported gunflints and strike-a-lights at the San Gabriel Mission is in contrast to the collection from another Spanish colonial site, the Presidio La Bahía in Texas (Bruseth et al. 2004). Residents of the Presidio La Bahía made their gunflints and strike-a-lights from local Guadalupe chert gravels and possibly small numbers from ships' ballast flint from France deposited during the previous French occupation of the fort.

The artifact assemblage as a whole demonstrates extensive use of gunspalls and subsequent reuse of these gunspalls for strike-a-lights. Many of the more complete gunspall fragments fall outside the recommended length described by Luedtke (1999:75) for reliable spark. Gunspalls and strike-a-lights were likely in short supply and used longer, hence intensive reuse of the artifacts occurred. Shipments from San Blas, if on schedule, at best arrived once a year (Perissinotto 1998:20). This reuse as a strike-a-light decreased the size of the piece through the removal of material to strike sparks and to make the strike-a-light sharp again after it dulled from use. A notable exception to this repeated use and reuse is artifact Catalog Number 02735.01 (see Figure 9.11). This artifact has some modification to its form, but it exhibits minimal reshaping and damage from use. It is not an expended gunflint as is the other example of English material within the collection.

Stone Artifact Summary

The San Gabriel Mission's lithic artifacts reflect the coexistence of several technological traditions within the community, consistent with the mixed heritage of the mission residents. Many of the flaked stone and ground stone forms have deep roots in Native Californian tradition, including the simple modified flakes, bifaces, projectile points (arrowheads), manos and metates, mortars and pestles, and stone bowls. Most of these basic but reliable hand-powered cutting and grinding implements have an 8,000-year history of use in California, and nearly all are made of raw materials that were available locally. Three items with California forms—a biface and two modified flakes—were made from glass. Tool forms native to Mexico are most visible in the ground stone collection, which includes highly shaped two-handed basalt manos and corresponding metates made from vesicular basalt, along with the basalt hoe. Because basalt is available in Southern California, it is not clear whether these items were produced locally, or imported from Mexico. Influences from Europe are evident in the gunspalls and strike-a-lights assemblage, which includes items imported from France and England, as well as artifacts with similar forms made from materials that were local to San Gabriel. The assemblage also includes a millstone from one of the most sophisticated machines of its time in this part of the world, the gristmill built by American Joseph Chapman. While the overall design of the mill originated in Europe's Industrial Revolution, it was constructed of local materials (including the millstone) by Native Americans at the direction of an American. In these ways, the stone artifact collection from San Gabriel Mission demonstrates both persistence of older technologies and innovative use of new technologies and materials in the colonial context.

Bone Artifacts

A small number of bone implements were recovered from the study, representing a wide range of forms and functions. These 16 items include two personal items and 14 bone tools (Table 9.23). The primary typology for California Native American bone tools and ornaments, published in 1940 by E.W. Gifford, still remains the basis for contemporary chronologies (e.g., King 1990). Items that could be correlated to Gifford (1940) types are identified in the discussion of tools below. Personal items, which are not included in Gifford's typology, are described separately.

Table 9.23. Bone Artifact Summary

Item	Personal Item	Tool	Total
Button	1		1
Ochre tool		1	1
Awl		2	2
Knife		1	1
Needle		1	1
Pipe stem	1		1
Modified bone		9	9
Total	2	14	16

Personal Items

Two personal items manufactured from bone were recovered in the course of the study, including a button, and a pipe stem. The button (Catalog Number 11585.01) was manufactured from large mammal bone, and features four holes for attachment to clothing using thread (Figure 9.13). Bone buttons are most commonly sew-through types like this one, with four-hole varieties reported from eighteenth and nineteenth century sites, and typically predating 1850 (South 1964).

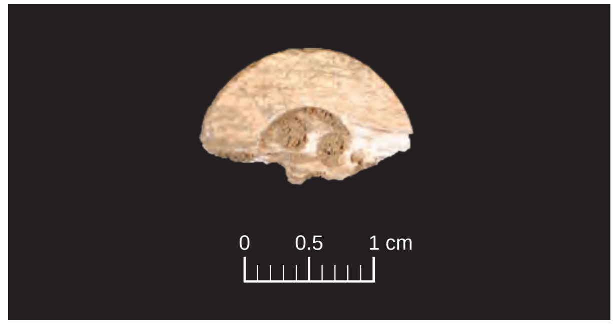

Figure 9.13. Bone button from EU 264. Catalog Number 11585.01.

The pipe stem (Catalog Number 04840.01) was manufactured from large mammal long bone, and features a beveled extension with a smaller diameter that was possibly inserted into a steatite or ceramic pipe and adhered using asphaltum, although none was observed on the artifact (Gifford 1940:179–180; Putnam 1879:24) (Figure 9.14). Some steatite pipes found in prehistoric archaeological sites in southern California featured a separate pipe stem or mouthpiece made of bird bone. Terra cotta or local brown clay pipes found at Hispanic sites in the Caribbean are usually stub-stem, elbow-shaped pipes which were intended to receive a separate mouthpiece of cane or another material (Deagan 2002:310).

Figure 9.14. Bone pipe stem from EU 137. Catalog Number 04840.01.

Tools

Fourteen bone tools were recovered during data recovery excavations at the San Gabriel Mission archaeological site. During the analysis the tools were separated into basic functional categories. In addition taxonomic groupings were made when possible (large mammal, small mammal, etc.), however, in most cases specific taxonomic identification or element identification could not be made due to the extent of the modifications to the bone. The bone tool assemblage contains five formal tools and nine modified bone fragments.

Awls

The bone tool assemblage included two shaped awls. Gifford (1940:161) defined awls as "single-pointed perforating implements without eyes or groove for cord attachment—more or less needle pointed awl, pin… or dagger." Awls were likely used primarily for the manufacture of coiled baskets, although other uses are known, including perforators for hides or skins (Gifford 1940). The majority of prehistoric awls were made from the deer metapodials. Other deer elements sometimes were used for awl manufacture as well, including radii, ulnae, and tibiae.

One complete awl was recovered from Excavation Unit (EU) 129 (Catalog Number 04921.01). This artifact was manufactured from the distal metapodial of a deer (Figure 9.15). One other shaped awl fragment (Catalog Number 04810.01) was recovered from EU108 that consisted of the tip of the tool.

Figure 9.15. Bone awl from EU 129. Catalog Number 04921.01.

Hafted Knife

A bone knife blade was recovered from EU 115 (Catalog Number 02499.01; Figure 9.16). This implement is finely shaped and flat with a curved edge. The blade exhibits wear from use, including scratches on both surfaces and wear on the edge. The base of the blade bears score marks on both surfaces, which may have provided added strength for hafting. The artifact compares well with Gifford's (1940, 1947:116) Type D tools, which are hafted knives, chisels, or scrapers.

Figure 9.16. Bone knife blade from EU 115. Catalog Number 02499.01.

Needle

One manufactured bone tool is best described as a needle, punch, or perforator (Catalog Number 05347.01; Figure 9.17). This implement compares well with Gifford's (1940:177–178) Type U2 Pointed, Blunt-based Object, which is described as curved and asymmetrical.

Figure 9.17. Bone needle, punch or perforator from EU 140. Catalog Number 05347.01.

Ochre Tool

One of the more interesting bone tools recovered from the site is interpreted as an ochre-stained bone tool (Catalog Number 17083.01). This tool was made from a fragment of large mammal long bone with a thick cortex and thick cancellous bone grooves. The fragment was shaped, as evidenced by flaking or carving scars at the proximal end of the tool. The distal portion of the tool exhibits a worn pattern on the cancellous bone grooves, as well as powdery red ochre filling the spaces between the grooves. The tool was possibly used in the preparation or application of ochre judging from the use-wear and amount of ochre present. The tool was fire-hardened and likely hafted to a handle with asphaltum.

Modified Bone

Nine modified bone fragments were recovered in the assemblage that exhibit use-wear or shaping and could represent modification or use, butchering or tool making debitage, or broken tool fragments. These items warrant description but were too fragmentary or exhibited modification too minor to definitively ascribe type or use.

Five of these modified bone fragments exhibited worn surfaces (polished, scratched, notched, etc.), but they were too fragmented to determine either their original form or use. Three bone fragments (Catalog Numbers 02490.01, 07817.01, and 11632.01) are large or very large mammal long bones that exhibit a polished cortical surface. Another bone fragment exhibits a polished and scratched or damaged cortical surface (Catalog Number 08636.01). Another bone fragment exhibits a polished and scratched cortical surface, as well as two areas of damage along one of the edges that may indicate use-wear (Catalog Number 08361.01).

The remaining four fragments were identified in the vertebrate bone assemblage. These implements do not exhibit evidence of manufacturing or shaping, but they do exhibit wear from use. One example (Catalog Number 05650.01) exhibits wear on its pointed tip, and one of its long edges exhibits two areas of damage, possibly from scraping. This item may be a piece of bone butchering debitage that was utilized. Two additional bone splinters (Catalog Numbers 07871.01 and 17400.01) exhibit pointed tips, and wear was evident on the distal edges of these splinters. Finally, another bone fragment (Catalog Number 08138.01) recovered in the vertebrate bone assemblage shows a worn (polished, chipped, and scratched) cortical surface. Additionally, this artifact may have been fire-hardened.

Bone Artifact Summary

The small assemblage of bone artifacts from the San Gabriel Mission archaeological site is most notable for its variety. The artifacts have little in common with one another aside from being crafted from large mammal bone. Encompassing only 16 items, the collection includes six distinct artifact types that represent personal items and tools. The personal items include a button and a pipe stem. The tools include cutting and perforating implements likely used in sewing, basket making, hide working, or similar tasks. The bone artifact assemblage includes items of ancient tradition in Native California, such as deer metapodial awls, as well as forms affiliated with nineteenth century European sites, like the four-hole bone button.

Beads

The study at the San Gabriel Mission archaeological site recovered 216 beads, including 123 made of shell, 69 of glass, 22 of ceramic, one of stone, and one of an unknown material that may be stone (Table 9.24). Beads were first classified according to material (shell, stone, glass, and ceramic). Depending on material class, the subsequent categories of analysis varied slightly, as described below. The collection was cataloged and analyzed using a 10–30× binocular microscope. After microscopic analysis was completed, the beads were further divided by material type. A single stone bead was determined to be made of talcose schist (commonly called soapstone), and the material type of a second possible stone bead could not be identified. Shell beads were categorized according to the genus and species of the shell material used to make the bead. Shell taxa identified include: *Haliotis rufescens*, *Kelletia kelleti*, *Mytilus californianus*, and *Olivella biplicata*.

Table 9.24. Bead Material Type Frequency by Phase and Area

		Bead Material Type					
Phase	**Location**	**Shell**	**Stone**	**Glass**	**Ceramic**	**Unknown Material***	**Subtotal**
I/II		**12**	**–**	**5**	**1**	**–**	**18**
III		**111**	**1**	**64**	**21**	**1**	**198**
	Area 1	16	–	10	–	1	27
	Area 2	81	1	45	21	–	148
	North of Area 2	2	–	4	–	–	6
	North Midden	1	–	1	–	–	2
	South Midden	11	–	4	–	–	15
Total		**123**	**1**	**69**	**22**	**1**	**216**

During the cataloging process, bead dimensions were recorded in millimeters using electronic calipers. The types of measurements recorded for each bead were determined by their shape; generally, these measurements included maximum diameter, thickness, and perforation diameter. Perforations for each bead were assessed for shape in order to better understand the methods used for drilling. There are three main types of perforation shapes: biconical, conical, and straight. One variation of the conical shape seen frequently and evident during microscopic analysis is a conically drilled perforation with a retouch on the opposite side of the bead to complete the drilling process.

Reference materials for the bead analysis include Bennyhoff and Hughes (1987), DeCorse (1995), DeCorse et al. (2003), Dubin (2009), Francis (1999, 2002), Gibson (1992), Gifford (1947), Karklins and Adams (2013), Karklins and Ross (2007), Karklins and Sprague (1972), Karklins (1985), Kidd and Kidd (1983), King (1990), Liu (1995), Milliken and Schwitalla (2012), Spector (1976), Sprague (1985), Beck (1929), and van der Sleen (1967). The analysis assigns the shell beads into types taken from the following publications: Bennyhoff and Hughes (1987) and Gifford (1947). The glass and ceramic bead analysis were tailored to record relevant attributes based on material. A bead typology was developed following methods detailed in Karklins (1985), Karklins and Adams (2013), and Kidd and Kidd (1983). Type numbers were assigned sequentially and are specific to the site's glass and ceramic beads. Overall, this is a medium-sized and diverse bead assemblage that is fairly typical of Mission-period archaeological sites. The distribution of the beads across the site shows a much higher frequency of beads in Area 2 dispersed throughout (see Table 9.24). Also of note, the South Midden area has a relatively high frequency of beads considering the small number of units that were excavated in this area. Further exploration of these patterns is included in Chapter 11.

Shell Beads

Beads and ornaments have been used by Native Californians for at least 8,000 years (King 1990). During that time, numerous materials were used to produce an intriguing variety of forms, of which bead necklaces are the most common, but beads were also used as decoration. Besides providing aesthetically pleasing ornaments, beads functioned as a medium of exchange and assisted in the flow of goods between various groups and individuals. So-called money beads, such as cupped olivella beads in California, were used by prehistoric societies to facilitate exchange and help in the redistribution of important resources. At its height, the economy in prehistoric

California resembled marketing systems more commonly found in agricultural societies such as seen in ancient Mesoamerica and the American Southwest.

Shells from the genus *Olivella* (also called *Callianax)* were the most common raw material used by Native Californian bead makers, particularly *O. biplicata*, which is native to the Pacific coast of southern California. Other species were occasionally used as well, including *O. baetica,* also from the Pacific, and *O. dama,* from the Gulf of California. Identifying the species from which small beads derive is often impossible due to the extensive modifications that they have undergone.

Conical and biconical perforations in shell and bone beads are typically associated with the use of flaked stone microdrills, a traditional bead-making technology. Narrower, straight-sided bead perforations were likely produced using imported iron needles (Dietler 2003).

Shell Bead Typology and Analysis Methods

Olivella shell beads were analyzed and typed following Bennyhoff and Hughes (1987) for analysis of the types and temporal indications. Additional information on temporal indicators for all shell bead types was drawn from King (1990) and Gibson (1992). The basis for all of the California shell bead typologies is the pioneering shell artifact volume by E. W. Gifford (1947), and this work was used for items not covered or typed by King or Gibson. Additional information regarding shell bead typology and analysis methods is found in Appendix F.

Shell beads were categorized according to the genus and species of the shell material used to make the bead. Attributes including the shape of the bead, the shape of the perforation, and diameter measurements were recorded (Table 9.25; Figure 9.18). They were described according to shape (barrel, rectangular, round, rounded square, irregular shape, unknown shape, etc.) and the perforation of each bead was assessed for shape as described above, in order to better understand the method of manufacture that may have been used. The shape of the perforation affects the diameter measurement, so the shape was also noted. Finally, the olivella shell beads were placed in the type categories established by Bennyhoff and Hughes (1987). Non-olivella shell bead types were categorized by the common name of the artifact type after King (1990) and Gibson (1992), and when applicable, a Gifford (1947) type was used. In the terminology used by these authors and the present study, each general *class* of bead style is divided into *types* and *sub-types*. For example, Class H encompasses Type H1, which is further divided into Sub-types H1a, H1b, etc.

Table 9.25. Shell Bead Types and Temporal Affiliations

Shell Type	Portion of Shell	Type	Perforation Type	Bead Diameter*	Perforation Diameter*	Period (Age)	Reference(s)	Count
Gastropod	Columella	AU3	Straight	8.0	3.4	Late period (A.D. 1150 to 1780)	King 1990	1
Haliotis	Epidermis	K1cII	Biconical	4.9–5.9	1.9–2.6	Late period (A.D. 1500 to 1820)	Gibson 1992, King 1990	2
	Epidermis	K1cII	Straight	10.3	1.7	Late period (A.D. 1500 to 1820)	Gibson 1992, King 1990	1
	Epidermis	KK2	Biconical	5.7	1.4	Late period (A.D. 1500 to 1820)	Gibson 1992, King 1990	1
	Epidermis	KK2	Conical	5.4–5.8	1.4–1.9	Late period (A.D. 1500 to 1820)	Gibson 1992, King 1990	2
Mytilus	Body	Mytilus disk	Biconical	6.3	1.6	Middle perio 5 to Mission period (A.D. 900 to . 1834)	Gibson 1992, King 1990	1
	Body	Mytilus disk	Straight	6.9	1.2	Middle period 5 to Mission period (A.D. 900 to 1834)	Gibson 1992, King 1990	1
Olivella	Callus	E1a	Biconical	5.9	1.7	Late period 2a (A.D. 1500 to 1600)	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	1
	Callus	E1a	Conical	4.4–6.1	1.2–1.8	Late period 2a (A.D. 1500 to 1600)	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	2
	Callus	E1a	Straight	4.8–6.7	0.9–1.7	Late period 2a (A.D. 1500 to 1600)	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	3
	Callus	E1b	Biconical	5.4	2	Late period 2a to 2b (A.D. 1600 to 1750)	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	1
	Callus	E1b	Conical	5.5–7.2	1.5–1.9	Late period 2a to 2b (A.D. 1600 to 1750)	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	3
	Callus	E1b	Straight	6.1	1.1–1.4	Late period 2a to 2b (A.D. 1600 to 1750)	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	2
	Callus	K1	Conical	3.9–5.0	1.6–1.7	Late period (A.D. 1150 to 1750)	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	2
	Wall	G1	Conical	3.5–4.9	0.9–2.2	Any period	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	15
	Wall	G1	Biconical	4.3g	1.0	Any period	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	1

Table 9.25. Shell Bead Types and Temporal Affiliations

Shell Type	Portion of Shell	Type	Perforation Type	Bead Diameter*	Perforation Diameter*	Period (Age)	Reference(s)	Count
	Wall	H1a	Straight	3.7–6.6	1.0–2.0	Mission period, early (A.D. 1770 to 1810)	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	16
	Wall	H1a	Conical	4.3	1.1	Mission period, early (A.D. 1770 to 1810)	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	1
	Wall	H1b	Conical	5.3	1.9	Mission period, late (A.D. 1790 to 1816)	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	1
	Wall	H1b	Straight	3.6–6.6	1.0–1.6	Mission period, late (A.D. 1790 to 1816)	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	14
	Wall	H2	Biconical	4.6–6.2	1.5–2.3	Mission period, terminal (A.D 1816 to 1834)	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	2
	Wall	H2	Conical	4.8–6.6	1.7–1.9	Mission period, terminal (A.D 1816 to 1834)	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	4
	Wall	H2	Straight	4.6–6.6	1–2.1	Mission period, terminal (A.D 1816 to 1834)	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	30
	Wall	H3	Conical	6.0–7.1	1.5–1.6	Mission period, post (A.D 1834 to 1900)	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	2
	Wall	H3	Straight	3.6–8	1.1–1.8	Mission period, post (A.D 1834 to 1900)	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	6
	Wall	J1	Biconical	5.4–5.8	1.0–1.5	Mission period (A.D. 1770 to 1834)	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	3
	Wall	J1	Conical	5.4–6.3	1.5–2.0	Mission period (A.D. 1770 to 1834)	Bennyhoff and Hughes 1981, Milliken and Schwitalla 2012	3
	Wall	Un-known	Biconical	-	-	Unknown	-	1
	Wall	Un-known	Conical	-	-	Unknown	-	1

* Values in millimeters. Where two values are listed, they represent minimum and maximum values.

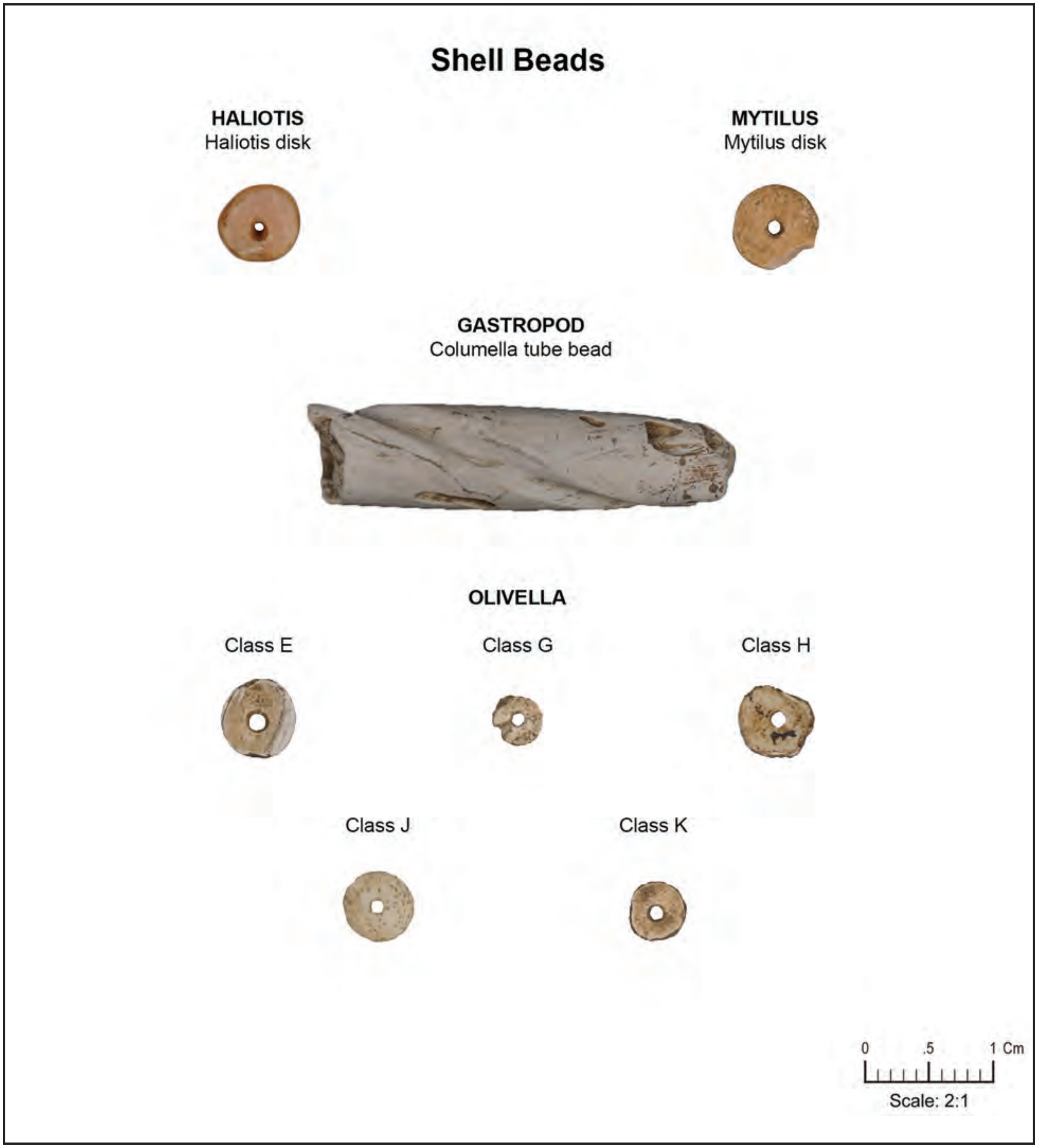

Figure 9.18. Shell bead types.

Stone Beads

Large Disk

One Large Disk stone bead was recovered from Area 2 (Catalog Number 08580.01). A second Large Disk bead was recovered from Area 1 that is likely made of stone, but its material could not be definitively identified (Catalog Number 07458.01; Figure 9.19). However, its dimensions and style were similar to the stone bead described below. Although stone beads were used continuously from the Middle period onwards, their presence in Late period or Historic period deposits is relatively rare. The rarity of these beads in later times seems to be related to their replacement by other types, such as abalone rim tubes, small columella beads, and certain types of callus beads (King 1990). Most stone beads made during the Late period were manufactured from green talc schist, serpentine, and black chlorite schist. Due to a lack of a published stone bead typology, and the relatively small amount of stone bead research that has been done to date (as compared to well-studied shell beads), the bead type definition is based on a system developed for the assemblage recovered at Landing Hill in Seal Beach, California (Cleland et. al. 2007) with a descriptive term based on diameter.

The diameter of the positively identified stone bead is 7.1 mm, and it was classified as a Large Disk stone bead because its diameter was greater than 5.0 mm (Cleland et. al. 2007). The possible stone bead was also classified as a Large Disk bead based on its diameter of 6.3 mm. This bead exhibits a material that is off-white in color and is made of a soft stone material or very hard shell material.

Figure 9.19. Stone bead from EU 200. Catalog Number 08580.01.

A specific determination of stone type could not be made, but it is possible that this bead was manufactured from Pelona schist. Stone beads such as these from this collection were usually strung together with shell beads. Stone beads have also been found in association with bone pendants and beads with asphaltum, and may have also been used as appliqué (King 1990).

Shell and Stone Bead Summary

The San Gabriel Mission archaeological site yielded a relatively small variety and modest number of shell beads, comprising 123 examples falling into five major types, given the nature of the site and the amount of excavation. The majority of the shell beads are olivella shell disk beads, including 100 wall disk beads. Ethnographic documentation suggests that wall disk beads were strung on necklaces, and also used as appliqué items on blankets or other textiles (King 1990). Based on burial lot studies, it appears that wall disk beads were associated with an economic subsystem controlled by hereditary political leaders (King 1974). Ethnographic data indicate that necklaces were traded during rituals between villages and in interregional exchanges between chiefs and other individuals of high status. Wall disks were used exclusively to validate social and political power (Gibson 1992).

Fourteen callus disk beads, which were used as currency in the late prehistoric and early historic era, were recovered. Twelve of the callus disk beads are lipped, retaining a portion of both wall and callus, and two are cupped callus beads and are made entirely from the callus portion of the shell. As is typical of Mission-period sites, the site did not contain any whole shell olivella beads.

Some of the more temporally diagnostic beads recovered at the San Gabriel Mission archaeological site deserve further discussion. The olivella bead collection is particularly useful for dating. It contains many types of wall beads with tightly defined temporal ranges, being affiliated with the Late period, as well as the early, late, terminal, and post-Mission periods (Figure 9.20). The occurrence of a small number of pre-Mission period bead

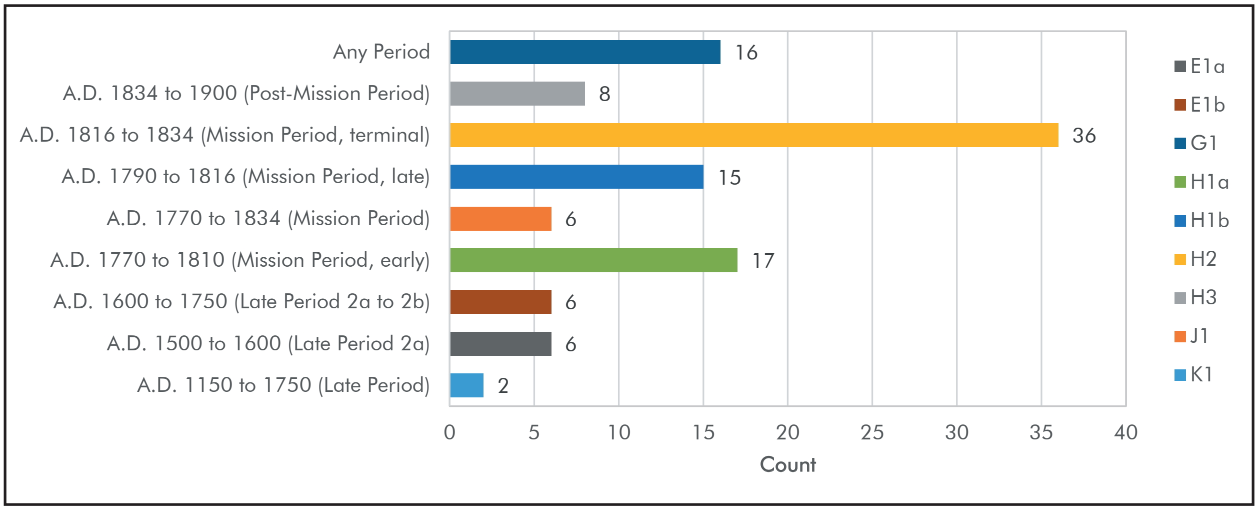

Figure 9.20. Count of Identifiable *Olivella* Disk Beads by Type and Period Affiliation

types confirm what has been found at other sites in southern California; namely, that some prehistoric bead types remained in circulation into the Mission period, even when a supply was no longer being manufactured.

Ground, Rough, and Chipped Disk beads (Class H) and South Coast Wall Disk beads (Class J) dominate the olivella bead assemblage, with Class H representing 62 percent of the collection and Class J representing 4 percent. Class J beads are found on other sites in association with Class H beads, and this pattern appears to hold true at San Gabriel Mission. Four Class H types were recovered in this study, together representing the entire Mission period. These include Types H1a, H1b, H2, and H3, which are markers for the Early, Late, Terminal, and Post-Mission periods, respectively. The dominance of these Mission-period bead varieties in the assemblage supports the temporal assignments made by King (1990) and other investigators (e.g., Bennyhoff and Hughes 1985; Gibson 1992; Milliken and Schwitalla 2012). The shell beads at the site reinforce the idea that beads remained in use and important to the inhabitants of the mission.

An intriguing possibility is that the frequent occurrence of Class H beads (see Figure 9.18) at historical archaeological sites throughout southern California is related to the rise of the *Chinigchinich* religion, which rapidly spread east and south of its point of origin in the Los Angeles Basin/San Clemente Island area. As shown in a recent study (Kirkish 2011), Class H disk beads were inextricably tied to rituals associated with this cult. Rituals such as rites of passage, eagle killing, and mourning ceremonies were probably incorporated in the new movement. As was typical in these ceremonies, beads (especially Class H) were frequently exchanged prior to, during, and after completion of the rituals (Lepowsky 2004). Thus as the cult spread, these beads and their use became even more important. In this sense, Class H beads are emblematic of this particular movement.

Other shell bead types such as the mytilus beads, epidermis disk beads, columella tube beads, and stone beads at the site occur in small numbers. These are known to occur in deposits from the Middle and Late periods, but they also can be found in Mission-period deposits (Gibson 1992:34). Colorful mytilus and stone beads were frequently strung with white olivella beads, but ethnographic descriptions typically describe the use of dark beads as a counterpoint to the brilliant white of the olivella beads. The mytilus examples from this site range in color from yellow to orange, as do the epidermis disk beads, perhaps indicating a different use here. The majority of these beads were recovered in Area 2.

A clear pattern emerges in the horizontal distribution of beads across the site, with the majority the beads found in Area 2. This distribution is discussed further in Chapter 11.

Glass and Ceramic Beads

Glass beads were used by the Spanish to facilitate interaction with Native Americans they contacted in California. In effect, the Spanish used glass beads to establish alliances and purchase goods and services. Although Cabrillo is reputed to have traded beads during his 1542 voyage, glass beads have not been identified in the archaeological sites dating from this time period, presumably due to their low number. Glass trade beads were commonplace in the Mission period, when they were used as currency. For instance, the construction of the presidio in Santa Barbara was paid for in large part with glass trade beads. It is probable that fairly large construction projects led to an enormous influx of glass beads in the local economy. After 1804, glass bead frequency decreased somewhat and shell beads increased in frequency once again. During the initial colonization of California, it appears that glass trade beads were substituted for cupped and lipped olivella callus beads and used as money in their stead. Once the local economy was flooded with glass beads, labor-intensive shell beads became more valuable again, leading to their resurgence in popularity. Glass beads never entirely dropped out of the system, but they continued to be used at a greatly devalued rate (King 1990; Kirkish 2011).

Excavations at the San Gabriel Mission archaeological site recovered 91 glass and ceramic beads, including 56 drawn glass, 13 wound glass, and 22 Prosser molded ceramic beads. While glass beads were found throughout the site, most were recovered from Area 2. All Prosser molded beads were recovered from Area 2 as well.

Glass and Ceramic Bead Typology and Analysis Methods

Glass and ceramic beads were assigned to types according to a number of attributes including manufacturing technique, structure, color, perforation type, luster, diaphaneity (transparency), decoration, and condition. They were also classified according to shape and size, with measurements of length and diameter recorded. Analysis methods and additional details of the glass and ceramic bead typology are provided in Appendix F.

Type-varieties identified within the San Gabriel Mission assemblage are assigned numbers designated by Arabic numerals 1 through 25. In addition to the descriptive analysis outlined above, classification of the glass and Prosser molded ceramic beads was made with reference to a typology developed by Karklins and Ross (2007), which expands upon the taxonomic system created by Kidd and Kidd (1983; see also Karklins 1985). This classification system is based upon manufacture method and physical attributes such as shape, size, and color of the bead (Kidd and Kidd 1983:220–221). Following standard conventions, varieties that do not appear in the Kidd and Kidd lists are marked by an asterisk (Karklins and Ross 2007:E1). A total of 25 glass and ceramic bead types were identified (Table 9.26). For each of these types, a representative type bead was selected and photographed (Figures 9.21 and 9.22).

Drawn beads are the most common type at the San Gabriel Mission archaeological site, comprising 56 specimens. These were made by blowing air into a piece of melted glass and then pulled at each end to form a rod or cane. Once the rod had hardened, the cane was snapped into short sections that were then placed into a rotating drum containing hot sand. This produced rounded beads that needed only a minimal amount of touch-up polishing to be fully finished (Gibson 1976). A massive quantity of beads could be manufactured in one episode of manufacture.

Table 9.26. Glass and Ceramic Bead Types

Manufacture Technique	SG Type	Reference Type-Variety*	Structure†	Diaphaneity‡	Perforation§	Color	Munsell	Shape¶	Decoration#	Type Bead	Diameter (mm)	Length (mm)	Quantity	Notes
Drawn Glass	3	Ia*; IIa39; IIa*	S	Tl, U	St	Bright aqua blue, bright turquoise, medium turquoise, aqua blue, aqua green	2.5B 5/5; 2.5B 6/4; 2.5B 6/7; 2.5B 7/2; 7.5BG 6/6; 7.5BG 6/8	Ci, T	UD	04451.1	2.72–5.06	2.33–4.7	15	
	4	IIa*	S	Tl, U	St	Dark emerald green	7.5G 3/8	Ci	UD	17755.1	3.61	3.06	1	
	6	IIa7	S	O	St	Black	N1	Ci	UD	08800.1	3.5–5.48	1.41–3.15	6	Rose-wine tint when held to light
	7	IIa*	S		St	Colorless		Ci	UD	11341.1	3.45–3.82	2.01–2.11	2	
	9	Ia5; IIa14	S	O	St	White	N9	Ci, T	UD	05516.1	2.49–4.33	2.19–4.05	8	
	10	Ia*; IIa*	S	Tl	St	Medium blue	5PB 3/6	Ci, T	UD	03828.1	3.14–5.35	1.89–6.53	11	
	11	IIa43	S	Tl	St	Bright aqua blue	2.5B 6/7	Ci	UD	14497.1	5.54	4.58	1	
	12	IIIa*	Cd	O	St	Brick red exterior with light lemon yellow or apple green core	7.5R 3/8 and 7.5Y 8/6 or 10GY 6/6	Ci, T	UD	08789.1	2.56–5.01	2.15–4.32	6	
	14	IIa*	S	O	St	Light blue	7.5B 6/4	Ci	UD	14279.1	3.07	2.42	1	
	15	If*	S	Tl	St	Ultramarine	6.25PB 3/12	TCH	F	09490.1	6.33	6.12	1	

Table 9.26. Glass and Ceramic Bead Types

Manufacture Technique	SG Type	Reference Type-Variety*	Structure†	Diaphaneity‡	Perforation§	Color	Munsell	Shape¶	Decoration#	Type Bead	Diameter (mm)	Length (mm)	Quantity	Notes
	17	IIa*	S	Tl	St	Leaf green	7.5GY 6/6	Ci, T	UD	10221.1	2.57–3.81	1.69–4.41	3	
	25	IIInn-a	Cs	U	St.	Blue	Unknown	TCH	I, F	11586.1	6.87	21.65	1	Chevron bead, blue and red, with white and gold stripes
Wound Glass	1	WIIIc*; WIIId*	Cx	Tl, U	St	Cobalt blue or ultramarine	2.5PB 3/6; 6.25PB 3/12	RG, RB	I, O	15371.1	5.52–7.61	4.92–7.99	5	Gold wavy line decoration
	2	WIf*	S	Tl	St	Colorless or light gray	N7	Co	UD	02768.1	5.15	5.23	1	Not heat rounded; edges of glass are distinct giving spiral-like appearance
	5	WIb*	S	Tl	St	Light gray	N7	RG	UD	15385.1	6.91	6.43	1	Wind marks evident; surface of body not smoothed
	8	WId*	S	Tl	St	Royal blue	7.5PB 2/10	D	UD	17503.1	6.34	3.43	1	
	13	WIb*	S	Tl	St	Topaz	10YR 5/10	RG	UD	10749.1	6.36	6.38	1	
	16	WIb*	S	Tl	St	Scarlet	7.5R 4/14	RB	UD	16400.1	8.13	--	1	
	20	WIb*	S	Tl	St	Medium blue	5PB 3/6	RB	UD	03080.1	5.4	4.2	1	
	24	WIIo*	S	Tl	St	Bright aqua	2.5B 6/7	SqB	UD	12843.1	4.43–4.76	10.49–10.71	2	Long square barrel (Beck 1929: IX.D.1.b.)
Prosser Molded Ceramic	18	PM*	S	O	C	Twilight blue	5PB 6/7; 5PB 6/8	Cy	UD	13968.1	5.86–6.2	4.68–5.51	7	

Table 9.26. Glass and Ceramic Bead Types

Manufacture Technique	SG Type	Reference Type-Variety*	Structure†	Diaphaneity‡	Perforation§	Color	Munsell	Shape¶	Decoration#	Type Bead	Diameter (mm)	Length (mm)	Quantity	Notes
	19	PM*	S	O	C	Oyster white	N8	Cy	UD	03741.1	5.53–6.17	5.42–5.9	8	
	21	PM*	S	O	C	Dark jade green	10G 4/5	Cy	UD	11774.1	5.92–6.09	4.78–5.18	4	
	22	PM*	S	O	C	Garnet	2.5R 2/6	Cy	UD	12222.1	5.91–6.07	5.07–5.2	2	
	23	PM*	S	O	C	Oyster white	N8	R	UD	10283.1	4.36	3.87	1	

* Kidd and Kidd (1983); Karklins (1985); Karklins and Ross (2007)

† Structure: S = Simple; Cd = Compound, Cx = Complex, Cs

‡ Diaphaneity: Tp = Transparent; Tl = Translucent; O = Opaque; U = Unknown

§ Perforation: St = Straight perforation; C = Conical perforation

¶ Shape: Ci = Circular; Co = Coil; Cy = Cylindrical; D = Doughnut; R = Round; RB = Round barrel-shaped; RG = Round globular; SqB = Square barrel; T = Tubular; TCH = Tubular, cornerless hexagon

Decoration: UD = Undecorated; I = Inlaid decoration; O = Overlaid decoration; F = Faceted

Figure 9.21. Drawn glass type beads.

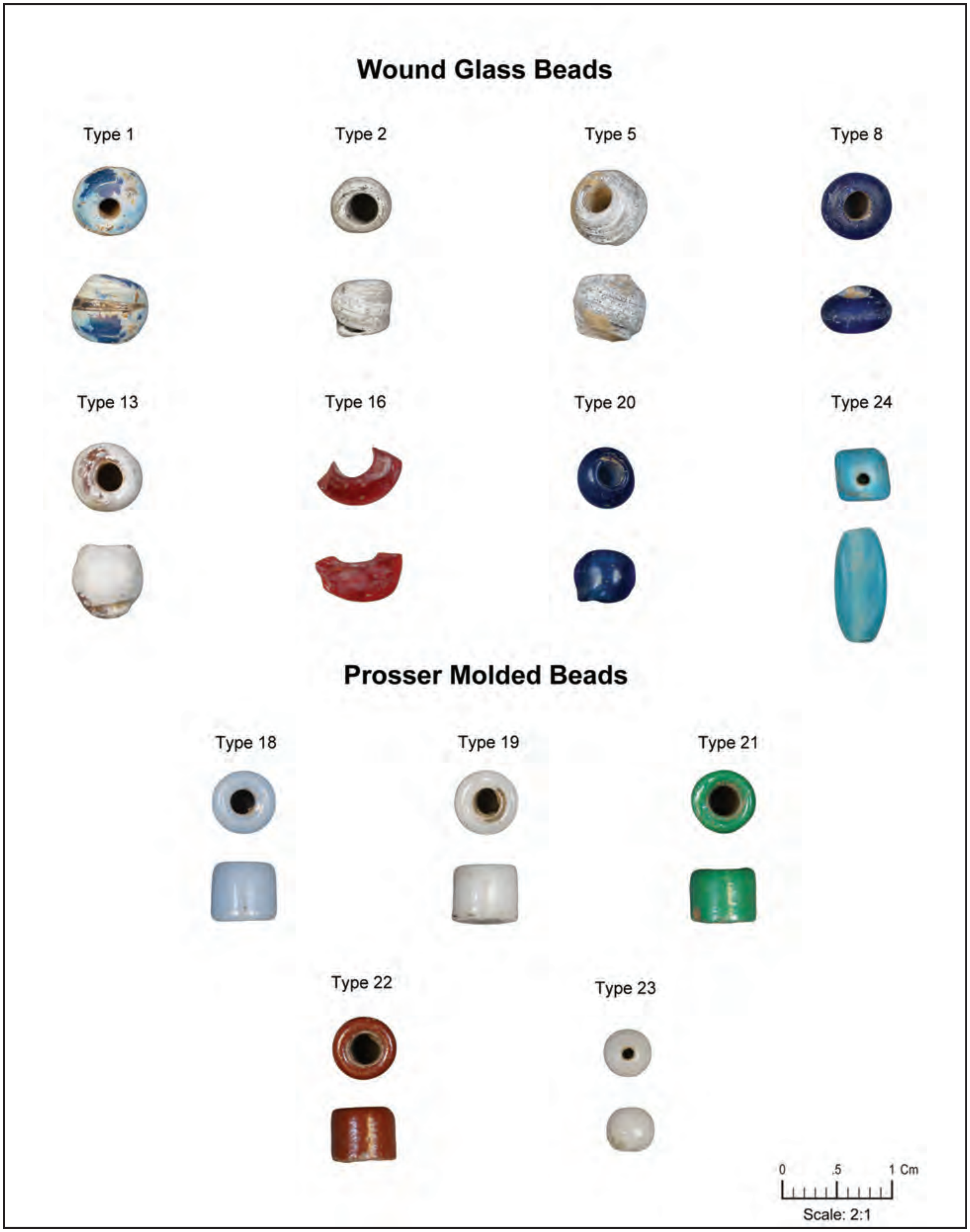

Figure 9.22. Wound and Prosser molded type beads.

Drawn beads in the collection include small beads known as seed beads, which were commonly used in embroidery (Sprague 1985:91). In the Kidd and Kidd system, these beads correspond to Type-Variety Ia, a simple drawn bead that is undecorated and tubular, or Type-Variety IIa, a simple drawn bead that is undecorated and non-tubular. The circular shape is formed by heat rounding, whereas tubular beads can have broken ends. In the Kidd and Kidd system, these beads are further divided into type-variety based on color and size. Other types of drawn beads present include larger drawn beads, compound beads made of multiple layers of glass, and one faceted bead.

The process of forming wound glass beads entailed a cane or rod of glass being heated over a small flame until it became malleable. Once in its plastic form, the rod was wound around a mandrel or wire. The mandrel was likely coated with graphite to facilitate the removal of the bead or beads after cooling. This type is distinguished by a concentric layering observable on the exterior of the bead, with elongated air bubbles oriented perpendicular to the perforation (Gibson 1976:104; Sprague 1985:93). There were 13 wound beads found at the San Gabriel Mission archaeological site, representing eight type-varieties. The most common color for these beads was blue.

In addition to the glass bead types described above, a total of 22 Prosser molded ceramic beads were also recovered from the site (see Kirkish 2014). Originally invented by the Prosser Brothers in England to make buttons, the Prosser manufacture process was patented in 1840 by Richard Prosser in London, and in 1841 by his brother Thomas Prosser in New Jersey. The process entailed the use of "clay-earths" which were crushed to make a fine powder and subjected to great pressure using a "common fly screw-press" to form the molded button (Sprague 2002). Eventually the process was adopted by a French manufacturer, Jean-Félix Bapterosses, who was able to make 500 buttons or beads at a time. Interestingly, Bapterosses used milk in the process, presumably to make the clay powder more plastic. Although these beads are frequently mistaken for glass artifacts, they are actually composed of ceramic material and are more closely akin to porcelain (Sprague 2002). Prosser beads found at the San Gabriel Mission archaeological site were recovered from the southwestern portion of the Millrace Complex of the site. Although the depths of the finds varied, most of the beads were found deeper than 110 cmbd (Datum 3). Five type-varieties of Prosser beads were recovered, including white, blue, green, and red colored beads, and both round and cylindrical forms.

Glass and Ceramic Bead Attributes

Glass and Ceramic Bead Color

Glass beads were first introduced to the Americas by early Spanish explorers, and arrived in southern California during the Cabrillo expedition of 1542. King (1985) reports that the "earliest explorers and Spanish occupation dates are A.D. 1500–1650 or the latest date that could be in the range, most [glass beads] were probably used during the pre-1803 historic occupation." Glass beads are available in a variety of colors and historic accounts indicate yellow, green, blue, red, black, and white were all available during various time periods. Several studies have argued that white, red, and black are especially prized colors of beads found in the Mission period in California (Graesch 2001:277; Silliman 2004:149).

A variety of colors are present in the collection from the San Gabriel Mission archaeological site. Specific shades are recorded for each individual bead, and these are grouped into larger color groups for the purposes of this discussion. Color groups include white, black, red, green, blue-green, blue, amber, gray, and colorless. The largest portion of beads fits into the blue, green, and blue-green categories. In fact, 59.4 percent (n = 54) of glass and ceramic beads recovered are blue, green, or blue-green in color. Another 18.7 percent (n = 17) are white, 9.9 percent (n = 9) are red, 6.6 percent (n = 6) are black, 3.3 percent (n = 3) are colorless, 1.1 percent (n = 1) are amber, and 1.1 percent (n = 1) are gray (Table 9.27).

Table 9.27. Glass and Ceramic Bead Color by Manufacture Technique

	Manufacture Technique				
Bead Color	**Drawn**	**Wound**	**Prosser Molded**	**Total**	**Percent**
Black	6	–	–	6	6.6%
Blue	14	7	7	28	30.8%
Blue-green	16	2	–	18	19.8%
Colorless	2	1	–	3	3.3%
Green	4	–	4	8	8.8%
Gray	–	1	–	1	1.1%
Red	6	1	2	9	9.9%
White	8	–	9	17	18.7%
Amber	–	1	–	1	1.1%
Total	**55**	**13**	**22**	**91**	**100%**

Glass Bead Decoration

Styles of decoration observed in the glass bead assemblage include decoration formed by added glass, and facets formed by molding, cutting or grinding. In total, seven beads (10.3 percent of glass beads) incorporated decoration of at least one type.

Inlaid or overlaid decoration formed of gold glass is present on Type 1 beads (Figure 9.23). This decoration is raised on the surface of the bead and typically extends around the bead's equator. In some cases, the decoration is fragmentary and only partially present.

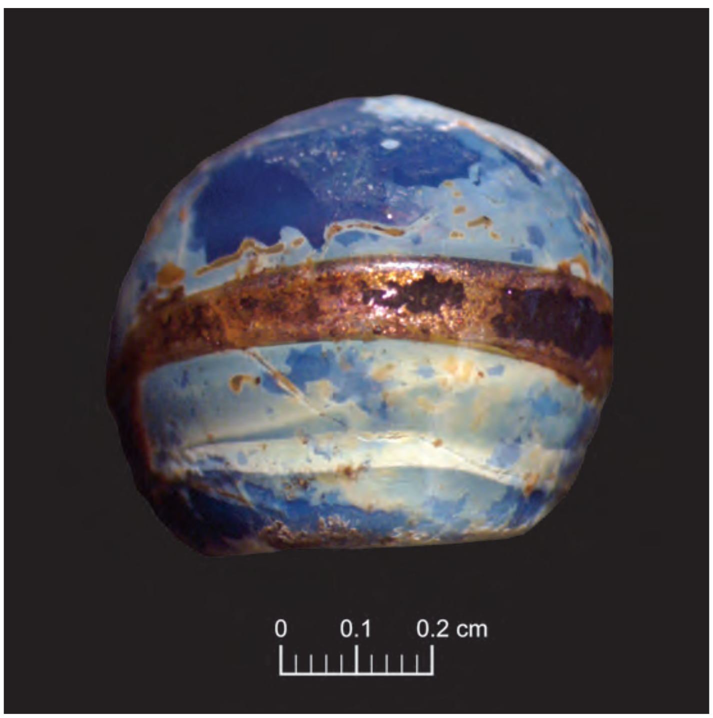

Figure 9.23. Type 1 bead, gold overlaid decoration. Catalog Number 15371.01.

Both inlaid decoration and facets are present on the single Type 25 bead in the assemblage (Catalog Number 11586.01; Figure 9.24). This is a composite drawn bead made up of multiple layers of glass, commonly known as a Chevron bead. The bead is covered in heavy patina and partially decomposed, making it difficult to determine the color of the glass. The body of this bead appears to be made of layers of blue and red glass, with compound stripes of opaque white and gold glass.

Figure 9.24. Type 25 Chevron bead with facets and compound stripes. Catalog Number 11586.01.

Facets are also present on the single Type 15 bead in the assemblage (Catalog Number 09490.01; Figure 9.25). This is a drawn bead that is in the form of a tubular, cornerless hexagon. The facets were formed by a semi-automated process of cutting and grinding. Such beads are typical of the nineteenth century production of both Venice and Bohemia (presently the Czech Republic) (DeCorse et al. 2003:85).

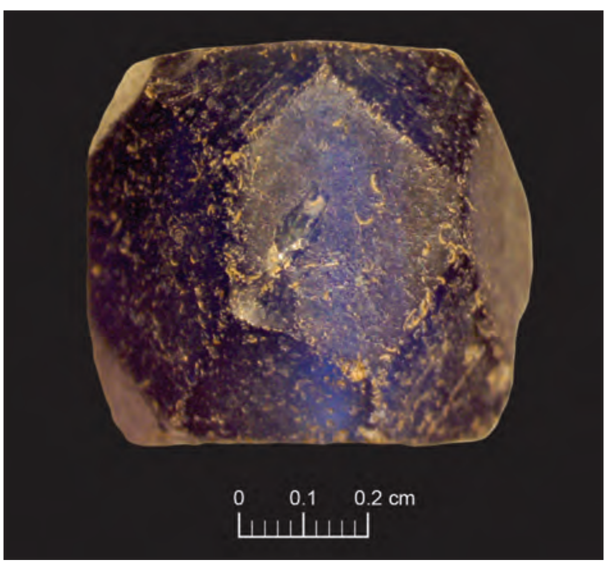

Figure 9.25. Type 15 faceted bead. Catalog Number 09490.01.

Glass and Ceramic Bead Size and Function

Beads in the assemblage range in size from 2.49 to 8.13 mm in diameter, with an average diameter of 4.77 mm; and from 1.41 to 21.65 mm in length, with an average length of 4.38 mm. Ross (1997:191) suggests that beads smaller than 6 mm should be considered "embroidery beads," and that beads larger than 6 mm should be considered "necklace beads." Within the assemblage, 68 (74.7 percent) of the glass and ceramic beads are less than 6 mm in size, or embroidery beads, and 23 (25.2 percent) are greater than 6 mm in size, or necklace beads.

Glass beads smaller than 6 mm were likely used as decoration, including clothing or basketry (Ross 1997; Silliman 2004). Given that the context of recovery for the bead assemblage is a Catholic mission, it is possible that some of the beads larger than 6 mm may be rosary beads or part of necklaces with religious medallions.

Glass and Ceramic Bead Origins

Glass beads were imported during the Initial Contact and Mission periods by the Spanish. They were extremely valuable in colonial southern California, as there were already Native American exchange systems and economic structures organized around shell and stone beads. The Spanish distributed the glass beads to Native Americans, while also limiting and regulating access. Glass beads were extremely valuable to the Spaniards because they could be used as incentives to secure Native American labor (Graesch 2001).

Most studies that address glass bead assemblages during the post-contact and colonial eras in southern California place the origins of glass beads as Venice, Bohemia (now the Czech Republic), and the Netherlands, or, more generally, "central Europe" (Costello 1989; Gibson 1976; Karklins 1982; Kidd 1979; Spector 1976). However, glass beads were part of a world-wide exchange system during the seventeenth, eighteenth, and nineteenth centuries and were produced widely throughout the world.

Archaeological bead scholars have suggested that the majority of glass beads found in southern California during this era were likely imported from the Murano glass factories of Venice, Italy (e.g., Graesch 2001). Chevron beads such as the Type 25 bead recovered from EU 264 are typically Venetian in origin. Chevron beads were manufactured there beginning in the sixteenth century (Allen 1983:188). At least one bead type from the San Gabriel Mission archaeological site assemblage (Type 15, Catalog Number 09490.01) was likely imported from Bohemia. This is a faceted bead with a tubular cornerless hexagonal shape (see Karklins 1985). Elsewhere on the West Coast, these types have been referred to as “Russian” beads, because they were introduced by the Russian-American Company. The beads are not likely of Russian in origin, however, and the argument has been made that they are most likely Bohemian (Ross 1997:181–182).

Bead Summary

Ethnographer John Peabody Harrington collected several statements regarding the Native American (specifically Chumash) of use of glass beads during the American period. His consultants indicated that glass beads, including blue, amber, and yellow varieties, were used in certain dances. “They were strung to go over one shoulder and under the opposite arm” (Gibson 1976:118). In addition, glass beads were used as offerings “at the depository of things of the dead,” which included glass beads, *muñecas* (rag or wooden dolls), silver pieces, and personal items (presumably of the deceased) left at such a shrine (Gibson 1976:119).

Gibson (1976:122–123) proposed temporal groupings for shell and glass bead types in Native American contexts in southern California. Beads that were common in the earliest period, from A.D. 1500 to 1782, included cobalt blue and turquoise blue drawn seed beads, small opaque white drawn beads that were spheroid in shape, and opaque red drawn beads with translucent green centers. Between 1785 and 1816, the available varieties of glass beads increased and included wound and pressed beads.

After secularization in 1834, cultural traditions surrounding beads in Native American society waned. Prior to secularization, the primary source of the glass beads in southern California was the Spanish mission. The influx of Americans after 1847 changed the pattern of bead importation and use. The American period is marked by the presence of faceted beads, and it is unknown whether shell beads were manufactured after 1850.

The Prosser molded beads present in the San Gabriel Mission archaeological site assemblage were produced after secularization, beginning circa 1840. These beads were all recovered within Area 2, primarily in the post-use fill of Chapman’s Mill and Millrace (Features 1 and 20) and the rectangular reservoir (Feature 21). Thus, these deposits likely date to the Secularization period.

Glass Artifacts

Glass artifacts are typically less abundant at California mission sites than other material classes. For example, glass recovered from excavations at the San Buenaventura Mission was too fragmented to yield any information (Greenwood 1976:270), excavations at Santa Clara de Asís Mission from 1985–1988 yielded no Mission-period glass (Hylkema 1995), and fewer than 10 Mission-period vessels, all European in origin, were identified during the barracks excavations at La Purísima Mission (Deetz 1963). Some glass was recovered from Santa Cruz Mission (Allen 1998), and an assemblage from San Fernando Mission contained a very small amount of glass, which was found mainly in the upper midden layers and dominated by aqua and olive glass fragments (Abdo-Hintzman et al. 2010). Excavations at Santa Inés Mission yielded the highest amount of Mission-period glass of the studies reviewed here, consisting of European bottle and window glass and one possible Mexican bottle (Costello 1989).

As with most categories of material found archaeologically at California mission sites, the majority of the glass used was imported from Europe or Mexico. Prior to 1810, virtually all kitchen wares, including glass vessels, were imported from Spanish ships sailing from San Blas, Mexico (Costello 1992a:121). By the late eighteenth century, the majority of glass imported from Spain was manufactured elsewhere in Europe and England (Deagan 1987:128–129). By 1821, English ships sailing from Lima, Peru had supplanted the Spanish trade, albeit with the same English and European vessels (Costello 1992a:121). Another potential source for imported glass was the glassworks at Puebla de Los Angeles, Mexico, which began operation in 1535 and was exporting goods by 1542 (Deagan 1987:129). However, no glass vessels from this glassworks have been definitively identified at any California mission site to date.

The dearth of glass vessel fragments at California mission sites may be attributed to the fact that glass simply does not travel well, and ceramic vessels often served the same purpose as glass. These ceramic vessels were sturdier, and could be reused more times. Additionally, Lightfoot (2005:196) hypothesized that glass is scarce in California mission contexts because it was scavenged by Native Americans for use as "pendants, beads, scrapers, and projectile points." Indeed, three examples of worked glass were recovered from the San Gabriel excavations (Catalog Numbers 01384.01, 18065.01, and 18623.01).

Glass associated with the Secularization period exhibits significant overlap in date with the early American period due to the broad date ranges of the glass-making techniques. Glass from this period is primarily European (especially English) in origin, although American-made glass from the East Coast may be represented as well.

Glass from the American period in California archaeological sites is typically the most diverse in form and function, and consists primarily of American-made glass. Although glassmaking in America began on the east coast in the seventeenth century, the first glass works in California was not successfully established until 1863, with the founding of Pacific Coast Glass Works in San Francisco (Hinson 1995). Glassmaking techniques followed traditional European mold-blown and hand-finished methods until the turn of the twentieth century, when semi-automatic and fully automatic machines were developed in the eastern United States. The first fully automatic bottle machine was developed in 1903 by the Owens Bottle Machine Company of Toledo, Ohio, and by the early 1920s nearly all American-made glass was produced on fully-automatic machines. European glass continued to be manufactured by hand or on semi-automatic machines on a greater scale for much longer, due to the lag in converting to the American technology (Lindsey 2013; Toulouse 1971). Over time, locally- and regionally-produced glass gradually became predominant within the assemblage, peaking in the 1930s with the expansion of the Owens-Illinois Pacific Coast Company of San Francisco throughout California.

Prior to Prohibition, almost all beverage bottles in the United States were refillable or reusable and most could be returned for a deposit, resulting in a relatively low amount of glass recovered from deposits dating to this period. After Prohibition was repealed in 1933, federal laws were passed prohibiting the reuse or resale of liquor bottles, and cans began to replace bottles for soda and beer by the 1950s. By the 1960s, the majority of soft drink and beer bottles were sold in so-called "one-way" bottles marked as "no deposit, no return" (Lindsey 2013). The advent of these disposable glass containers accounts for the comparatively large glass collections that are associated with mid-to-late twentieth century deposits.

Glass Analysis Methods

The glass was analyzed to assess and quantify technology, form, and function. Detailed analysis was conducted for all glass beads and complete bottles, all Mission-period glass, and other diagnostic glass, including flaked glass from the 15 sample excavation units. Other diagnostic glass from outside the sample excavation units and all bulk glass was subject to basic cataloging by lot. In total, 453 of the 5,259 diagnostic glass items were analyzed, out of a total sample of 38,995 glass artifacts.

Functional analysis of the glass assemblage was based on South (1977) and Van Wormer (1996), as outlined in Table 9.2. Under this system, consumer items include various types of bottles, jars, flasks, and their closures. Household items include domestic artifacts such as household furnishings and maintenance products. Personal artifacts are those that can be attributed to an individual, such as items of adornment, toys and games, medicine, and health- and hygiene-related items.

Glass Results

The excavations conducted at San Gabriel Mission yielded 38,995 glass artifacts (Table 9.28). Artifacts made of glass represent a wide range of objects, including various types of bottles, jars, jugs, tableware, beads (see Glass Beads section above), and marbles. Of the collected glass artifacts, 34 were complete bottles, and 5,259 were other items or fragments of containers that were considered functionally and/or temporally diagnostic.

Container glass dominates the diagnostic assemblage, representing 82 percent of the analyzed sample (n = 370). Glass beads (n = 69), tableware (n = 7), light bulb parts (n = 3), a toy marble (n = 1), and worked glass (n = 3) were also analyzed.

Six glass-making technologies are represented in the container/tableware/light bulb portion of diagnostic glass assemblage; excluding beads and marbles, these total 383 items. These consisted primarily of later-American-period glass made by fully-automatic machines (n = 85, or 22.2 percent of the analyzed assemblage). In addition, earlier technologies represented include mouth-blown (n = 41, or 10.7 percent), turn mold (n = 3, or 0.8 percent), cup mold (n = 5, or 1.3 percent), post bottom mold (n = 1, or 0.3 percent), and two-piece (iron-hinged) mold (n = 64, or 16.7 percent). The remainder of the sample assemblage (n = 184 items, or 48 percent) could not be identified with regard to manufacturing technology.

Table 9.28. Glass Artifact Summary

Category	Color	Phase I/II	Phase III	Total
Bulk Glass				
	Amber	1,551	6,587	8,138
	Amethyst	35	329	364
	Aqua	211	2,843	3,054
	Black	49	113	162
	Blue	11	78	89
	Cobalt	67	32	99
	Colorless	3,726	14,345	18,071
	Green	573	2,045	2,618
	Milk	1	80	81
	Olive	95	871	966
	Red or Purple	21	36	57
Other Diagnostic Glass		2,249	2,941	5,190
Glass Beads		5	64	69
Complete Glass Bottles		15	19	34
Flaked Glass		1	2	3
Total		**8,610**	**30,385**	**38,995**

The analyzed glass artifacts include consumer items, household artifacts, kitchen artifacts, and personal items, as well as three items of indeterminate function (Table 9.29). Consumer artifacts make up 81.1 percent of the analyzed glass assemblage. These include beverage containers such as beer, champagne or wine, liquor, milk, and soda or water bottles, as well as food containers such as condiment bottles, jars, and jugs. In addition, medicine or extract bottles are included in this category.

Personal items make up another 16.2 percent of the analyzed glass assemblage. These include the 68 glass beads discussed above, as well as one marble, three toiletry bottles, and one perfume bottle. Household and kitchen items each comprise less than 1 percent of the assemblage. Household items include three fragmentary light bulbs. Kitchen items include fragments of glass cups and tableware.

Table 9.29. Diagnostic Glass Artifact Summary

Artifact Group	Item	Fragmentary	Complete	Total
Consumer	Beer bottle	34	1	35
	Champagne/wine bottle	14	1	15
	Condiment bottle	53	8	61
	Flask	6	1	7
	Indeterminate container	83	2	85
	Indeterminate food	1	–	1
	Jar	33	–	33
	Jug	16	–	16
	Lid liner	1	–	1
	Liquor bottle	17	1	18
	Medicine/extract bottle	25	12	37
	Milk bottle	3	–	3
	Soda/water bottle	52	–	52
	Other container	1	–	1
Household	Light bulb	3	–	3
Kitchen	Canning jar	–	1	1
	Cup	3	–	3
	Indeterminate tableware	3	–	3
Personal Items	Bead	–	69	69
	Marble	–	1	1
	Perfume bottle	–	1	1
	Toiletry bottle	1	2	3
Indeterminate	Flaked glass	3	–	3
Total		**352**	**100**	**452**

Mission-Period Glass

Only a small amount of glass recovered from the San Gabriel Mission archaeological site excavations. Of the Mission-period glass fragments (Figure 9.26; n = 34), 12 fragments are free-blown, mold-blown, or dip-molded very dark olive (or "black") vessel glass, 18 fragments are hand blown aqua vessel glass, and two are colorless hand blown containers, including one vial. Forms consist almost exclusively of wine and liquor bottles, aside from one vial and a possible snuff jar. Four fragments could be Hispanic in origin, including the vial (Catalog Number 08878.01), the neck and finish of a possible oil bottle (Catalog Number 16174.01), a large olive green bottle base (Catalog Number 16937.01), and a large aqua bottle base (Catalog Number 12666.01). The remainder of the glass was likely manufactured in England or elsewhere in Europe.

The majority of the Mission-period glass was found within the Area 1 portion of the site, in the vicinity of the Area 1 Structure (see Figures 4.4 and 4.5). Four fragments were associated with the northwest corner of the building (Feature 36), two with the tile floor on the western edge (Feature 13), and two along the east wall (Feature 3). Twenty additional fragments, including 16 fragments of a single jug, were associated with Feature 14, trash pit that was intrusive into the structure floor. Only one fragment was recovered from sediments east of Area 1, one from Mechanical Trench (MTR) 7 in the far northeast portion of the site, and one from EU 115 in the center of the site, above Feature 8. The remaining fragment is from Undefined Hand Excavation 34. Other glass artifacts that may date to the Mission period are fragments of worked glass. These specimens are discussed above in the Flaked Stone section.

A very small amount of glass from the site can be confidently dated to the Secularization period (Figure 9.27). This period is represented by 15 examples consisting of fragmented vessel glass. Forms include liquor and wine bottles. This portion of the assemblage is small due to the short duration of the time period and the substantial overlap in technologies with the previous and subsequent periods. The remaining majority of the glass dates to the American period.

Figure 9.26. Sample of Mission-period glass from the San Gabriel Mission archaeological site.

Figure 9.27. Sample of Secularization-period glass from the San Gabriel Mission archaeological site.

American-Period Glass

Thirty-six identifiable maker's marks were present on analyzed glass artifacts, each providing a date range for the artifact based upon manufacturing data. (Table 9.30). All of these artifacts date to the American period, together ranging in age from 1866 to the present. Most ranges fall between the 1890s and the 1960s, and the average date of the marked samples is 1932. During the Phase II excavation (Dietler et al. 2010), a concentration of complete, marked bottles dating to the 1930s was found adjacent to Chapman's Mill. These very likely represent refuse that accumulated in the areas of the mill excavated by Marshall and Webb's team in 1934. Photographs of the area from around 1935 show that the excavations were not backfilled, and were allowed to become overgrown with weeds (see Figure 2.12).

Table 9.30. Identifiable Marks on American-Period Glass

Catalog Number	Contents	Description	Mark	Manufacturer	Date Range
00850.01	Medicine or spice	Automatic bottle machine (ABM) medicine bottle, amber glass	"W above a T, within an inverted triangle/ 2 oz/0" embossed on base.	Whitall Tatum Company, Millville, New Jersey	1922–1938
00888.01	Olive oil	ABM bottle, colorless glass	"Re Umberto's Pure Olive Oil" embossed on shoulder. "REG US PAT OFF/ 2" embossed on base.	–	1910–1960s
00888.02	Olive oil	ABM bottle, colorless glass	"Re Umberto's Pure Olive Oil" embossed on shoulder. "REG US PAT OFF/ 3" embossed on base.	–	1910–1960s
00889.01	Medicine (laxative)	ABM medicine bottle, colorless glass	"Omnis Orbis/[Globe Logo]/Warner/Established 1856" printed in blue on screw cap. "MADE IN USA/8" and "1 [Owens Illinois logo] 4" embossed on base.	Omnis Orbis Warner, Est. 1856; Owens Illinois, Toledo, Ohio plant	1934
00889.02	Medicine (laxative)	ABM medicine bottle, colorless glass	"Omnis Orbis/[Globe Logo]/Warner/Established 1856" printed in blue on screw cap. "MADE IN USA/11" and "1 [Owens Illinois logo] 8" embossed on base.	Omis Orbus Warner, Est. 1844; Owens Illinois, Toledo, Ohio plant	1938
00892.01	Medicine	ABM medicine bottle, amber glass	"P L"/ and a triton within a triangular shield embossed on base; "Physician's Sample" embossed on face. Owens-style suction scar on base.	–	1905–present
00893.01	Medicine	ABM medicine bottle, amber glass	"7 [Owens Illinios] 3/ 7." embossed on base.	Owens Illinois, Alton, Illinois plant	1933–1934
00893.02	Medicine	ABM medicine bottle, amber glass	"7 [Owens Illinios] 8/ 2." embossed on base.	Owens Illinois; Alton, Illinois plant	1938
00894.01	Medicine	ABM medicine bottle, amber glass	"8 [diamond with an "I"]" emboss on base.	Illinois Glass Company	1916–1929
00895.01	Medicine or spice	ABM medicine bottle, amber glass	"3W over a T in an inverted triangle/2/2 oz." embossed on base.	Whitall Tatum Co., Millville, New Jersey	1922–1938
00933.01	Medicine or liquor	ABM bottle, aqua glass	"7 (or 1) [Owens Illinois mark] 3/Made in the U.S.A/3".	Owens Illinois; Toledo, IL or Alton, Ohio plant	1933–1943
00934.01	Condiment	ABM condiment bottle, colorless glass	"[Hazel-Atlas mark]/5 K-5862" embossed on base. "2 1/2 oz." embossed on shoulder.	Hazel-Atlas	1920–1964
00935.01	Medicine	ABM medicine bottle, colorless glass	Front panel is embossed with "Dr/ 2/ 4/ 6" from bottom to top; on right "CC/ 10/ 20" from bottom to top. Base is embossed with "[Whitall Tatum mark]/"U.S.A./38".	Whitall Tatum Company; Millville, New Jersey plant	1922–1938
00938.01	Medicine	ABM medicine bottle, amber glass	"7 [Owens Illinois mark] 3/ 7." emboss on base. "PHYSICIAN'S SAMPLE" embossed on shoulder.	Owens Illinois; Alton, Illinois plant	1933–1943

Table 9.30. Identifiable Marks on American-Period Glass

Catalog Number	Contents	Description	Mark	Manufacturer	Date Range
01195.01	Liquor	Post bottom mold liquor bottle, amber glass	"LGCo/24" embossed on base.	Lindell Glass Company, St. Louis, Missouri (1875–1890),Louisville Glass Works (Co.) (ca. 1880), Lyndeborough Glass Company (Lyndeboro), South Lyndeborough, New Hampshire (1866–1888)	1866–1890
02630.01	Canning jar	ABM canning jar, colorless glass	"12 / [Hazel-Atlas mark]/ 0 863" embossed on base.	Hazel-Atlas	1923–1964
02823.01	Soda/ water	Automatic bottle machine soda/water bottle, colorless glass	Stippled base with "[Owens Illinois mark] 5" embossed. "[q]UART" embossed on heel.	Owens Illinois	1945
03024.01	–	ABM bottle, amber glass	Embossed on oval base is "7/ D II/ 56-47/ [Owens Illinois mark]".	Owens Illinois	1929–1954
04118.01	–	ABM bottle, colorless glass	Embossed on base: "D-I/ 54-54/[Owens Illinois]".	Owens Illinois	1954
05638.01	Mustard	Cup bottom mold condiment bottle, amethyst glass	"763/ H" embossed on base.	Holt Glass Works; West Berkeley, California	1893–1906
05649.01	Condiment	Cup bottom mold condiment bottle, amethyst glass	"763/ H" embossed on base.	Holt Glass Works; West Berkeley, California	1893–1906
07000.01	Medicine	Cup bottom mold medicine bottle, amber glass		Whitall-Tatum; Millville, New Jersey	1935–1938
07482.01	–	ABM bottle, amber glass	"I.P.C.Co 3036" on heel	Illinois Pacific Coast Co. San Francisco, California	1930–1932
08046.01	Milk	ABM bottle, colorless glass	"ONE PINT/ ABBOT" embossed on front. "8 - 2" embossed twice on heel.	Abbot	1890–1950s
08048.01	Liquor	ABM flask, colorless glass	"HALF PINT" embossed on back. Red paper label fragment attached to front. "LIQUOR BOTTLE/ 75/ 5/ 2 5603 [Thatcher mark]" embossed on base.	Thatcher Manufacturing Company/Thatcher Glass Mfg. Corporation	1904–1985
08170.01; 08819.01; 21432.01 (mend)	–	Two-part mold (iron-hinged) jar, aqua glass	"WOODBURY GLASS WORKS/ WOODBURY NJ/ 0S" embossed on base. "WOODBURY" embossed on body over Woodbury logo.	Woodbury Glass Works, Woodbury, New Jersey	1882–1900

Table 9.30. Identifiable Marks on American-Period Glass

Catalog Number	Contents	Description	Mark	Manufacturer	Date Range
08192.01	–	Jar (indeterminate manufacture), colorless glass	"Vacuum Jar & Fruit Package Co./ No C 2" embossed on base.	Vacuum Jar & Fruit Package Co., San Francisco, California	1890–1910
08705.01	Wine/ champ-agne	ABM champagne/wine bottle, colorless glass	"4/5 PINT" repeated 4 times and the number "24" embossed on heel. "E & J GALLO WINERY/ MODESTO CALIF./24 7/ 4808/ A/ REFILLING PROHIBITED" embossed on base.	Gallo; E & J Gallo Winery; Modesto, California	1943–ca. 1966
11261.01	Toiletry	ABM toiletry bottle, milk glass	"MENTHOLATUM/ REG. TRADE MARK" embossed on base.	–	1894–present
11583.01	Chili powder	ABM bottle, colorless glass	“Gebhardt Eagle" and "Chili Powder" embossed on bottle's sides. Base embossed with "b [diamond]".	Gebhardt Eagle	1904–ca.1950
12746.01	Perfume	Hand blown bottle, colorless glass	"LUBIN PERFUMEUR PARIS" embossed on front, "HP" embossed on heel.	HP; Lubin Perfumeur Paris	1928–1933
13961.01	–	ABM bottle, amber glass	"7 [Owens Illinois mark] 7/ 77" on base.	Owens Illinois; Alton, Illinois plant	1937
15993.01	Soda/ water	ABM soda/water bottle, colorless glass	Colorless base fragment embossed with "S.P./ 52 [Owens Illinois Makers Mark."	Owens Illinois	1929–1954
17610.01	Beer	ABM beer bottle, amber glass	"[Maywood mark] / 9/ 47/ 9"	Maywood Glass Co.; Compton, California	1930–1959
17162.01	Soda/ water	Soda/water bottle (indeterminate manufacture), colorless glass	"..S INC/ [Thatcher Manufacturing Company makers mark]" embossed on base	Thatcher Manufacturing Company/Thatcher Glass Mfg. Corporation	1904–1985
20702.01	Toiletry	ABM ointment jar, colorless glass	"7 [Owens Illinois mark]0 /9" embossed on base.	Owens Illinois; Alton, Illinois plant	1930–1940

This may have been an attractive location for refuse discard. These dates suggest that the accumulation of refuse slowed in the study area after the completion of the residential subdivision south of Main Street in 1941 (see Chapter 2).

The marked glass artifacts include a variety of medicine, ointment, perfume, beverage, condiment, and other food-related containers. In some cases, specific contents could be identified. Medicine containers identified include two Owens Illinois bottles with marks for Omnis Orbis Warner (Catalog Numbers 00889.01 and 00889.02), a producer of laxatives. Other medicine bottles with identifiable marks included two Physician's Sample bottles (Catalog Numbers 00892.01 and 00938.01), four Whitall-Tatum medicine bottles (Catalog Numbers 00850.01, 00895.01, 00935.01, and 07000.01), two amber-colored Owens Illinois medicine bottles with unknown contents (Catalog Numbers 00893.01 and 00893.02), and one amber-colored Illinois Glass Company medicine bottle (Catalog Number 00894.01).

Toiletry bottles with identifiable marks include a hand blown perfume bottle from Lubin Perfumeur Paris (Catalog 12746.01; Figure 9.28), a Mentholatum jar (Catalog Number 11261.01), and an Owens Illinois ointment jar (Catalog Number 20702.01).

Beverage bottles with identifiable marks include a complete milk bottle (Catalog Number 08046.01), likely from a local dairy, embossed with "One Pint/ Abbot." In addition, a soda bottle fragment (Catalog Number 17162.01) bears the maker's mark of the Thatcher Manufacturing Company of Elmira, New York, and a complete liquor flask (Catalog Number 08048.01) was manufactured by the Thatcher Manufacturing Company of Saugus, California.

Food or condiment bottles with identifiable marks include two condiment bottles manufactured by the Holt Glass Works of West Berkeley, California (Catalog Numbers 05638.01 and 05649.01), a Hazel-Atlas condiment bottle (Catalog Number 00934.01), a Hazel-Atlas canning jar (Catalog Number 02630.01), two Re Umberto Olive Oil bottles (Catalog Numbers 00888.01 and 00888.02), and a Gebhardt Eagle Chili Powder spice bottle (Catalog Number 11583.01). Gebhardt Eagle Chili Powder, which originated in San Antonio, Texas, was the first chili powder spice marketed in America.

Figure 9.28. Lubin Perfumeur perfume bottle from MTR 2. Catalog Number 12746.01.

Glass Summary

Within the San Gabriel Mission archaeological site artifact assemblage, glass artifacts from the Mission and Mexican/Secularization periods are relatively uncommon. Glass items that may date to the Mission period include hand-blown, mold-blown, or dip-molded dark olive (black) glass wine bottles, or aqua-colored glass bottles. In addition, three fragments of glass recovered showed evidence modification for reuse through flaking; these also likely date to the Mission period. Deposits from the site's later periods include larger quantities and a higher diversity of glass artifacts, including personal, medicinal, and toiletry items. The average date for the analyzed, marked glass vessels is 1932. Many of these may have been discarded in the area around Chapman's Mill that Marshall and Webb excavated in 1934.

The majority of the Mission-period glass was found in and around the large structure foundation in Area 1. The largest concentration of glass artifacts is related to the Feature 14 trash pit, which dates to the American period. Most other glass from the site was recovered from post-use (fill) assemblages within the structural features.

Metal Artifacts

The excavations conducted at San Gabriel Mission yielded a total of 38,058 metal artifacts (Table 9.31). Artifacts made of metal represent a wide range of objects, including items of personal adornment, fasteners, containers, munitions, hardware, tools, coins, and kitchen and household items. Detailed analysis was conducted for cans and other diagnostic metal from the 15 sample excavation units, as well as select items from other proveniences. Diagnostic metal and cans from other excavation units as well as all bulk metal were subjected to basic cataloging by lot.

Table 9.31. Metal Artifact Summary

	Phase I/II	Phase III	Total
Can	23	2,370	2,393
Bulk Metal	1,361	30,298	31,659
Diagnostic Metal	9	3,997	4,006
Total	**1,393**	**36,665**	**38,058**

Of the 38,058 metal artifacts, 2,393 (6 percent) were cans, and an additional 4,006 (11 percent) were identifiable artifacts that were considered functionally and/or temporally diagnostic. Much of the bulk metal consists of small and highly corroded fragments of ferrous metal cans, nails, and other consumer and architecture-related items. In total, 748 of these metal items were subject to detailed analysis. These included diagnostic items and cans from the 15 sample units, as well as select diagnostic items from other proveniences.

Metal Analysis Methods

The metal artifacts were analyzed to assess material, technology, form, and function. Materials represented in the sample include ferrous metals such as iron and steel, and non-ferrous metals such as aluminum, lead, silver, copper, copper alloy, brass, and tin.

Functional analysis of the metal assemblage was based on South (1977) and Van Wormer (1996), as outlined in Table 9.2. Under this system, consumer items include various types of cans and container closures. Architectural items include various fasteners, hardware, and building materials. Garment-related artifacts include clothing fasteners such as buckles, buttons, clasps, rivets, and eyelets. Household items include domestic artifacts such as household furnishings and maintenance products. Personal artifacts are those that can be attributed to an individual, such as items of adornment, toys and games, medicine and health- and hygiene- related items. Munitions include musket balls, bullets, and cartridge casings; and the tool group includes various agricultural tools, livery, and other tools. The following discusses the assemblage in light of these interpretive categories and the chronology of the site.

Metal Results

The analyzed metal artifacts include architecture, consumer, garment, household, industry, kitchen, and munitions-related items, as well as coins, hardware, and personal items (Table 9.32).

Architectural items such as bolts, brackets, nails, screws, tacks, hinges, washers, and locks made up the largest portion of the analyzed assemblage, accounting for 37 percent of analyzed metal artifacts. Other hardware such as chain, springs, and straps account for another 26.7 percent of the analyzed items. Garment-related artifacts such as buckles, buttons, eyelets, rivets, and cufflinks comprise 16.2 percent of the analyzed metal assemblage, while another 6 percent of the metal items analyzed are consumer containers such as cans or closures. Tools comprise 5.5 percent of the analyzed metal, and are dominated by livery-related items such as shears, horseshoes, spurs, and tack. Munitions-related artifacts account for another 2 percent of the assemblage, including musket balls, cartridge cases, and bullets.

Table 9.32. Analyzed Metal Artifacts Summary

Artifact Group	Subgroup	Item	Count
Architecture		Wire	104
	Fasteners	Bolt	4
		Bracket	2
		Nail (square)	41
		Nail (indeterminate)	48
		Nail (wire)	54
		Screw	10
		Tack	10
		Washer	2
	Window/door related	Hinge	1
		Lock	1
Coins		U.S. dime	1
		U.S. nickel	1
		U.S. penny	4
		Foreign	1
Consumer	Closures	Crown cap	12
		Other closure	5
		Threaded cap	2
	Containers	Can	24
		Jug or tank	1
		Other container	1
Garment		Clothing embellishment	2
	Fastener	Buckle	12
		Button	76
		Corset busk	2
		Eyelet	23
		Cufflink	1
		Rivet	4
		Suspender hardware	1
Hardware		Chain	8
		Indeterminate	9
		Indeterminate (square)	1
		Lock plate	1
		Spring	126
		Strap	37
		Other hardware	18

Table 9.32. Analyzed Metal Artifacts Summary

Artifact Group	Subgroup	Item	Count
Household		Pin	2
		Key	1
		Light bulb	3
Industry	Railroad	Other	2
		Spike	1
Kitchen	Flatware	Knife	1
		Utensil	3
Munitions		Bullet	3
		Cartridge case	8
		Musket ball	3
		Other munitions	1
Personal Items	Jewelry	Earring	1
		Jewelry fastener	1
		Medallion	2
		Pendant	1
		Pin/brooch	1
		Ring	1
		Watch	2
Tools		Handle	4
		Hook	1
		Unidentified tool	6
	Agricultural tools	Barbed wire	6
		Shears	3
	Livery	Horseshoe	15
		Spur	3
		Tack	2
		Other livery	1
Unknown function		Indeterminate	20
Total			**748**

Personal items such as medallions, pendants, pins, broaches, rings, and watch parts comprise another 1.2 percent of the analyzed metal assemblage. Artifacts from the coin, household, industry, and kitchen groups each represent less than 1 percent of the assemblage.

Consumer Items

Consumer goods represent a small proportion of the diagnostic metal, but it is likely that small, unidentifiable fragments of cans and other consumer items form a sizeable proportion of the bulk metal.

The analyzed consumer goods included 12 crown caps (patented in 1892), two threaded caps (widely used by 1924), and five other closures. Cans were most numerous in this category, and these included cone-top beverage cans (introduced 1935), sanitary food cans (introduced 1904, ubiquitous by 1911), and key-opened cans (used on sardines by 1919) (Rock 1987). The majority of the metal consumer items appear to date to the first half of the twentieth century.

Garment Items

The analyzed metal assemblage includes numerous garment-related artifacts such as buckles, buttons, eyelets, cufflinks, rivets, suspender hardware, corset busks, and clothing embellishments. Fill excavated from Feature 14 included two complete and four fragmentary buckles (Figure 9.29). The complete buckles include a fragmentary rectangular buckle (Catalog Number 09330.01) and a rectangular flat buckle with a central bar and a missing pin (Catalog Number 14673.01). The latter buckle has a cloth imprint on the back surface and may be a horse tack buckle or a belt buckle. In addition, a rectangular curved buckle with a single prong was recovered (Catalog Number 21449.01), which is likely a horse tack buckle.

Figure 9.29. Buckles from Feature 14. Catalog Numbers 09330.01, 14673.01, and 21449.01 (left to right).

Another complete buckle (Figures 9.30 and 9.31) was recovered from the northern portion of the Area 1 structure. Made of brass, this is a pre-Civil War waist belt plate (O'Donnell and Campbell 1996:187, 213; Sewell et al. 2010:332; Smith and Field 2001:125–127). It has two interlocking pieces, with a round frame 1.9 inches (4.8 cm) in diameter and rectangular belt attachments. The central plate features an eagle insignia with a striped shield, surrounded by 27 stars. This style is a nonregulation militia plate which, based on the presence of 27 stars, was struck in 1845 (O'Donnell and Campbell 1996:213). This artifact may be associated with the U.S. Army California Battalion, which was billeted at San Gabriel Mission in 1847 (see Chapter 2).

Figure 9.30. Belt Buckle. Catalog Number 06838.01.

Other garment related artifacts include a brass buckle (Figure 9.32) recovered from Feature 14 (Catalog Number 17828.01). This oval-shaped single-bar buckle features a decorative leaf pattern on one side.

A total of 76 metal buttons were included in the analyzed metal sample. These include buttons made of iron, brass, and copper alloy. Styles include two- and four-hole sew-through buttons, flat disk shank buttons, and a filigree-decorated button or cufflink (Figure 9.33). Dates for these buttons range from the eighteenth century to the mid-twentieth century.

The analyzed assemblage includes 41 pants stud buttons, 31 of which are Levi Strauss buttons recovered from Feature 14. Most of these are of a type that dates from 1902 to 1944. One pants stud button (Catalog Number 17548.01) is a brass World War II–era United States Army button with 13 stars embossed on the face.

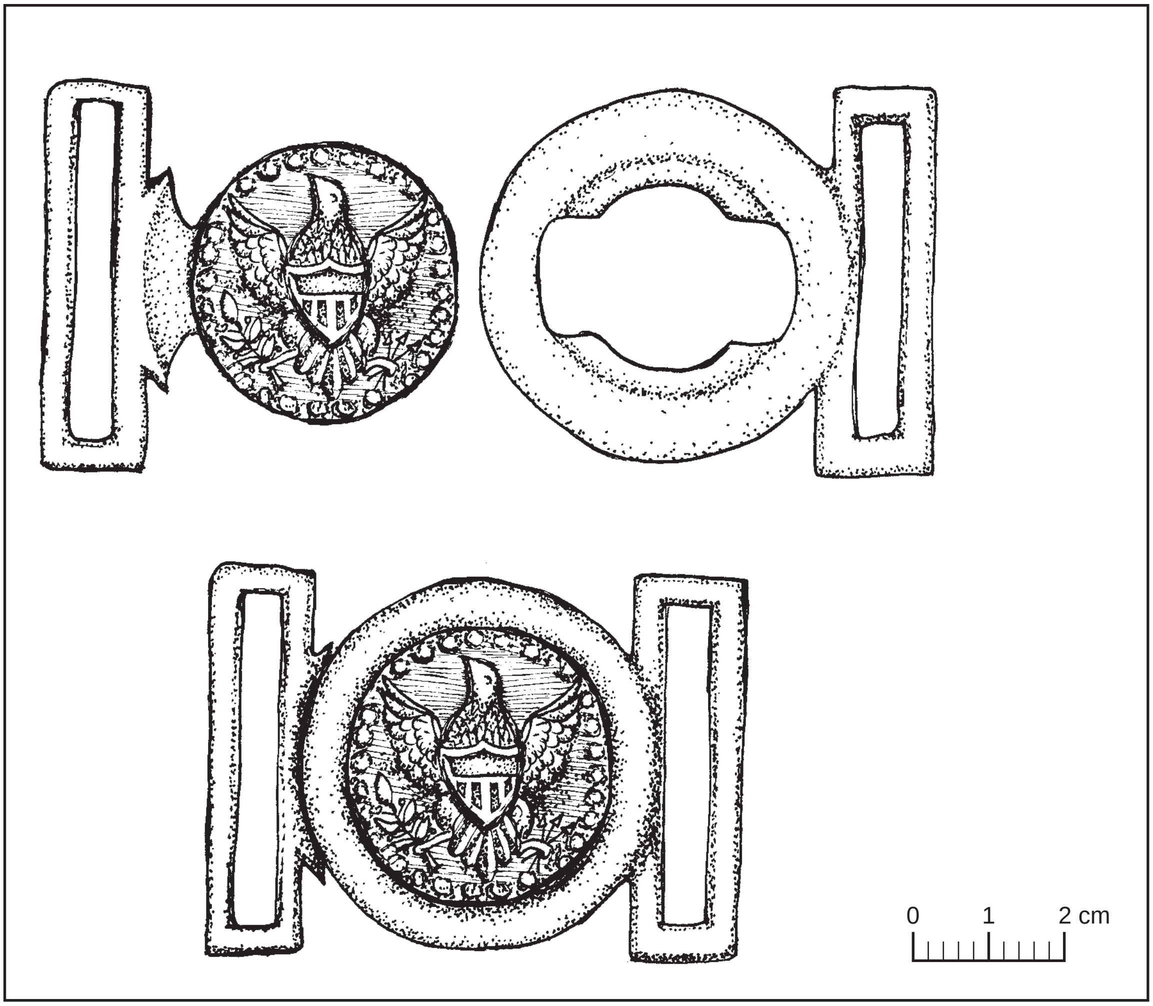

Figure 9.31. Belt Buckle, two views. Catalog Number 06838.01.

Figure 9.32. Brass Buckle from Feature 14. Catalog Number 17828.01.

Figure 9.33. Variety of metal buttons, front view at top, back view at bottom.

Eight one-piece flat disk buttons with shanks were analyzed: four of these had alpha loop shanks, three had drilled eye shanks (for example, Catalog Number 04276.01; Figure 9.34), and one had a shank cast in boss (Catalog Number 11993.01; Figure 9.35).

Alpha loop shank buttons are one-piece flat disk buttons with a loop shank made of hand-drawn wire brazed (a process similar to soldering) to the disk with filler metal. Three of these buttons are undecorated and measure 0.6–0.8 inches (1.5–2.1 cm) in diameter. In general, this technology dates from the 1770s to approximately 1800 (Hughes and Lester 1981:221). The fourth flat disk alpha loop shank button is a phoenix button (Catalog Number 07372.01). Phoenix buttons have been widely documented at archaeological sites on the western coast of the United States, especially along the lower Columbia River in Washington and Oregon and at mission sites in California (Sprague 1998; Strong 1960, 1975). The buttons were produced for the uniforms of the army of King Henri Christophe of Haiti, and made their way to western North America after his death in 1820. They are believed to have been made in England based on "Bushby London" maker's marks observed on some examples. The buttons feature a phoenix with spread wings over a nest of fire, with the motto "JE RENAIS DE MES CENDRES" ("I am reborn from my ashes") encircling the phoenix, and a regiment number below (Figure 9.36). One Regiment 25 phoenix button was recovered from EU 221 in Area 2, adjacent to the triangular reservoir (Feature 10/12/31/39).

Figure 9.34. Button with drilled eye shank. Catalog Number 04276.01.

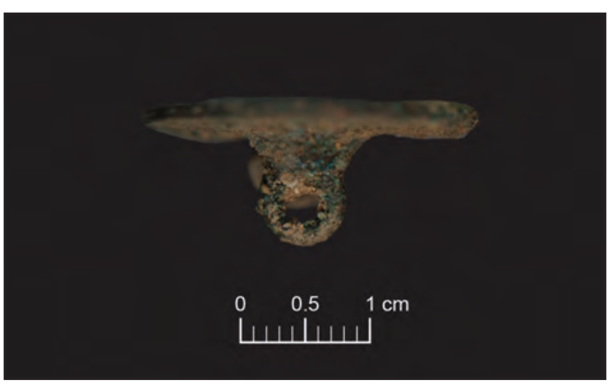

Figure 9.35. Button with shank cast in boss. Catalog Number 11993.01

Figure 9.36. Phoenix button from EU 221. Catalog Number 07372.01.

Other button types include one semi-domed button with a loop shank, one small domed button, seven cross-bar or D-bar buttons, six four-hole sew-through buttons, two two-hole sew-through buttons, and one stamped brass button. One piece (the metal backing) of a two-piece button was also identified (Catalog Number 12837.01), as were two possible button covers (Catalog Numbers 08518.01 and 15116.01). One cloth-covered or possible cloth shank button (Catalog Number 16974.01; Figure 9.37) was collected from Undefined Hand Excavation 34, north of Area 2.

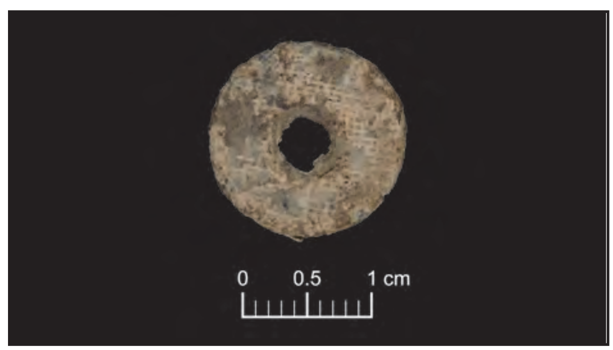

Figure 9.37. Cloth covered or cloth shank button. Catalog Number 16974.01.

A circular, domed button with a colorless faceted glass insert was recovered from EU 105 (Catalog Number 06047.01; Figure 9.38). The button measures 1.6 cm (0.63 inches) in diameter and has a loop shank on the back. This is similar to "jeweled" buttons described by Deagan (2002:171–172), a style that was manufactured in the eighteenth and nineteenth centuries.

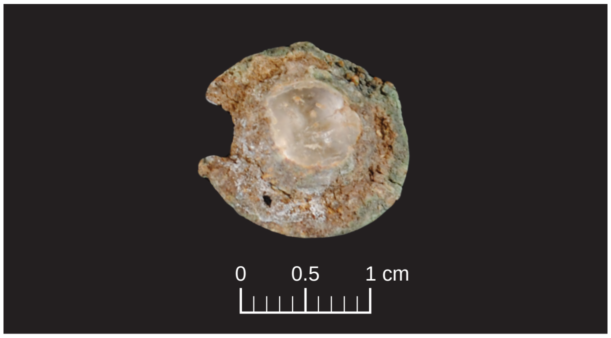

Figure 9.38. Jeweled button from EU 105. Catalog Number 06047.01.

One brass filigree button or cufflink (Catalog Number 13292.01; Figure 9.39) was recovered from EU 208 in Area 2, atop Chapman's Mill (Feature 20). The body of this fastener is hollow and round, with an attached loop on the backside. The body measures 0.47 inches (1.2 cm) in diameter and the decoration is a floral motif.

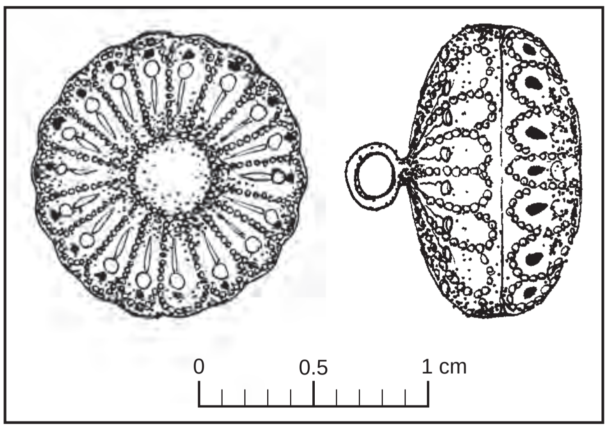

Figure 9.39. Brass filigree fastener from EU 208. Catalog Number 13292.01.

Personal Items

Personal items made of metal include two religious devotional medals and one pendant. A religious devotional medal (Catalog Number 01005.01; Figures 9.40 and 9.41) was recovered from Trench 1, Section C during the project's testing phase (Dietler et al. 2010:56), within the trough of the millrace. The medallion measures 1.5 inches (3.8 cm) in diameter. The obverse depicts the bust of a man, with an inscription on the left that may read "N_T" and an inscription on the right reading "VNDUS ALVA."

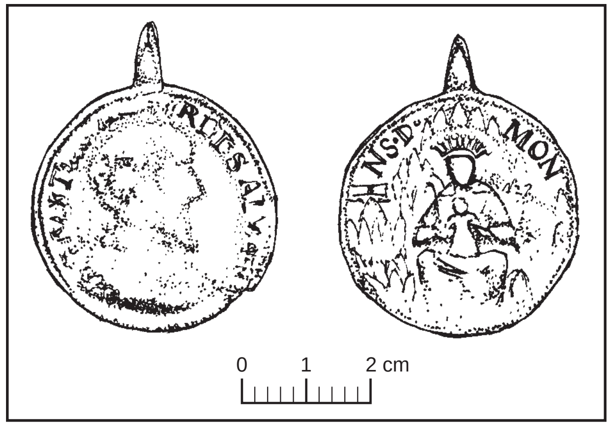

Figure 9.40. Religious devotional medal. Catalog Number 01005.01.

Figure 9.41. Religious devotional medal. Catalog Number 01005.01.

The reverse side depicts a seated person with a smaller figure in her lap, undoubtedly Mary and the infant Jesus. Mary sits in the Queen of Heaven pose, with a scepter in her right hand and a crown on top of her head. The background suggests mountains, and the letters "NSD" and "MON" are visible above the central image. This is the abbreviation for *Nuestra Señora de Montserrat*

(Our Lady of Montserrat). The bearded figure on the obverse is likely Saint Benedict. A Benedictine monastery located in Montserrat, a mountain near Barcelona, Spain houses a sculpture of Mary known as a “black Madonna.” The location has historically been a popular site of pilgrimage and Our Lady of Montserrat is the patron saint of Catalonia.

A second religious devotional medal (Catalog Number 17791.01; Figure 9.42) was recovered during surface collection near the Millrace Complex. The obverse of this medal includes a depiction of Mary with the inscription “MARY CONCEIVED WITHOUT SIN / PRAY FOR US WHO HAVE RECOURSE TO YOU.” The reverse depicts an M with a cross and two hearts surrounded by 12 stars. This is a so-called “miraculous” medal. The popular cult of the Immaculate Conception experienced a revival in the early nineteenth century, with the striking of this style of medal beginning in 1832; it is claimed that by 1875 there were more than 30 million of these medals in circulation throughout the world, and they continued in use through the mid-twentieth century (Deagan 2002:54). The example from San Gabriel Mission likely dates to the twentieth century, based on its condition and quality of manufacture, attesting to the long duration of this practice.

Figure 9.42. Religious devotional medal. Catalog Number 17791.01.

A copper disk pendant (Catalog Number 07159.01; Figure 9.43) was recovered from EU 194, located west of the Area 1 Structure. This pendant is 2.4 cm (0.9 inches) in diameter and is engraved with flowers and script that appears to read “Laurenn” on the obverse, and with two roses on the reverse. The pendant has a pierced perforation at the top center above the decoration.

Figure 9.43. Pendant from Unit 194. Catalog Number 07159.01.

Other personal items include a possible finger ring (Catalog Number 07371.01; Figure 9.44); several sequins (Catalog Numbers 11453.01 and 16888.01),

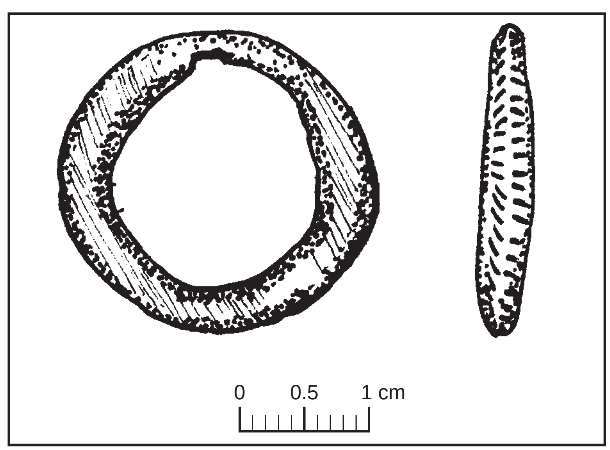

Figure 9.44. Ring. Catalog Number 07371.01.

a silver pendant earring (Catalog Number 07373.01; Figure 9.45), and a hair pin (Catalog Number 16854.01; Figure 9.46).

Figure 9.45. Silver pendant earring. Catalog Number 07373.01.

Figure 9.46. Hair pin. Catalog Number 16854.01.

Tools and Livery Items

Tools in the assemblage that were analyzed include one full pair and one half pair of sheep shears, both hand forged of iron and recovered from within the Area 1 Structure (Catalog Numbers 05068.01 and 07990.01). The full pair of shears (see Figure 8.9) has blades 6.3 inches (16 cm) long and is approximately 12.8 inches (32.5 cm) in length, including the handle.

Two fragments of a Western- or Spanish-style spur were recovered from EU 135 in Area 1 (Figure 9.47). The swan neck spur is made of iron and includes the left side of the yoke, neck, and rowel. In addition, an engraved aluminum inlay was recovered, which mends to the exterior of the yoke of the spur.

A fragment of a possible horse tack accessory or a handle featuring a finial (Figure 9.48) was recovered from EU 106, in Area 2. This copper artifact is approximately 6.1 cm long.

Figure 9.47. Spur recovered from EU 135. Catalog Number 03804.01.

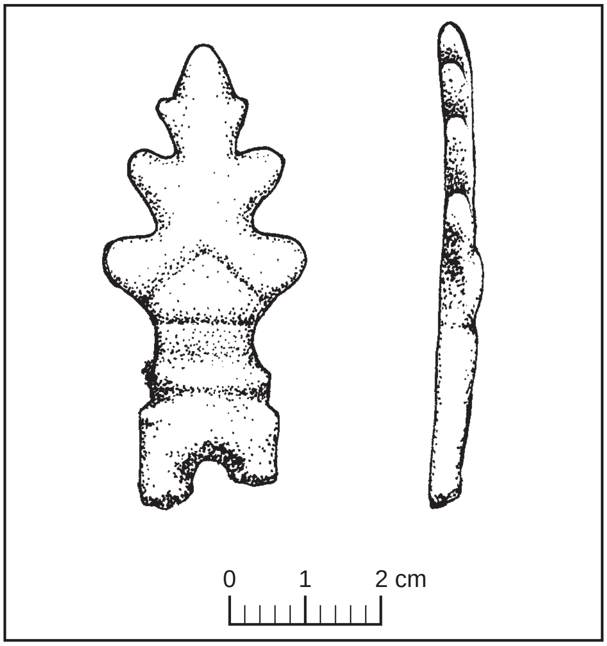

Figure 9.48. Horse tack accessory or handle from EU 106. Catalog Number 05531.01.

Coins

A total of seven coins were analyzed. Six date to the American period. These include four United States pennies; the three with legible dates were minted in 1934, 1944, and 1975. In addition, a 1906 nickel and a 1967 dime were recovered. Most of these twentieth century coins were found in initial excavation levels or in disturbed soils. The 1934 and 1975 pennies and the 1967 dime came from Area 2; the 1944 penny came from EU 194 in Area 1; and the 1906 nickel was collected as a point provenienced artifact in the South Midden area.

A silver Spanish one-*real* coin (Figures 9.49 and 9.50) was recovered from Feature 14 at 140 cmbd (Datum 3). The coin measures 2.1 cm (0.8 inch) in diameter. On one side, the coin has a Bourbon coat of arms at the center, flanked by the pillars of Hercules on each side, with the letters around the edge of the coin reading "NE 1R / HISPAN…I," the abbreviation of HISPANIARIUM AND INDIARIUM REX, meaning King of Spain and the Indies (Deagan 2002:252). The reverse face features a bust at the center and the legend reads "FERDIN VII / DEI GRATIA / 1816."

Figure 9.49. 1816 Spanish coin from Feature 14. Catalog Number 05644.01.

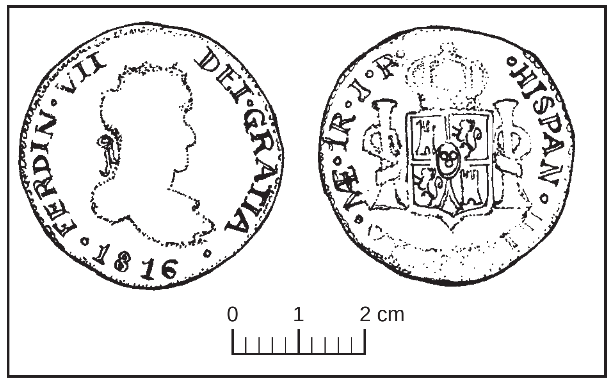

Figure 9.50. 1816 Spanish coin from Feature 14. Catalog Number 05644.01.

This is a Ferdinand VII "Bustos" coin, minted in Lima, Peru in 1816 during the reign of Ferdinand VII (1808–1833). These coins were produced until Peruvian independence in 1824 (Deagan 2002:254). Because most of the diagnostic items found in Feature 14 date to the American period (see Chapter 6), it is likely that this coin was quite old when discarded.

Metal Summary

The metal artifacts recovered from the San Gabriel Mission archaeological site may be the most diverse of all of the artifact categories. This category includes building materials, hardware, cans, bottle caps, coins, jewelry, tools, and horse tack, representing the broad range of activities that took place within this agricultural community.

The site's broad history is represented with well-dated metal objects, including an 1816 coin, an 1820s phoenix button, a belt buckle possibly associated with the 1847 U.S. Army occupation of the mission, railroad items associated with the post-1874 Southern Pacific Railroad, and consumer goods and coins dating to the early and mid-1900s.

Functional Artifact Groups

The analyses discussed in this chapter investigated artifacts from San Gabriel Mission archaeological site manufactured from stone, bone, glass, and metal, as well as beads made of shell, glass, and ceramic. In addition to distinguishing material types, it is also useful to consider the function of each artifact group. Toward this end, artifacts from the 15 sample excavation units were classified according to the functional artifact groups described in Table 9.2. The material from these sample excavation units was considered to be fairly representative of the assemblage as a whole (Table 9.33). Of the materials for which function could be determined, 77.7 percent were building materials, attesting to the dominance of debris related to the large buildings that once stood in the study area (see Chapter 6). Consumer items made up 13.5 percent of the assemblage, kitchen artifacts made up 6.5 percent of the assemblage, and tools made up 1.7 percent of the assemblage. Artifact groups accounting for less than 1 percent of the items each include coins, garment, household, industry, lithic, munitions, and personal items.

Comparing the sample excavation units from different areas of the site reveals some interesting trends (Figure 9.51). The Area 1 materials include a larger percentage of consumer artifacts and tools, and a smaller proportion of architecture-related artifacts than the other site areas. This reflects the dense concentration of consumer refuse in the Feature 14 trash pit. The relative proportions of artifacts belonging to the various functional groups are fairly similar to one another in Area 2 and the South and North Middens. In each of these sample areas, more than 75 percent of the recovered artifacts were architectural. The North Midden sample excavation units contained few kitchen artifacts than other areas, while this activity group dominated the non-architecture material in the South Midden. The horizontal distribution of artifacts is explored in greater depth in Chapter 11.

Table 9.33. Summary of Sample Unit Assemblages by Artifact Group

Artifact Group	Area 1 Sample Units	Area 2 Sample Units	North Midden Sample Unit	South Midden Sample Units	All Sample Units
Architecture	35.33%	87.57%	92.16%	75.55%	77.65%
Coins	0.02%	0.01%	–	–	0.01%
Consumer	49.02%	5.37%	4.38%	7.92%	13.50%
Garment	2.49%	0.02%	0.03%	0.05%	0.48%
Household	0.17%	–	0.03%	–	0.04%
Industry	0.02%	–	0.03%	–	0.01%
Kitchen	4.78%	6.92%	2.58%	14.14%	6.47%
Lithic	–	0.01%	–	–	–
Munitions	–	0.01%	–	0.05%	0.01%
Personal items	0.40%	0.09%	0.08%	0.40%	0.17%
Tools	7.78%	0.01%	0.73%	1.89%	1.67%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

Note: Values are percent of sample unit artifact total, by count. Sample Units are as follows. Area 1 (n = 5,271): Units 121, 135, 149, 165, 166, 243, and 255; Area 2 (n = 17,478): Units 105, 108, 137, and 206; North Midden (n = 3,724): Unit 269; and South Midden (n = 2,008): Units 118, 273, and 282.

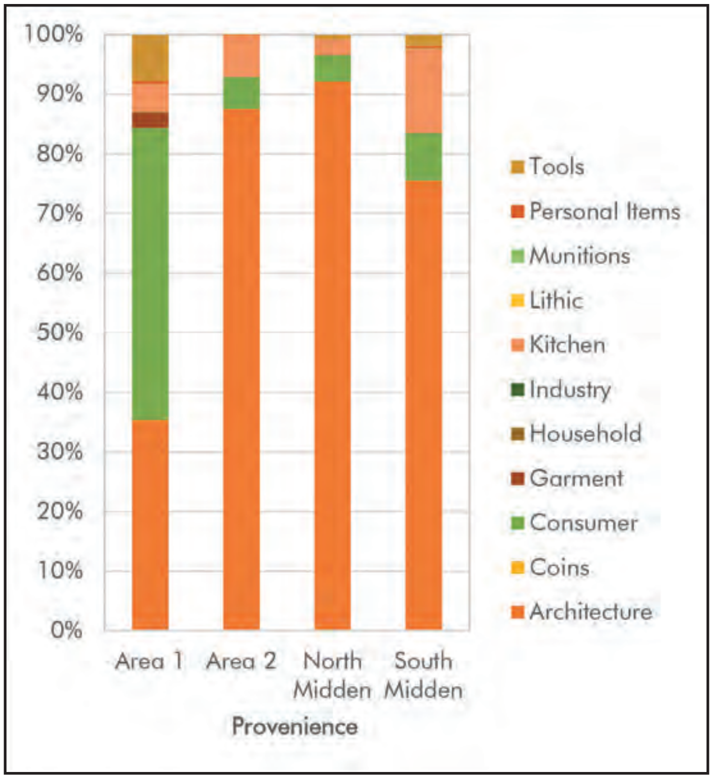

Figure 9.51. Summary of sample unit assemblages by artifact group and site area.

CHAPTER 10: CERAMICS

M. Colleen Hamilton, Kholood Abdo Hintzman, Suzanne Griset, and Heather Gibson

A total of 12,407 ceramic artifacts were collected during the study (Table 10.1). The majority of artifacts made of ceramic were sherds of vessels that were either produced locally by Native Americans or imported from Europe, Asia, or Mexico. These vessel ceramics generally fall into either the consumer or kitchen artifact groups. In addition to vessels, other artifacts made of ceramic include household items, tobacco pipes, buttons, beads, dolls, marbles, and other toys.

The Imported Ceramics section of this chapter was prepared by M. Colleen Hamilton and Kholood Abdo Hintzman. The Native American Ceramics section was prepared by Suzanne Griset. The Non-vessel Ceramics section was prepared by Heather Gibson.

In total, 12,379 ceramic vessel sherds were recovered from the study area. Of these, 8,040 sherds were identified as Native American; the remaining 4,204 sherds were imported from the Spanish East Indies, New Spain/Mexico, Great Britain, and China. Most of the sherds date to the Mission period (1769–1834), while a smaller number date to the Secularization period (1834–1847). Later-period British and American ceramics dating to the mid- to late 1800s were also recovered, primarily from in and around the refuse pit in the western portion of the site (Feature 14). This chapter presents the results of analyses of all ceramic artifacts, including ceramic (Prosser) beads, which are also included in the bead section of Chapter 9, Artifacts. It begins by describing imported ceramics of European, Mexican, and Asian origin. This is followed by a discussion of Native American ceramics.

Table 10.1. Ceramic Artifact Summary

		Phase I/II	Phase III	Total
Imported Ceramics		1,003	3,364	4,367
	Consumer	41	192	233
	Garment	–	13	13
	Household	3	30	33
	Industry	2	5	7
	Kitchen*	887	2,882	3,769
	Personal Items	6	37	43
	Unknown	64	205	269
Native American Ceramics		701	7,339	8,040
Grand Total		**1,704**	**10,703**	**12,407**

Imported Ceramics

All 4,204 imported ceramic vessel fragments recovered from the excavations were analyzed at the laboratory of Applied EarthWorks, Inc., in Hemet, California. Basic analysis of the assemblage involved grouping the ceramics by ware type and identifying decorative technique, color, and style. Of the 4,204 sherds reviewed, 866 were not identifiable to origin of manufacture (Mexican, Majolica, Asian, British, or American earthenware). Further, a sample of 474 sherds from 19 excavation units was subjected to more detailed analysis, which involved identifying surface decorative treatment, registered patterns, or manufacture/registry marks. In addition, mending or refitting of sherds from across proveniences was completed. Counts do not reflect mending. The sample for detailed analysis was selected primarily from three areas of the site (Table 10.2; see Figure 4.6).

Methodology

The initial step taken in the analysis of the ceramics assemblage was classification of ware type based upon technical attributes. Each ceramic sherd was examined for paste consistency, density, color, and hardness. Paste refers to the clay fabric that forms the vessel. It is composed of clay and added or natural fluxes that are formed into a wet malleable state prior to forming the vessel in preparation for firing. Distinctions between ware characteristics are related to kiln firing temperature and physical characteristics of the material, such as hardness, porosity, and color (Rice 1984). Ceramic wares include three basic classifications based on paste characteristics: earthenware, stoneware, and porcelain. Earthenware can be further subdivided into refined and unrefined, which refer to the preparation of the ceramic body and firing temperature. Once the paste type was identified, sherds were examined for general surface treatment such as finishing and glazing; this can include lead glaze, salt glaze, lead slip, tin enamel, unglazed, and polished (burnished) ceramic surfaces. These treatments may occur on the interior and/or exterior of the vessel. Next, secondary decorative treatments were identified and recorded. Decorative treatments can include painted, transfer printed, molded, gilded, and edge/rim decorated. Design patterns were categorized as floral, scenic, geometric (bands and lines), and stylized patterns or a combination therein. Percentages for decorative classes are based on the total number of sherds within a given ware and/or decorative type, which is provided at the beginning of each ware type discussion.

Ware Types

The San Gabriel Mission nonnative ceramics collection is divided into broad ware classifications that have implications for dating. Four types of eighteenth- and nineteenth-century imported ceramics were recovered from San Gabriel Mission: 1) Mexican-made low-fired earthenware; 2) tin-enameled Majolica (which is also a low-fired earthenware manufactured in Mexico); 3) Chinese export ceramics, including porcelains and stoneware; and, 4) British refined earthenwares (dates subdivided below) (Table 10.3). British and American earthenwares can be subdivided into three temporal components: early British ceramics (1750s–1830s), transitional ceramics (1840s–1860s), and late Victorian-era ceramics (1870s–ca. 1901). These classifications are based on decorative attributes and/or firing techniques. British- and American-made late-period ceramics include improved white paste earthenware such as white ware, ironstone, or vitrified earthenwares, of which a few were found at the San Gabriel Mission archaeological site.

Table 10.2. Sample Excavation Units for Detailed Analysis

Area/Provenience	Sample Excavation Units	Number of Sherds Analyzed
Area 1	121, 135, 165, 166, 243, 255	108
Area 1, Feature 14 (refuse pit)	149	6*
Area 2	105, 108, 137, 206, 251, 252	203
North and South Middens	118, 273, 282, 270, 271, 283	157
Total		**474**

*This represents a sample of sherds from this unit.

Table 10.3. Imported Ceramics from San Gabriel Mission Archaeological Site

Ware	Type	Subtype	Count	Percent of Total
Mexican Low-fired Earthenware	Galera		131	
	Brunido (Tonala)		10	
	Other Lead-glazed		25	
	Unglazed		46	
	Indeterminate		21	
	Subtotal		**233**	**5.5%**
Majolica Tin-Enameled Earthenware	Puebla Blue-on-white	Hujotzingo	13	
		Wavy	21	
		San Augustine	5	
		(general)	159	
	Puebla Polychrome	San Elizario	243	
	Abo/Aranama Polychrome	Monterey	23	
		(general)	22	
	Undecorated		396	
	Subtotal		**882**	**21.0%**
Chinese Export Ceramics	Underglaze Porcelain	Canton	40	
		Nanking	4	
		Blue Canton/Nanking	4	
		(general)	37	
	Overglaze Porcelain	Famille Rose	19	
		Late-Eighteenth-Century Bands and Lines	3	
		(general)	24	
	Provincial Ware		20	
	Chinese stoneware		6	
	Undecorated		38	
	Indeterminate		4	
	Subtotal		**199**	**4.7%**
British Earthenwares	Cream ware	Decorated	2	
		Undecorated	166	
	Pearl ware	Decorated	115	
		Undecorated	49	
	White ware	Decorated	480	
		Undecorated	310	
		Other	566	
	Other earthenware		866	
	Subtotal		**2,554**	**60.8%**
Other Ceramics			336	8.0%
Total			**4,204**	**100.0%**

The following is a discussion of the various ware types recovered from the site, primarily focusing on the ceramics from the sample units. However, some ceramic types found at the site were not represented in the sample units. These types are described because they are important to understanding the chronology of the collection as a whole.

Mexican Low-Fired Earthenware (1780–1830)

This type totals 233 sherds and composes 5.5 percent of identifiable ware types (see Table 10.3). During the sixteenth century, the Spanish introduced unrefined soft paste earthenware manufactured in the portion of New Spain later known as Mexico. These vessels were molded or wheel-thrown and glazed, at least in part, with a clear, lead salt glaze. Vessels were largely utilitarian in form and upon introduction were quickly absorbed into indigenous cultures. These ceramics were produced on a large scale in Mexico and various locations throughout New Spain (Benté et al. 1990:4B-1). Small quantities were produced at Alta California missions (Skowronek et al. 2003), but it remains unknown whether they were produced at San Gabriel Mission. Lead-glazed earthenwares include Galera, Brunido (or Tonala), and green and brown glazed earthenware. Galera derives its name from the technique of glazing and its red paste. Brunido wares are similar in construction and firing technique but are best described as gray-bodied vessels revealing a thin slip and/or burnished exterior surface (Benté et al. 1990:4B). All ceramic variants were produced in New World colonies between 1780 and 1830, although modern versions are still commonly produced by the potters of Jalisco, Mexico. Early variants can be distinguished from modern types when found in context with other early ceramics. Lead-glazed wares include green and brown glazed ceramic vessels, though the origin of their production is not fully understood (Hamilton et al. 2006). Unglazed wares include burnished ceramic sherds and cream wares, painted with black and/or red lines and swirls.

Galera

Lead-glazed wares mostly represent Galera, with very few examples of Brunido or Tonala (see Table 10.3). While Galera sherds from each of the three sampled areas of the site vary in terms of quantity, the majority of the recovered sherds came from Area 2, where 75 fragments were recovered. Only 35 Galera sherds were found in the North and South Midden areas; another 13 were found in Area 1. The remainder of the Galera sherds were collected from the surface or from test units located outside the data recovery study area.

The assemblage of low-fired earthenware is highly fragmentary; few sherds mend. General vessel shape was determined from rim sherds representing plates and shallow bowls, small jars, and cups. Galera recovered from the site include plain, undecorated, and painted body and rim fragments. Plain vessels are covered on the interior with a clear or green glaze usually carried over the rim, leaving the rest of the vessel exterior unglazed. The exterior of some sherds show soot blackening from being used on an open fire.

Painted Galera was decorated with black underglaze or overglaze monochrome decorations. Since the ceramic sherds are very fragmentary, it was difficult to identify or reconstruct complete decorative patterns or design elements. Vessels display both interior and exterior secondary decoration. Patterns include dots along the rim and lines or bands on the exterior and interior of vessel rims. One vessel fragment is painted on the exterior with a geometric pattern of a swirled shape within two parallel lines. A few sherds are painted on the interior with an abstract fan design. This motif was executed in thick brush strokes representing leaves or a floral pattern (Figure 10.1). Only two small sherds were identified as polychrome. These are Galera decorated with black lines and white dots over a dark red exterior glaze (Figure 10.2, left and bottom left). A single Galera rim exhibits a green glaze (see Figure 10.2, top right).

Figure 10.1. Various Galera sherds from the San Gabriel Mission archaeological site.

Figure 10.2. Galera sherds from the San Gabriel Mission archaeological site, including polychrome sherds (left and bottom left) and green glazed sherd (top right).

Brunido (Tonala)

Brunido (Tonala) sherds are few in number, represented by 10 specimens. Of these, one was collected from Area 1 and nine were collected from Area 2. These are mainly grayish-cream exterior and interior body fragments of utilitarian bowls and/or jars (Figure 10.3). A few sherds exhibit a finely executed painted exterior, but are too fragmentary for further identification of the pattern. All sherds represent fragments of small vessels such as bowls or jars.

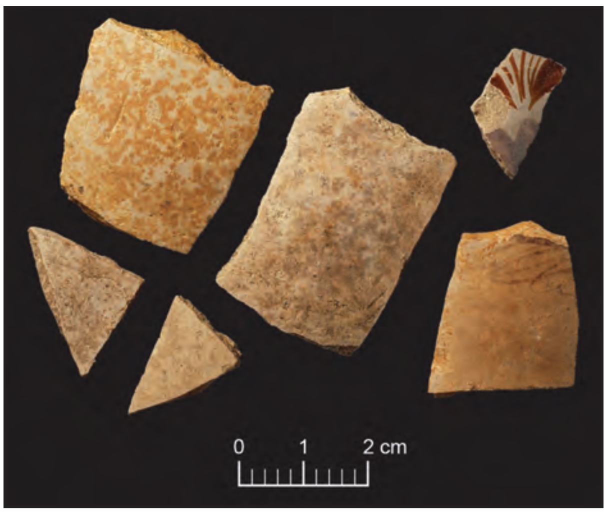

Figure 10.3. Tonala sherds from the San Gabriel Mission archaeological site.

Other Lead-Glazed Sherds

Other lead-glazed sherds, which consist of 25 total specimens, have some evidence of glaze, either green or brown (Figure 10.4). These fragments represent small and large utilitarian jars, and they were recovered from all areas of the site. More than half of these, or 13 specimens, were recovered from Area 2, another 10 were recovered in the North Midden and South Midden, and the remaining two were found in Area 1.

Unglazed

Low-fired unrefined earthenware included 46 specimens of unglazed utilitarian fragments. Of these, eight were collected from Area 1, 27 from Area 2, eight from the North Midden, and three from the South Midden. These sherds likely represent small- and medium-sized utilitarian jars and bowls. Examples include burnished cream sherds painted with black and/or red horizontal lines and swirled patterns (Figure 10.5) and olive-jar ringed neck portions (Figure 10.6).

Majolica Tin Enameled Earthenware (1750–1835)

This type totaled 882 sherds, which comprised 21 percent of the identifiable ware types. Majolica (or Maiolica) earthenware is a hallmark of Spanish colonial tradition and characteristic of Spanish-era archaeological assemblages found in Alta California. It is a class of earthenware best described as a porous, soft paste pottery, with an opaque enamel glaze. Majolica derives from a long tradition of pottery making introduced to the New World with roots in Majorca, Spain (Barnes and May 1972; Benté et al. 1990; Deagan 1987; Fairbanks 1972; Goggin 1968; Lister and Lister 1974, 1976, 1982; and Cohen-Williams and Williams 2004). This earthenware was first produced in La Puebla de Los Angeles, Mexico, in the sixteenth century. To the eighteenth-century potter, this ware type was known as *loza blanca* (Benté et al. 1990:4A-1). To the eighteenth-century potter, this ware type was known as *loza blanca* (Benté et al. 1990:4A-1). As described by Barber (1915:5): Maiolica is a soft pottery, of whitish to buff tint, covered with an enamel, or glaze, whose dense white color and hardness are imparted by a greater or lesser proportion of tin in the composition. Being entirely opaque, the tin or stanniferous enamel will obscure any decoration, which may be applied beneath it. The colors must be painted either over the enamel, after it has been fixed by the fire, or in it, being applied to the dry enamel before firing. After being fused in the kiln, the tin glazed designs appear to be incorporated with the enamel. This later method was the one employed by the Mexican potters.

By 1600, Mexican ceramicists perfected the production of Majolica (Deagan 1987:71), and most of the Majolica that arrived in Alta California in the 1700s derived from Mexico rather than Spain (Voss 2012:44).

Figure 10.4. Mexican green and brown glazed sherds (exterior and interior views).

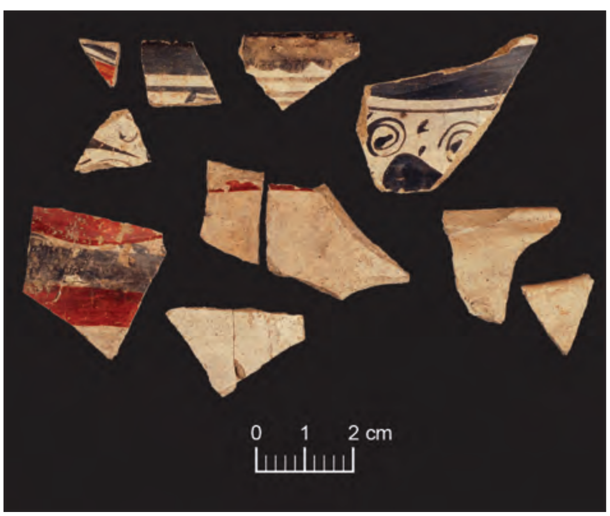

Figure 10.5. Red and black on cream sherds from the San Gabriel Mission archaeological site.

Figure 10.6. Olive jar ringed neck recovered from Area 2.

Painted designs found on ceramics from Spanish colonial sites generally are believed to be eighteenth-century renditions of Chinese porcelain patterns exhibiting European artistic influence (Benté et al. 1982:77–78). Designs developed for importation to the New World evolved from the Puebla blue-on-white tradition. Stylistically, these vessels were decorated with blue rim bands, parallel rows of dots or stylized flowers, with a centrally placed motif commonly composed of a floral unit. Benté et al. (1982:77) refer to these as medallions. Changes to this decorative tradition have been shown to be temporally sensitive, often expressed in the re-emphasis of traditional elements with the addition of subtle changes in color palette or highlighting of key attributes. Variants of the Puebla blue-on-white tradition include polychrome designs composed of brown, green, yellow, and orange pigments.

Puebla Blue-on-white (1769–1835)

Puebla Blue-on-white is divided into several variants. Those found at San Gabriel Mission archaeological site include Huejotzingo, Wavy Rim, and San Augustine variants, all of which are described in detail below. The recovered sherd fragments represent tableware such as plates, cups, and bowls.

Huejotzingo Blue-on-white

This type is characterized by a single blue band encircling the vessel lip. The blue band could be on or near the lip (Figure 10.7). This simple decoration is applied on creamy white enamel and generally exhibits crazing, or a web-like network of fine cracks. Vessel type variations usually include chocolate cups, soup plates, and bowls (Cohen-Williams and Williams 2004:19). Among the 13 examples of Huejotzingo sherds found at the San Gabriel Mission archaeological site, a total of 12 were found in Area 2. Only a single example of Huejotzingo was found in Area 1. In the San Gabriel Mission assemblage, all Huejotzingo sherds are plate fragments.

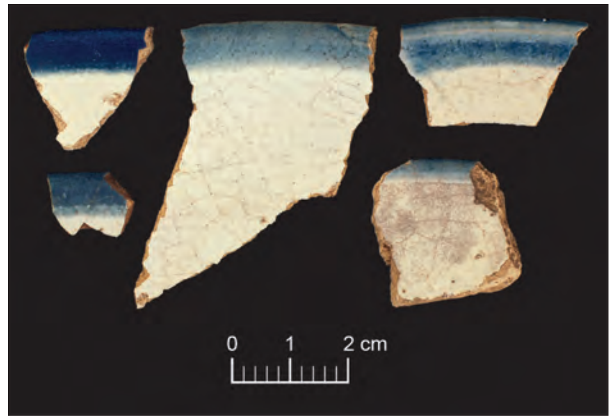

Figure 10.7. Huejotzingo Blue-on-white sherds from the San Gabriel Mission archaeological site.

Wavy Rim Blue-on-white

This type is characterized by a wavy cobalt blue band encircling the vessel lip applied on creamy white enamel, displaying crazing. This decoration is found primarily on the rims of soup bowls (Cohen-Williams and Williams 2004:22). A total of 21 Wavy Rim Blue-on-white sherds were recovered, 16 of which came from Area 2 (Figure 10.8). One sherd came from Area 1. The remaining four sherds were from the North Midden.

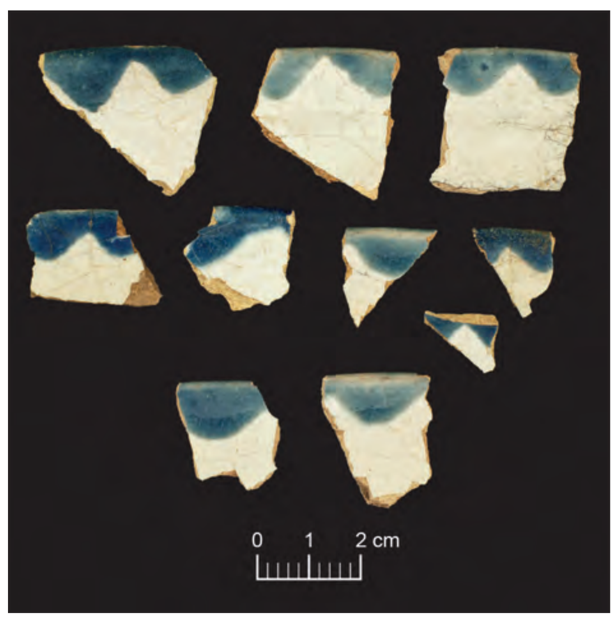

Figure 10.8. Wavy Rim Blue-on-white from Areas 1 and 2.

San Augustine Blue-on-white (1750–1800)

This type, a variant of Puebla Blue-on white, is characterized by the use of two colors of blue—a dark rich cobalt blue and a lighter medium blue. The decorative attributes generally cover the entire surface of the vessel and can include floral and geometric design elements. An occasional anthropomorphic or zoomorphic motif is incorporated into the design, generally set as a central medallion. These decorations are applied on smooth, white, glossy enamel. San Augustine Blue-on-white has been found on plates, bowls, and jars. The medallion, when present, is situated in the interior base of the plate or bowl. San Augustine Blue-on-white is common on Spanish colonial sites from the first half of the eighteenth century (Cohen-Williams and Williams 2004:24).

At the San Gabriel Mission archaeological site, this decorative type is represented in limited numbers. The five examples were retrieved from Area 2, where a plate rim was found in Excavation Unit (EU) 105. Examples retrieved generally exhibit floral patterns.

Puebla Blue-on-white General Category

A total of 159 sherds recovered at the site were too small to be identified as a specific variant and were placed in the general category of Puebla Blue-on-white. Design elements identified from the San Gabriel assemblage include floral patterns exhibited on plate rim sherds, along with medallions similar to the San Elizario polychrome category (described below). The Puebla examples, however, lack the use of black accents typical for San Elizario examples. This assemblage exhibits bands with pendant floral petals created from a combination of lighter and darker blue elements (Figure 10.9). Small cups and bowls are decorated on the exterior with blue lip band and light blue bands and dots.

Figure 10.9. Puebla Blue-on-white sherds from the San Gabriel Mission archaeological site.

In general, Puebla Blue-on-white vessel fragments are identified by the presence of cobalt blue decorations. While a few plate rim sherds were recovered, in an assemblage totaling 116 samples, a majority of fragments typed under this category derived from small cups. This classification was based on the many fragments with thin walls, in addition to the presence of numerous bases with small diameters. Cups are usually decorated on the exterior with a cobalt blue band encircling the lip, with horizontal bands and dots and/or clusters of petals covering the rest of the exterior. Area 2 yielded the largest number of these sherds, in an assemblage totaling 141 examples. The North and South Midden areas yielded 11 such sherds. Notably, the fewest Puebla Blue-on-white sherds recovered came from Area 1, where only two sherds were found. The remaining five sherds were recovered from surface collection and test excavation outside of the data recovery study area.

Puebla Polychrome

San Elizario Polychrome: Blue and Black-on-white (1750–1830s)

San Elizario is a variety of Puebla polychrome that is differentiated from the other types by the presence of black accent lines, encircling blue bands, and central medallion figures (Cohen-Williams and Williams 2004:30). Rims are usually decorated with wide blue bands edged in black, with blue round or petal-shaped pendants suspended from this band (Figure 10.10). Center medallions composed of zoomorphic shapes, such as birds and deer, can be found on plates. San Elizario decorative variants are found on creamy white crazed enamel. The most common vessel types are plates, with few bowls, cups, and jars occurring. This pattern was introduced around the 1750s and remained popular until the 1830s.

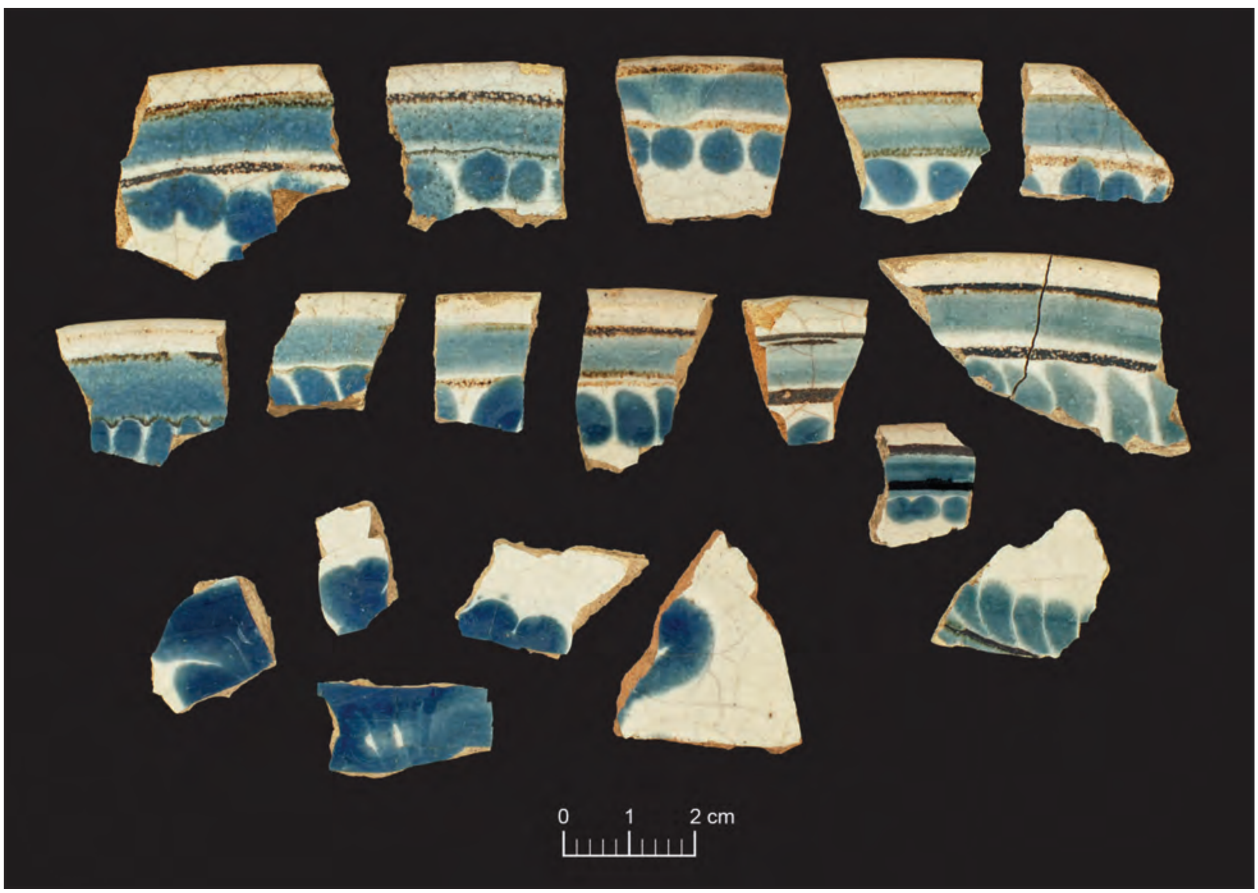

Figure 10.10. San Elizario Polychrome sherds recovered from the San Gabriel Mission archaeological site.

Among the 4,204 ceramic sherds examined, 243 were identified as San Elizario. The largest concentration of these was in Area 2, which yielded 206 examples. Of these, 32 are from sample EUs 105, 206, and 252). The former two units were east of the millrace, while EU 252 was situated in the northwest corner of the rectangular reservoir in Area 2. Area 1 produced a total of eight examples of San Elizario sherds, and another 28 were recovered from the North and South Middens. The remaining sherd was recovered from a shovel test pit east of Area 2. San Elizario vessel fragments from the San Gabriel Mission archaeological site derive mostly from plates, although a few cup or cup/bowl and jar fragments were identified.

Abo/Aranama Polychrome (1769–1835)

Abo/Aranama Polychrome sherds are identified by the presence of an orange band with black or dark brown accent lines. Other decorative elements occur in green, yellow, and orange. Abo/Aranama is divided into several varieties. Polychrome varieties from the San Gabriel Mission archaeological site were very fragmentary, and therefore ceramic sherds were classified under the general heading of Abo/Aranama and its sub-type Monterey Polychrome.

A total of 22 ceramic sherds of the general Abo/Aranama type were found at the San Gabriel Mission archaeological site, 18 of which came from Area 2 (Figure 10.11). One sherd of this type was recovered from Area 1, and two sherds were found in the South Midden. The remaining sherd was found in shovel test pit outside of the data recovery study area.

Ceramic sherds typed under the general Abo/Aranama category represent plate rims and body sherds with a small number identified as cup, bowl, and jar fragments. Polychrome colors exhibited on the sherds found at the San Gabriel Mission archaeological site include black, brown, orange, yellow, green, and blue. None of the sherds mended or were large enough to exhibit a complete decorative pattern.

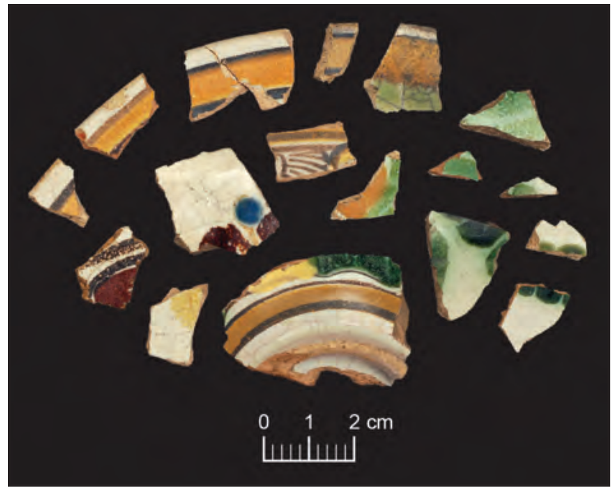

Figure 10.11. Abo/Aranama Polychrome Majolica sherds from Area 2 and the North and South Middens.

Monterey Polychrome (1750–1830)

Monterey Polychrome is distinguished as a variant of Abo/Aranama by the extensive use of green and yellow in the area between the rim and in the central medallion. It is distinct for the presence of combinations of orange bands with black accent lines. Green floral sprays with yellow and brown corn-stalked elements are repeated in the central medallion (Cohen-Williams and Williams 2004:41).

The Monterey Polychrome examples from the San Gabriel assemblage are extremely fragmentary, with the majority being painted green on plate rims and body fragments (Figure 10.12). A total of 23 sherds are identifiable as this variant. As with the other varieties of Majolica, a majority of specimens (17 out of 23) were found in Area 2. Two examples were found in Area 1, and three sherds were recovered from the North and South Middens. The remaining sherd was recovered from a test excavation east of Area 2.

Undecorated Ceramic Majolica Fragments

This category was created to encompass the many miscellaneous sherds of undecorated Majolica. The 396 undecorated Majolica sherds recovered could

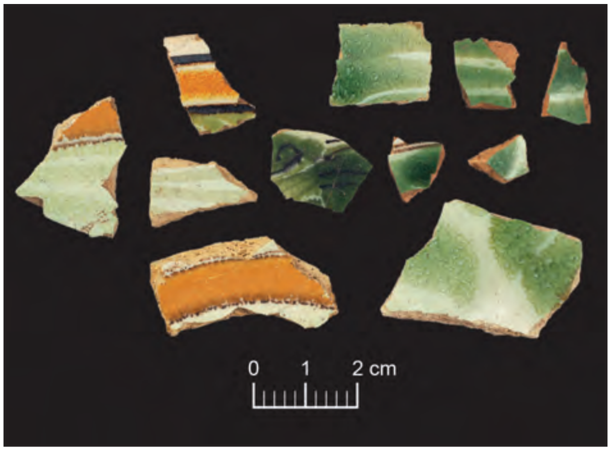

Figure 10.12. Monterey Polychrome Majolica sherds from the San Gabriel Mission archaeological site.

not be classified further. These sherds probably represent vessel forms discussed above. A majority of undecorated Majolica sherds (n = 304) were recovered from Area 2.

Chinese Export Ceramics (1720–1850s)

A total of 199 fragments of Chinese porcelain and/or stoneware were recovered. This accounts for 4.7 percent of the imported ceramic assemblage (see Table 10.3). Of these 199 fragments, a majority (173) are standard Chinese hard-paste export porcelain. The assemblage also includes a total of 20 examples of Chinese Provincial wares and six examples of Chinese brown-glazed stoneware.

Provincial wares and Chinese stoneware did not generally find favor among European and North American consumers on the East Coast of North America. For this reason, they represent an interesting sub-group of wares that were common until 1800 in southeast Asian communities, the Cape of South Africa, and mid-nineteenth-century Chinese expatriate communities in California (Madsen 2008:D-18). These wares represent only 1 percent of the Chinese ceramics identified at San Gabriel Mission archaeological site, but they have been found at other California mission sites as well, including Santa Barbara Mission (Hamilton et al. 2008).

Chinese porcelain recovered, 51 percent, or 89 specimens, were found in Area 2. Area 1 yielded only 23 sherds, while the North and South Middens yielded 50 ceramic sherds. The Chinese hard-paste export porcelains recovered are very fragmentary. Thirty-eight fragments are undecorated parts of vessels and could only be identified to the ware type, while some fragments exhibit enough pattern and/or glaze color to be classified according to decorative motif. As an assemblage, these wares allow some evaluation of Chinese ceramic preferences and/or availability during the late eighteenth and early nineteenth centuries. With the majority recovered from Area 2, this sample strengthens the conclusion that an earlier deposit exists in the area of the mill (see also Chapter 11, Spatial Analysis).

Chinese hard-paste export porcelains consist of two main decorative types. The first is underglaze blue painted wares, including Nanking and Canton, and the second is overglaze painted wares. Later design application of Canton and Nanking motifs were less well-executed than the early variants and therefore difficult to distinguish by pattern, resulting in a combined classification of Canton/Nanking styles in some cases. Overglaze painted wares such as Famille Rose and a generalized category of painted band and lines on porcelain were produced contemporaneously with Canton and Nanking for New World distribution. The eras of production for these four patterns reflect the following subtle temporal distinctions: 1) Famille Rose (1720–1800); 2) Nanking (1764–1820s); 3) Bands & Lines (1765–1810s); 4) Canton (1785–1853); and 5) Canton/Nanking (1785–1820s).

Underglaze Blue Chinese Export Wares

A total of 48 underglaze blue painted Chinese export porcelains were recovered from the San Gabriel Mission archaeological site. Among these identifiable patterns of underglaze blue Chinese export wares, Canton and possible Canton style wares compose the most numerous group, representing 83 percent, or 40 specimens, of the identifiable underglaze blue wares. Nanking style and Nanking variants are represented by four sherds. Other identifiable underglaze blue wares recovered include a total of four specimens of blue Canton/Nanking.

Canton (1785–1853)

Canton and possible Canton-style decorated wares are the most common identifiable underglaze blue Chinese porcelain patterns recovered from North American sites. Madsen and White described Canton as follows:

> Canton is not only the common name for this late eighteenth and early nineteenth-century underglaze blue pattern, but it is also the port through which the majority of the Chinese wares were shipped to the west for trade in the new world. The Canton pattern typically consists of a loosely painted aquatic landscape, including a pavilion, islands, willow and pine trees, and bridges, all placed within a riverine scene. The Canton rim pattern had a border of short diagonal lines within a continuous scalloped, wavy line known as the rain and cloud motif. Canton decorated export wares were manufactured in a wide variety of tea and tableware forms including standard plates and platters, tureens, warming plates, tea and coffee pots in the columnar bodied "drum" and "lighthouse" shapes, helmet shaped creamers, bakers, pudding dishes, butter boats, milk pots, and cider flagons. (Madsen and White 2011:101)

A majority of Canton ceramic sherds from the study area were tableware rim or body fragments (Figure 10.13). Area 2 yielded 20 Canton sherds, four of which came from EUs 105 and 137. The sherds from EU 137 were found between 80 and 100 cmbd (Datum 3). Eleven sherds were recovered from Area 1 units, including an example from EU 149 (Feature 14). Four sherds were recovered from the North Midden. The remaining five fragments identified as Canton were from surface collections and test excavations outside the data recovery study area. The San Gabriel underglaze blue Canton specimens exhibited the most common decoration motif on rim sherd fragments with sections of the rain and cloud motif.

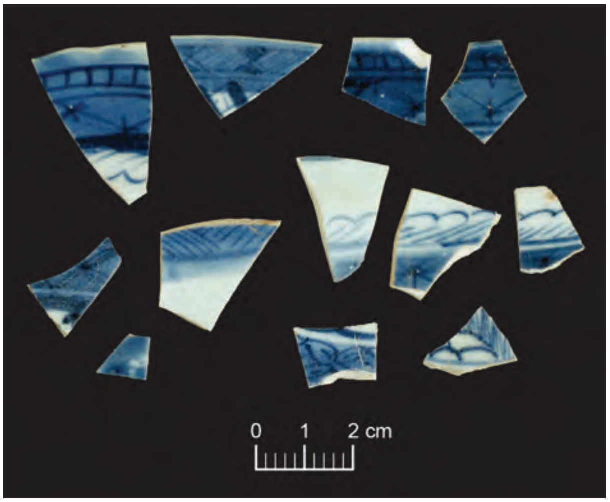

Figure 10.13. Canton sherds from the San Gabriel Mission archaeological site.

Nanking (1764–1820)

Nanking decorated Chinese export porcelain sherds recovered were limited to four fragments. Nanking decorated porcelains consist of a group of wares decorated with an aquatic landscape similar to those that characterize the Canton wares. However, the Nanking wares are typically painted with much more precision (Madsen 2008:D-9). The aquatic landscape typical of the Nanking wares shares the common elements of a pavilion, islands, bridges, willow and pine trees, and sometimes anthropomorphized figures; a greater amount of detail is displayed in these landscapes, however, and the scenes appear less hurriedly executed. While the Canton rim borders are typically little more than a loosely executed trellis pattern with a blue wash and scallop border, Nanking rim patterns typically detail a repetitious pattern that can include butterflies and scrolls set amongst various diaper patterns. The Nanking wares were produced during the late eighteenth century, a period of gradually declining quality and increasing standardization of export wares. These wares were initially produced earlier than the Canton style wares, but their period of production overlapped with Canton from ca. 1785 to 1820 (Madsen 2008:D-9). Vessel forms of Nanking style wares, like the Canton, typically include the full array of table and tea wares such as plates, platters, cups, saucers, mugs, warming plates, cream pitchers, sugar bowls, sauce boats, oval and octagonal tureens, teapots, and coffee and chocolate pots. Ornamental forms included vases, as well as candlesticks, punch bowls, washstand ewers, basins, and chamber pots.

Examples found in the study area with this motif include tableware sherds exhibiting sections of the butterfly diaper motif (Figure 10.14). One sherd came from Area 1, two from Area 2, and one from the North Midden (located between the structural ruins).

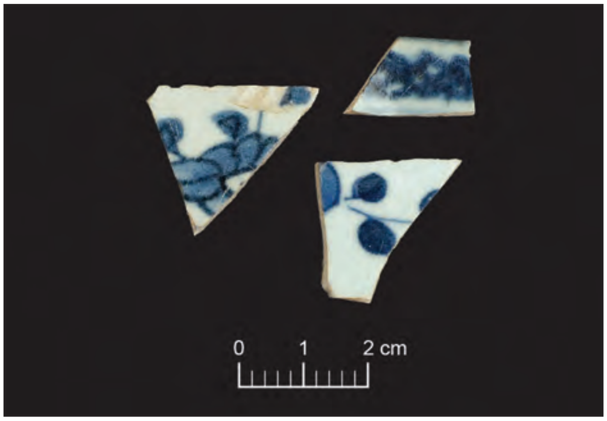

Figure 10.14. Nanking sherds recovered from the San Gabriel Mission archaeological site.

Overglaze Decorated Chinese Export Wares

A total of 46 overglaze painted Chinese export porcelain sherds were recovered from the study area. Some of the fragments could be identified according to the decorative motif/color palette, but generally the very small size of the porcelain fragments recovered from the site did not allow for firm identification of decorative patterns. Nearly half, or 19, of the identifiable styles were Famille Rose polychrome sherds. The remaining 27 sherds belong in the general overglaze porcelain category, including red and gold, and red lines and dots including a single half circle and dot motif, and some fragments with traces of red and green, and blue overglaze painted patterns.

Famille Rose (1720–1800)

The term Famille Rose, or "pink family," was created by French scholars Albert Jacquemart and Edmond Le Blant in their 1862 book, *Histoire de la Porcelaine* (Jaquemart and Le Blant 1862). Famille Rose-decorated porcelains have been defined by ceramicist John Goldsmith Phillips as "the most popular style of porcelain painting in eighteenth-century China and includes all porcelains in which one of the enamel pigments is of an opaque rose-pink color" (Madsen and White 2011:106).

Madsen and White, in an evaluation of the Santa Barbara Chinese porcelain collection recovered from the Historical Society property on De la Guerra Street, cited Dr. George C. Williamson (1970), author of a scholarly book on Famille Rose:

> The Famille Rose decoration is a decoration in which the prominent color is pink, pink in various shades from the very palest possible tone to a deep, strong, brilliant colour, very marked and noticeable. It does not really matter how much pink there is in the decoration, if the pink which has been made from the salts of gold is present, then pieces are declared to be Famille Rose. (Madsen and White 2011:106)

Famille Rose overglaze export wares are characterized by opaque, often blended enamels made from metallic oxide pigments suspended in a lead glaze. This color palette also includes green created from oxide of copper and opaque blue created from cobalt oxide, or carbonate fused with quartz with the addition of oxide of zinc and carbonate of sodium. Other colors include purple or aubergine derived from manganese ore, red from peroxide of iron, turquoise from binoxide of copper, and a bright yellow, as well as a new opaque white. Overglaze gilding or sepia could also be added to this color combination. Famille Rose decorated wares are known to have a terminal date of 1800 (Madsen 2008:D-14).

At the San Gabriel Mission archaeological site, most Famille Rose tableware seems to be fragments of teaware vessels, with red, black, and green painted design elements. The sections of motifs exhibited on some fragments include very fine floral design, with red being the dominant color. Famille Rose sherds were recovered from across the site (Figure 10.15). Eight examples were collected from Area 2. Six sherds came from the South Midden. One sherd came from Area 1. The remaining four sherds were from surface collections and test excavations outside the data recovery study area.

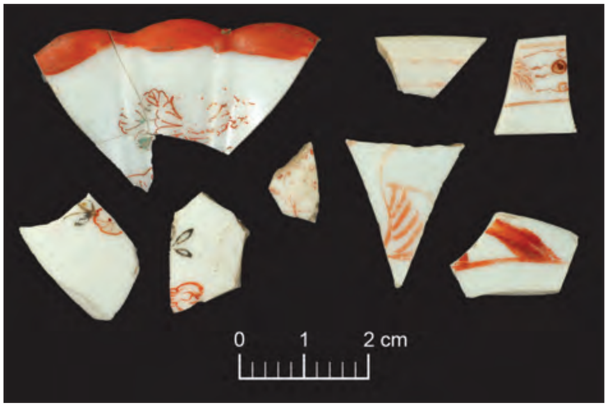

Figure 10.15. Famille Rose Chinese export porcelain sherds.

Late-Eighteenth-Century Bands and Lines (1765–1810)

Three sherds of the overglaze enameled export wares recovered from the San Gabriel Mission archaeological site are decorated with one of a variety of bands and lines patterns. This group of patterns was popular during the late eighteenth and early nineteenth centuries; it signified a trend toward a restrained, tasteful neoclassical arrangement of overglaze decoration (Madsen 2008:D-14). A wide diversity of Bands and Lines patterns has been documented on Chinese ceramics ranging from repeated rows of stars set on a blue band background, to a simple "dogtooth" pattern, which appears as a repeated wave, to a series of connected arrow points known as the "husk chain." These Band and Line patterns typically adorn the rims of vessels and are most often seen on the full range of teawares, though tablewares were also decorated with the bands and lines style patterns. Wares decorated with bands and lines achieved their greatest popularity toward the end of the eighteenth century and the first decade of the nineteenth century (Madsen 2008:D-14).

The examples from the study area exhibit three patterns: the Wavy Band overglaze, Half Circle and Dot, and Dogtooth motifs. The Wavy Band and Half Circle and Dot sherds were recovered from Area 2. The Dogtooth motif was found on a sherd from the South Midden (EU 115) (Figure 10.16).

Chinese Export Overglaze General Category

Twenty-four fragments of overglaze decorated Chinese exports do not exhibit sufficient attributes to be categorized under a specific pattern or design motif. These include sherds with small sections of overglaze painted patterns that are faded or of single or multiple colors (including red and green, or black and blue). Some of these sherds are covered with a thick patina, further obscuring the design. They can only be classified as Chinese export porcelains of unknown age.

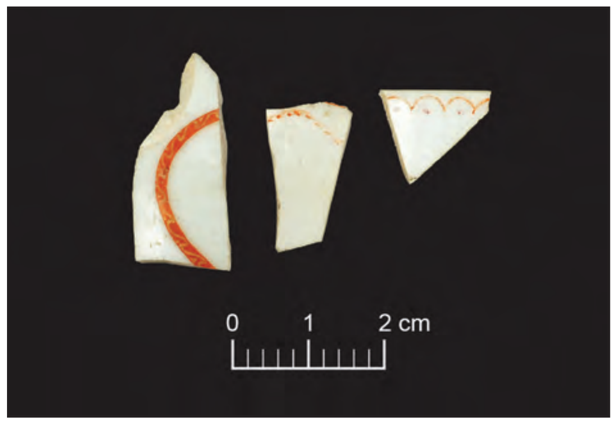

Figure 10.16. Chinese export porcelain sherds decorated with late-eighteenth-century Bands and Lines.

Chinese Provincial Wares

Twenty fragments of Chinese Provincial wares, also referred to as "Asian market ware" (Madsen 2008:D-16), were recovered from the study area. Limited definitive data exists concerning the location and date of manufacture of Provincial wares. However, Madsen (2008:D) suggested that these ceramics may have been manufactured in South China kilns in the provinces of Fujian and Guangdong. Shipwrecks of Chinese junks, such as the ca. 1822 wreck of the *Tek Sing*, and European vessels, such as the *Diana*, which sank in 1817, document the popularity of these wares as an export commodity in the nineteenth century.

These Provincial wares found favor largely with residents of the broader area of Southeast Asia, as well as at the cape of South Africa during the seventeenth through early nineteenth centuries. Largely considered too unrefined for European taste, these wares were rarely marketed in Europe, although Dutch East India Company ships—such as the *Geldermalsen*, which sank in 1751—carried quantities of these wares largely for their colonial outposts. The recovery of Provincial wares from the 1850 shipwreck of the *Frolic* suggests that expatriate Chinese communities in California desired these wares. Their recovery from the Santa Barbara I Manufactured Gas Plant site and from San Gabriel Mission archaeological site suggests a broader distribution of these wares among the Spanish colonial sites in Alta California, perhaps as a result of greater access to the Spanish galleon trade (Madsen 2008).

Generally, the fragments recovered from the study area are decorated with bluish-gray underglaze geometric patterns, or grayish-green color of the same pattern (Figure 10.17). The majority of Provincial wares were recovered from Area 2 where 10 specimens were found. Two were recovered from the North Midden, two from the South Midden, and five examples from Area 1.

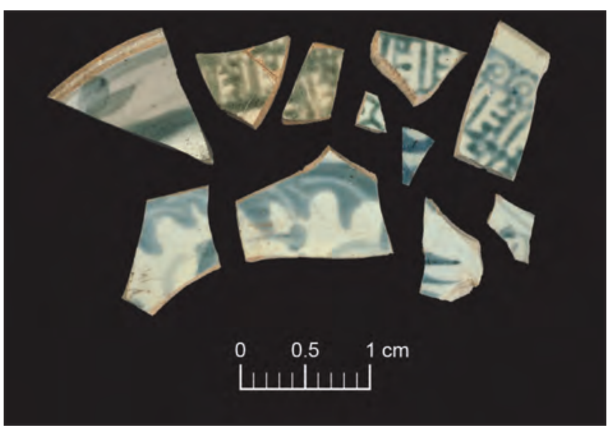

Figure 10.17. Chinese Provincial ware sherds from the San Gabriel Mission archaeological site.

Chinese Brown Stoneware

Six fragments of Chinese brown stoneware were recovered. The sherds were mainly recovered from Area 1. Chinese stoneware was mainly produced as utilitarian vessels for domestic use (Figure 10.18). Brown glazed and olive glazed vessels were recovered from the 1822 shipwreck of the *Tek Sing*; these wares were believed to have been made in Dehua or Yixing (Madsen 2008:D-17). Both were important regional centers of Chinese domestic ceramic production. The Chinese brown stonewares were mainly produced as lidded pots and jars; however, the wreck of the *Tek Sing* also yielded urinals and small stoves made from similar brown glazed wares (Madsen 2008:D-17).

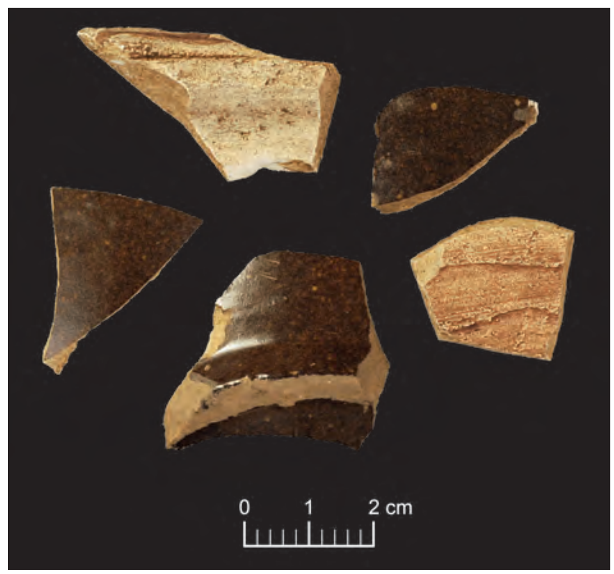

Figure 10.18. Chinese brown stoneware recovered from the San Gabriel Mission archeological site.

British Earthenware (1750s–1860s)

The number of British earthenware specimens recovered totaled 2,554, or 61 percent of the imported ceramic assemblage. By the mid-eighteenth century, British potters had developed and marketed a competitive, white-bodied, hard-paste earthenware. The earliest form is described as cream ware, due to its rich off-white or yellowish-tinted glaze and creamy to slightly yellowish-tinted body. This experimentation by British ceramicists challenged the dominance of the highly popular Chinese porcelain in the European export market.

Continued refinement of British earthenware in competition with Chinese porcelain and Mexican Majolica resulted in the introduction of a blue-tinted earthenware (also referred to as pearl ware in modern literature). The new product was achieved by adding cobalt to the glaze in an attempt to duplicate the translucent appearance of Chinese porcelain. This improvement followed a rapid introduction of secondary design application, including lathed annular banded wares, painted edge wares, complex floral painted designs, and the development of transfer prints, a uniquely British decorative technique. Even whiter-looking glazed earthenware was fabricated in the early nineteenth century by adjusting the amounts of cobalt added to the glaze during production. White ware production continued the use of secondary decorative motifs introduced on pearl ware. By the 1830s, transfer printing dominated production. This experimentation in ceramic glazing, decorative patterns, and color variation spanned the 1750s through early 1800s, overlapping production and transition in Majolica patterns and manufacture of Nanking, Canton, and multicolored palettes on Chinese porcelains. Close analysis of paste characteristics, glaze tint, and decorative designs and colors allows for accurate dating of British ceramic vessel fragments manufactured during the late eighteenth- and early nineteenth-century and introduced to the New World through transatlantic trade (Table 10.4).

Table 10.4. British Earthenwares (1750s–1860s)

Type	Dates
Cream ware	1762–1810s
Pearl ware	1779–1820s
Edge Decorated	
On pearl ware	1780s–1800s
On white ware	1830s–1860s
Annular Ware	
On pearl ware	1780s–1840s
On white ware	1830s–1860s
Painted Peasant (thick-line and thin-line)	
On pearl ware	1790s–1820s
Painted Blue-on-white	
On pearl ware	1820s–1830s
On white ware	1830s–1860s
Painted Sprig	1830s–1840s
Sponge/Spatter	1820s–1860s
Single-color transfer print	
On pearl ware	1782–1840s
On white ware	1830s–1860s
Transfer Printed sheet pattern	1840s–1860s
Flow patterns	1830s–1860s (later reintroduced)
Blue Willow	1780s–1860s (later reintroduced)
Wild Rose	1830s–1850s

Cream Ware, Pearl Ware, and White Ware

Cream ware was produced from 1762 until around 1810. By 1770, cream ware replaced Dutch delft and British white salt-glazed stoneware in the export trade. By 1779, pearl ware had been perfected and introduced to the transatlantic market. Both remained in production during the early 1800s, but declined with the introduction of white ware and semivitreous earthenware in the 1820s (Majewski and O'Brien 1987). In general, when compared to highly decorated pearl ware and white ware vessels, cream ware is found to have less applied decoration. The initial decorated forms, when present, tended to be molding around the rim, painted floral motifs, mocha banding, and gilding. Cream ware continued to be produced during the nineteenth century, but it was largely undecorated except for molded patterns and was generally a low-priced commodity.

Blue-tinted glazed earthenware (herein referred to as pearl ware, although we acknowledge that this is not an historical term under which the ceramics were marketed) was introduced by Josiah Wedgewood in 1779 as an alternative to cream ware. Pearl ware became common in the 1790s and declined in popularity by the 1820s. This manufacturing process resulted in the creation of a pearly-white ceramic body produced by adding calcined ground flint stone to the ceramic paste, and a small amount of cobalt oxide to the glaze previously used in the production of cream ware. The new techniques masked the yellowish color of cream ware, adding a slightly bluish tint to the glaze (Majewski and O'Brien 1987:118). The degree to which British potters added cobalt to the glaze varied over time.

Although its use waned in popularity in the early 1800s with the introduction of white ware, blue-tinted glaze gained popularity first in the 1860s (with the introduction of ironstone) and again in the late 1800s. The marketing of flow blue transfer prints in the mid-1830s through 1860s also resulted in the bleeding of blue into the glaze between patterns on undecorated elements of white ware vessels. This use and reintroduction of bluing in the glaze overtime makes the identification of early pearl wares problematic in collections spanning the nineteenth century. Its presence must be evaluated closely against the occurrence of secondary decoration and later intrusive elements.

Pearl ware exhibits far greater variety in secondary decoration than does cream ware. Types of decoration include molded relief edge wares such as shell edge, plume, and herringbone embossed patterns. The applied decorations found on these relief-molded designs range from blue, to green, and, on occasion, to red pigment (Majewski and O'Brien 1984). Additional colors were found to be represented in the San Gabriel Mission collection, including brown and yellow Shell Edge decorated wares. Equally popular was the application of annular banding and painted floral motifs on pearl ware bodies. Initially, painted patterns appeared in natural or muted hues such as yellow and orange painted in broad strokes, with foliage appearing in drab green and black. Following this predominantly yellow phase, a blue-and-white pattern of floral design was introduced, only to be replaced by a thick line–thin line sprig pattern depicting red flowers and blue berries (Hamilton 1990:77). Sprig patterns tend to occur on white ware vessels. Annular wares are created by turning the body of the unfired earthenware vessel on a lathe. Cutting through the glaze to colored slips below reveals the pigment as raised bands on what was generally a hollow ware vessel (cups, bowls, mugs, and serving vessels). Annular ware was first manufactured on pearl ware and later on white ware. Again, variation in color signals temporal changes and dates of production.

White ware developed as a result of continued experimentation in production of a semi-vitreous paste and search for a translucent glaze. The ultimate goal was to develop a true bone china or porcelain characteristic of Chinese porcelain manufactured during the first quarter of the nineteenth century (Majewski and O'Brien 1987:119). This continued refinement led to a growth in popularity and demand independent of Chinese porcelain production. White ware is generally decorated with overglaze and underglaze hand painting and underglaze transfer printing. Applied in a variety of colors, transfer printing became the most common method of design application after the mid-1700s. This evolution of form and type of decoration was applied first to pearl ware, and then to white ware. The technique of transfer printing provides a temporal hallmark with which to date British earthenwares found in archaeological contexts. Transfer prints are not prevalent on New World sites until the 1750s, and when they do occur at this early date they are generally found on pearl ware and limited to blue, sepia, or black. The presence of a transfer-printed white ware sherd at the San Gabriel Mission archaeological site suggests the collection dates to a later period of time, post-dating the 1820s when white ware displaced pearl ware in popularity.

During the late eighteenth and early nineteenth centuries, British potters experimented with a wide variety of underglaze decorations on refined earthenwares. Soft paste varieties gave way to harder paste bodies described as semi-vitreous. Firing occurred at higher temperatures, and multiple firings were required in the application of underglaze decorative patterns. The various decorative applications included simple painting of edge relief molding, elaborately painted or stamped patterns, and complex transfer prints. The development of transfer print techniques allowed for the rapid application of complex scenic patterns reminiscent of laboriously painted Chinese Nanking and Canton designs. With the introduction of white ware, variation in decoration increased several-fold and experimentation in color application allowed further marketing choices. Once transfer-printed patterns were introduced, painted patterns became less popular. They nearly disappeared until painting was reintroduced in combination with printed patterns in the 1840s. The success of transfer printing ultimately led to mass production and the availability of matched sets of dishes by the early to mid-1800s. These decorative techniques and various combinations of each are described in greater detail below.

The total number of cream ware sherds in the San Gabriel Mission collection is 168; of these, 37 are from Area 2, 85 from Area 1, 46 from the North and South Middens. Of the cream ware, 166 sherds are undecorated. Only two sherds exhibit secondary surface decoration: one is painted blue-on-white, and the second evinces a green painted pattern. A total of 164 fragments of pearl ware were recovered from the site. Of these, 49 sherds are undecorated (approximately one-third) as compared to nearly 100 percent of the cream ware sherds recovered. This reflects a dramatic shift in the decoration of British ceramics. Pearl ware from the analyzed sample totaled 126, which includes 30 sherds (30 percent) from Area 2; 64 sherds (39 percent) from Area 1; and 32 sherds (19 percent) from the North and South Middens. The total number of white ware sherds in the collection is 1,368 (31 percent of all imported historical ceramics). Of the undecorated sherds, white ware sherds total 863 (63 percent).

As demonstrated by the percentage of undecorated cream ware recovered in comparison to pearl ware, there was an explosion in the use of secondary decoration on British earthenware around the 1750s. In the mid-1700s, molding of rim pattern and lathing of hollow vessels increased but most ceramic vessels were still laboriously painted. The use of various new colors played into the marketing of ceramics, but it was not until the invention of transfer printing in 1752 that decoration truly became mechanized. However, it took this new production method 30 years to reshape the market. It is with this transformation that British ceramics increased exponentially in popularity. It allowed for the manufacture of matched sets of dishes and complex patterns, and it became a hallmark of the industrial and consumer revolutions. As colors and patterns waxed and waned in popularity, purchasers discarded the old and bought whole new sets. These changes in manufacture, consumption, and distribution allow assignment of narrow date ranges for British ceramics found in archaeological deposits.

Edge-Decorated Wares (1750–1860s)

Edge decoration is considered a type of painting done when a single color is applied by hand over a molded relief design. Initially, it was painstakingly applied to the molded rim pattern, at times being feathered to accentuate the molding. Later the molding became less pronounced and the pigment was quickly applied using a single brush stroke. The molding occurs around the rim of plates, platters, and bowls. This style of decoration was first produced in England and exported to the New World beginning in the 1780s. Edge-decorated patterns occurred first on pearl ware and later on white ware vessels. Edge-decorated ceramics with painted borders were produced in a variety of patterns, including Shell Edge (the most popular); Feather Edge; Cord and Herringbone; Fish-scale; Cord and Fern or Cord and Tassel; and Dot and Plumes. Many colors were used in the process, with cobalt blue being the first and most popular, and green coming in a close second. Less often seen are red or pink variants. Shell Edge patterns applied to pearl ware vessels represent the earliest application of this decoration.

A total of 66 Shell Edge or other edge-decorated sherds was recovered from the study area, including four sherds from surface collections and test excavations outside the data recovery study area. Three types of molded decoration were identified in the assemblage including Shell Edge (the most frequently occurring pattern); Beaded Edge or Dot Edge; and Cord and Fern with a stylized rope pattern. Painted edge-decorated patterns recovered from the San Gabriel Mission archaeological collection include 60 Shell Edge sherds, two cobalt blue Cord and Hanging Fern/Tassel sherds, and one Stylized Rope pattern sherd. The San Gabriel Mission assemblage of Edge-decorated sherds contains a variety of colors, including cobalt blue, green, brown, and yellow, with the blue color being the most common in the collection (n = 51), followed by nine green sherds, two brown sherds, and one yellow sherd (Figure 10.19).

One variant of the Edge-decorated ware is worthy of note, having been recovered from EU 133 at a depth of 100 cmbd (Datum 3). This sherd was found in Area 1. The single sherd rim was from a small dish or saucer. The decoration consists of a molded rope relief encircling the rim paralleled by a series of repeating wave-like patterns executed as a black rim accent. This pattern is similar to the Chinese Dogtooth overglaze decoration popular in the late eighteenth century. The decoration was clearly applied to a pearl ware vessel, dating the variant from San Gabriel Mission archaeological site between 1779 and 1820.

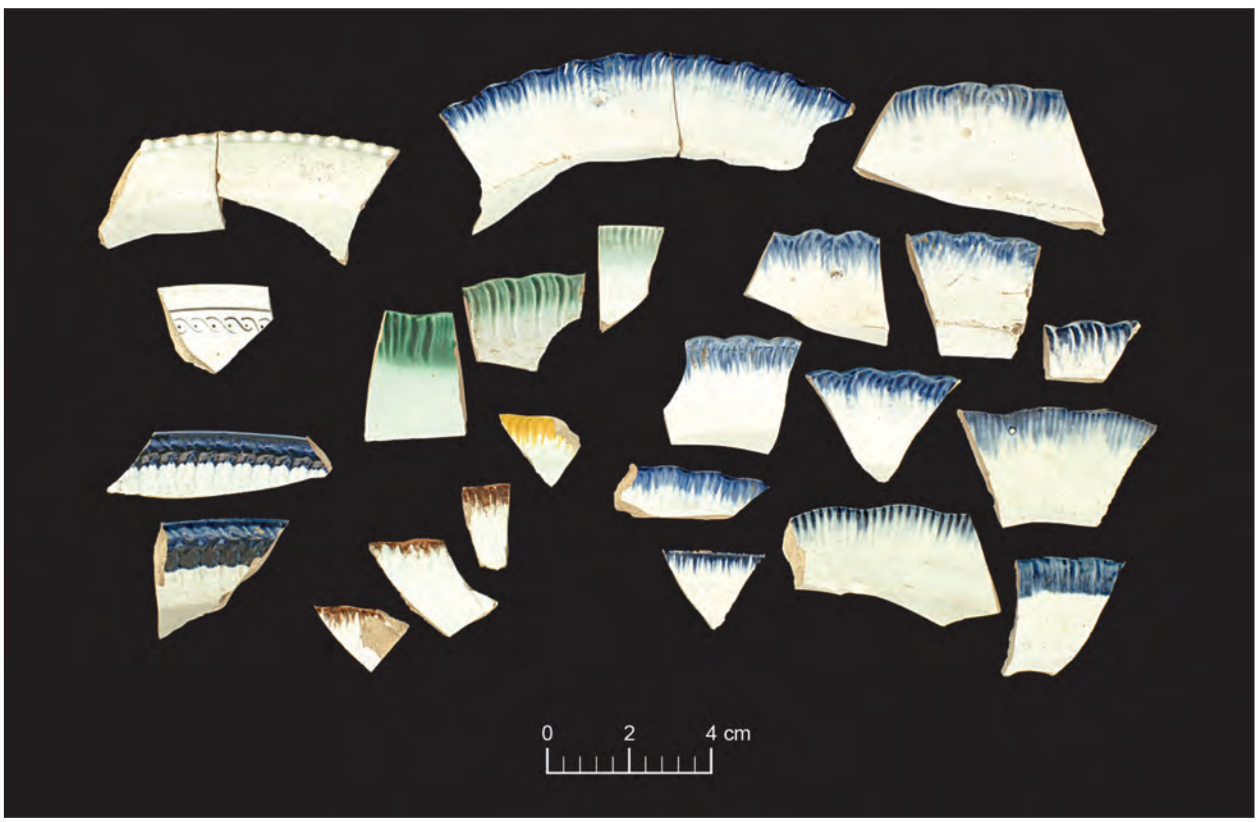

Figure 10.19. Edge-decorated sherds from the San Gabriel Mission archaeological site.

A total of 16 Edge-decorated wares were found in Area 2; these include 15 Shell Edge plate fragments. A single cobalt Blue Cord and Hanging Fern/Tassel pattern was found in EU 129, having been recovered from inside the mill. A similar tasseled vessel fragment was recovered from Hand Trench 13, also associated with the mill. This hand excavation unit was dug north of EU 105, outside the eastern wall of the mill.

The sample of 24 sherds of Edge-decorated ware from Area 1 consists of mainly plate rim fragments (n = 21) represented in three colors. Blue is the most prevalent color (n = 15), followed by green (n = 4), and a single brown painted sherd. Two fragments of pearl ware serving dishes exhibit a molded relief and beaded designs encircling the rim.

The North and South Middens yielded 22 fragments of Edge-decorated sherds, all but one of which were identified as Shell Edge. Four colors of Shell edge decoration are present: blue (n = 14), green (n = 4), brown (n = 2), and a yellow plate rim fragment (n = 1) recovered from EU 273. Several individual sherds were recovered below the railroad fill/disturbance in what appeared to be in situ mid-nineteenth-century historical sediments.

Painted Decorations (1790–1860)

The production of hand-painted ceramics reached its height in popularity during the 1800s and was most frequently found on pearl ware and early forms of white ware. Some standardized patterns included flowers, foliage, and stylized Chinese landscapes (Majewski and O'Brien 1987:132). This decorative style is more intricate than Shell Edge painted vessels and requires greater skill of the artisans to produce it. The following varieties were recovered from the study area.

The thick line–thin line treatment or Peasant style is characterized by floral motifs painted in broad brush strokes that cover the majority of the vessel surface (Majewski and O'Brien 1987:157). Pearl wares decorated in this style date to as early as 1790. The color palettes employed have temporal implications. Manufacturers marketed polychrome floral patterns between 1790 and 1850 (Hamilton 1990:64). Artisans applied the earliest motifs in natural color pigments, including mustard yellow, deep red, and drab olive green. These colors were superseded by floral patterns also painted in broad brush strokes in deep hues of cobalt blue on a white background ca. 1820s (Hamilton 1990:64). Finally, painted flowers depicted in bright reds or blues with black stems and sprightly green foliage were introduced in large numbers by British potters between the 1820s and 1850s (Hamilton 1990:64). The Sprig type designs were composed of fine black lines for stems and small green leaves with stylized red flowers and blue berries (Hamilton 1990:64; Majewski and O'Brien 1987:157). Both the thick- and thin-line painted patterns reached peak production between 1820 and 1840, although they continued in production until the 1860s. Later-period painted designs were applied to white ware vessels, while those painted on pearl ware represent the early period of the production range. The assumption is that this type of decoration on vessels post-dating 1830 will be on white ware. The presence of painted decoration on both pearl ware and white ware vessel fragments at the San Gabriel Mission archaeological site suggests that the introduction of British earthenware occurred during this market transition and were delivered by British and American merchants illegally trading along the west coast.

When evaluating the presence of painted earthenware found at the San Gabriel Mission archaeological site (n = 133), all three styles were observed: Peasant style of thick line–thin line floral patterns; Blue-on-white patterns; and Sprig patterns. Many ceramic fragments are very small or exhibit a small section of the pattern with single or multiple colors but still enough to identify the styles represented. Fragments exhibit floral patterns, mostly sections of leaves, sprigs, or both. Colors represented in this assemblage are red, cranberry, green, black, and blue (Figure 10.20).

Painted tableware vessel fragments were recovered in small quantities from Area 2 (n = 26 or 19 percent by count), including a pearl ware saucer rim and body sherds painted in the Peasant style. These sherds came from EU 137 inside the mill and EU 252 inside the northern wall of the southern extension to the mill. A single pearl ware cup fragment exhibits the Sprig pattern and was found in EU 135.

Figure 10.20. Hand-painted sherds from the San Gabriel Mission archaeological site.

Area 1 yielded the highest number of painted sherds (n = 52). These include a pearl ware cup body painted in the Peasant style recovered from EU 243. A small quantity of sherds was recovered from within the structure (n = 15 or 11 percent), including four examples of blue painted pearl ware vessel sherds.

Annular Banded Earthenware (1790–1860)

Annular ware or "banded cream ware" consists of raised decorative bands of slip executed parallel to the exterior rim and base of a vessel, usually in earthen tones. The raised banding was achieved using a lathe and stationary brush while rotating the unfired vessel on a potter's wheel (Sutton and Arkush 1998:212). Multiple bands may be present. The vessel may be covered in a colored slip through which the bands were cut. This type of decoration is often found on pearl ware, white ware, and Yellow ware. Vessels invariably are mugs, bowls, cups, and covered container jars. The date for this decoration on pearl ware is ca. 1790–1830 and on white wares ca. 1830–1860 (Majewski and O'Brien 1984:45). American potters continued the manufacturing tradition of annular banding on yellow ware vessels well into the twentieth century.

The early annular forms have narrow painted bands or stripes of earth-toned pigments and many have secondary decorative motifs. Engine-turned or rouletted decoration refers to a design formed by using a sharp implement to cut through the slip of an unfired vessel, resulting in a repetitive pattern around the rim. The design took on the form of the instrument used, such as a diamond, raised dot, chevron, or other shape. This patterned design was then painted, often in green and blue. The body of the vessel may also have been painted with swirled or dendritic patterns resembling trees, seaweed, fronds, or trailed designs such as "cat-eye" and finger-painted motifs. The later-period annular decorations tend to have wider bands of brighter background colors (i.e., medium blue, yellow, and white) with very narrow white or black bands around the rim (Majewski and O'Brien 1984:45). Secondary decorations include the dendritic patterns but other detailing was no longer employed.

A variety of Annular ware decorative types was found at the San Gabriel Mission archaeological site (Figure 10.21). Annular decorations were applied to pearl ware, white ware, and yellow ware. A total of 97 sherds were classified as Annular ware. Of these, Area 2 yielded 26 sherds (27 percent) exhibiting cabled and finger-painted motifs of blue, black, and brown on a dark heather slip background. Simple brown-banded vessels, with marbled polychrome design of light blue, red, and brown were recovered, which can be dated to 1790–1820 because they are applied to pearl ware. Fragments of blue dendritic patterns on yellow ware cup/bowls were recovered and are associated with later site utilization (ca. 1840s).

Figure 10.21. Annular ware sherds from the San Gabriel Mission archaeological site.

Interestingly, Area 1 area yielded the highest number of Annular ware (n = 49 or 51 percent). Sherds of mostly cups or bowls exhibit a variety of decorations, some similar to those found in Area 2. Sherds exhibit finger-painted motif on brown and dark heather slip; simple banded wares; and green dotted and checkerboard roulette patterns, one of which was recovered from EU 135 in Area 1. Blue-banded Annular ware and yellow ware sherds were also recovered from Area 1. The presence of a medium blue slip suggests a manufacture date of the 1840s or later.

Finally, 19 sherds (20 percent) came from the North and South Middens and include a bowl rim decorated with a green checkerboard roulette pattern of early manufacture (ca. 1790–1830s). A very small sherd with a section of a mocha dendritic motif was found in EU 269, north of the railroad tracks. The remaining three sherds came from surface collections and test excavations outside the data recovery study area.

Luster Ware (1800s forward)

The term luster ware applies when the surface decoration consists of a thin metallic oxide film deposited on the surface of a ceramic vessel, generally in bands parallel to the rim. After firing, the luster effect appears spontaneously without further processing (Majewski and O'Brien 1987:140). The colors range from copper, gold, silver, and mother-of-pearl, to shades of pink and purple. Color decorations are applied under, over, or as part of the glaze and can be produced in various ways, ranging from molded, painted to transfer print to decaling. With overglaze painting, it is often necessary to paint one color and then fire it and repeat for each additional color desired. The maturing temperatures vary depending on the color of pigment and mineral content. Although this process was invented and first made popular by Islamic potters of the ninth century, its popularity and production in England did not arise until the nineteenth century when potters such as Josiah Wedgewood and Josiah Spode revived the technique (Columbia Encyclopedia 2005:1). The earliest decorations were manufactured with platinum oxide in the form of bands in 1805. The use of an all-over silver luster was introduced in 1823.

Very few sherds of luster ware (n = 7) were recovered from the San Gabriel Mission archaeological site. These sherds are very fragmentary copper luster with a dark brown, reflective finish. Examples from Area 1 include two rim sherds of a very small cup or bowl, and a body sherd from a hollow vessel. A single body sherd was recovered from Area 2 and three sherds were recovered from the North Midden.

Transfer-Printed Earthenware (1750–1860s for the San Gabriel Collection)

Transfer printing is a British innovation in ceramic decorative technique, incorporating numerous printed patterns, motifs, and color palettes. The process involves the application of printed designs transferred from ink-infused paper, taken from copper plate engravings, and applied to an unfired clay vessel surface. Transfer printing was developed in England between 1753 and 1756 by the Battersea Enamel-works of London (Normand-Wilcox 1965). The earliest transfer print colors were black and sepia (introduced in 1752); around 1780, deep cobalt blue patterns were introduced. Cobalt blue dominated the market between the 1780s and 1820s (Hamilton 1990:64).

As products in these colors saturated the market, new colors were introduced, including green, mute blue, mulberry/cranberry, grey, and purple. Several underglaze patterns were marketed, including Blue Willow and Wild Rose (Starr 2012). Introduced in the 1780s, these blue scenic patterns did not reach peak popularity until the 1820s–1830s, at which time the patterns were copied widely. The Blue Willow pattern mimicked Chinese painted designs typical of Canton and Nanking-style porcelain, portraying southeast Asian landscapes. Wild Rose varied greatly from one potter to the next but always had the open Wild Rose pattern with broad leaves and thorny vines (Starr 2012).

Flow blue, a later variant of the early transfer print patterns, involved the firing of vessels in an atmosphere that contained volatile chlorides. The addition of this chemical forced the printed pigment to spread or flow under the glaze, creating a blurred or misty appearance (Majewski and O'Brien

1987:143). While blue was the predominant color used in the production of this design, flow transfer prints were done in other colors such as black, yellow, brown, red, and green. The method was introduced in 1825, though vessels were not widely marketed during this experimental phase. After 1835, mass production of flow blue began and the pattern became extremely popular (Snyder 1999:7).

The process was further streamlined with the invention of lithography. Using a lithograph, the designs were composed of numerous small, colored dots that were barely visible to the casual observer. The creation of flexible sheeting allowed for molding the design to the contours of many vessel types. This allowed for the production of matched tableware and serving dishes. Transfer of the design is generally made under the glaze, in contrast to a later technique using decals applied over the glaze (Sutton and Arkush 1998:211). The first successful multicolor transfer prints required separate color applications and firings, a method perfected around 1840 (Majewski and O'Brien 1987:143). Lofstrom et al. (1982:9–140) place the introduction of this technique between the 1840s and 1860s. It was not until the 1860s that multicolored transfer printing was perfected in a single design application using combinations of blue, red, and yellow. The lack of multicolored transfer prints on a site verifies a pre-1860 occupation date, for which the San Gabriel Mission mill and the Area 1 structure clearly qualify.

Table 10.5 lists the various colors and styles of transfer prints recovered from the sample units in Area 2 (reservoir complex and mill), Area 1 (possible granary structure), and from the North and South Middens between the structural ruins of the site.

A total of 411 transfer-printed sherds was recovered. Cobalt blue patterns were ubiquitous, as were mute blue and single colors. Only one multicolor transfer print/painted sherd was found. This transitional sherd is decorated with a single color transfer print under the glaze; it is highlighted by painting over the glaze with multiple color pigments (Figure 10.22). This is a technique introduced in the 1840s that continued in use through the end of the century. This sherd was found in EU 121 Area 1 near Feature 9, an area paved with *ladrillos* (Mission-period bricks). Other transfer-printed colors found at the San Gabriel Mission archaeological site included black, sepia/brown, cranberry, grayish blue, mute blue, and purple. Purple was created by applying a cranberry transfer print over a blue transfer-printed pattern. This application results in a faint but distinct halo. As with the experimentation with printed/painted decorations described above, the application of two colors was attempted in the 1840s and led to the successful development of multicolor transfer printing by the 1860s.

Blue and cobalt blue transfer prints are the most ubiquitous colors found on site, totaling 200 of the sherds identified (Figure 10.23). Area 2 yielded 40 sherds, Area 1 yielded 81 sherds, the North Midden yielded 44, and South Middens yielded 22 sherds. The remaining nine sherds were recovered from surface collections and test excavations outside the data recovery study area. Most of the transfer prints were applied to White ware. However, four pearl ware sherds with transfer prints were found at variable depths in the North and South Middens.

Single-color transfer prints collected from the site include cranberry, black, sepia/brown, gray, green, mute blue, purple, and flow patterns in blue, black and red (Figure 10.24). The total count for single-color transfer prints other than blue/cobalt blue is 211 sherds, or 51 percent of all transfer prints recovered. Table 10.5 provides the depths at which these artifacts were recovered.

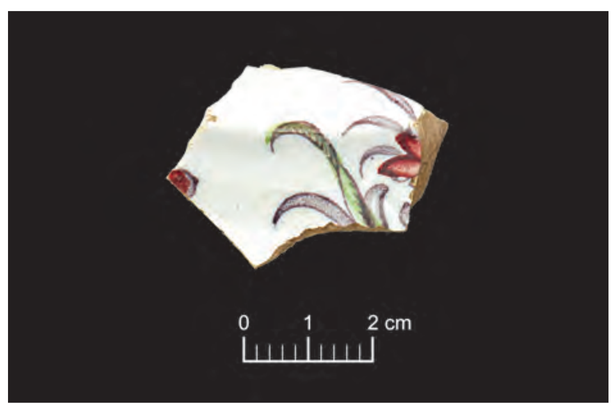

Figure 10.22. Transfer-printed and painted sherd recovered from the Area 1 structure (EU 121).

Table 10.5. Inventory of Colors and Styles of Transfer Prints Recovered from the San Gabriel Mission Archaeological Site

Sample Unit Area	EU	Beginning Depth (cmbd)[1]	End Depth (cmbd)[1]	Attribute	Artifact Description	Color Pattern	Date
Area 1	121	80[1]	100	White ware	Scenic floral pattern	Mute blue	1840–1860s
Area 1	121	80	100	White ware	Scenic	Black	1840–1860s
Area 1	121	80	100	White ware	Floral pattern	Cranberry	1828–1860s
Area 1	135	77	100	White ware	Flow black	Black	1835–1860s
Area 1	135	77	100	White ware	Flow blue	Blue	1835–1860s
Area 1	135	100	110	White ware	Scenic	Brown sepia	1830–1860s
Area 1	135	100	110	Pearl ware	Floral pattern	Blue	1780–1820s
Area 1	165	96	110	White ware	Floral pattern	Cranberry	1830–1860s
Area 1	166	96	110	White ware	Indeterminate	Blue	1820–1860
Area 1	165	110	120	White ware	Floral Pattern	Blue	1820–1860s
Area 1	243	120	130	White ware	Scenic floral pattern	Mute blue	1840–1860s
Area 1	243	130	140	White ware	Very small	Blue	Indeterminate
Area 2	137	40	50	White ware	Floral pattern	Grayish blue	1880s
Area 2	137	80	90	White ware	Indeterminate	Blue	1820–1860s
Area 2	251	90	110	White ware	Scenic	Cobalt blue	1830–1860s
Area 2	252	100	110	White ware	Floral Pattern	Cranberry	1830–1860s
North Midden	270	120	130	Pearl ware	Indeterminate	Blue	1780–1830
South Midden	118	100	110	White ware	Floral pattern	Cobalt blue	1830–1860s
South Midden	273	116	130	White ware	Indeterminate	Blue	1820–1860s
South Midden	273	116	130	White ware	Indeterminate	Blue	1820–1860s
South Midden	273	116	130	White ware	Floral pattern	Blue	1840–1860s
South Midden	273	116	130	Pearl ware	Scenic	Blue	1780–1820s
South Midden	273	116	130	White ware	Indeterminate	Brown	1830–1860s
South Midden	273	116	130	White ware	Very small	Black	Indeterminate
South Midden	273	150	160	White ware	Floral pattern	Blue	1840–1860s
South Midden	282	100	110	White ware	Very small	Blue	Indeterminate

Table 10.5. Inventory of Colors and Styles of Transfer Prints Recovered from the San Gabriel Mission Archaeological Site

Sample Unit Area	EU	Beginning Depth (cmbd)[1]	End Depth (cmbd)[1]	Attribute	Artifact Description	Color Pattern	Date
South Midden	282	100	110	Pearl ware	Indeterminate	Purple	1780–1820s
South Midden	282	100	110	White ware	Floral pattern	Black	1840–1860s
South Midden	282	110	120	White ware	Floral pattern	Black	1830–1860s
South Midden	282	110	120	Pearl ware	Indeterminate	Black	1780–1820s
South Midden	282	120	130	Pearl ware	Indeterminate	Cobalt blue	1780–1830
South Midden	282	120	130	White ware	Indeterminate	Brown	1830–1860s
South Midden	282	120	130	White ware	Indeterminate	Black	1830–1860s
South Midden	282	130	140	Pearl ware	Indeterminate	Black	1780–1820s

[1]Depths below datum references are as follows: Datum 3 for EUs 118, 121, 135, 137, 165, 166, 243, 251, 252; Datum 8 for EU 270; Datum 12 for EUs 273 and 282

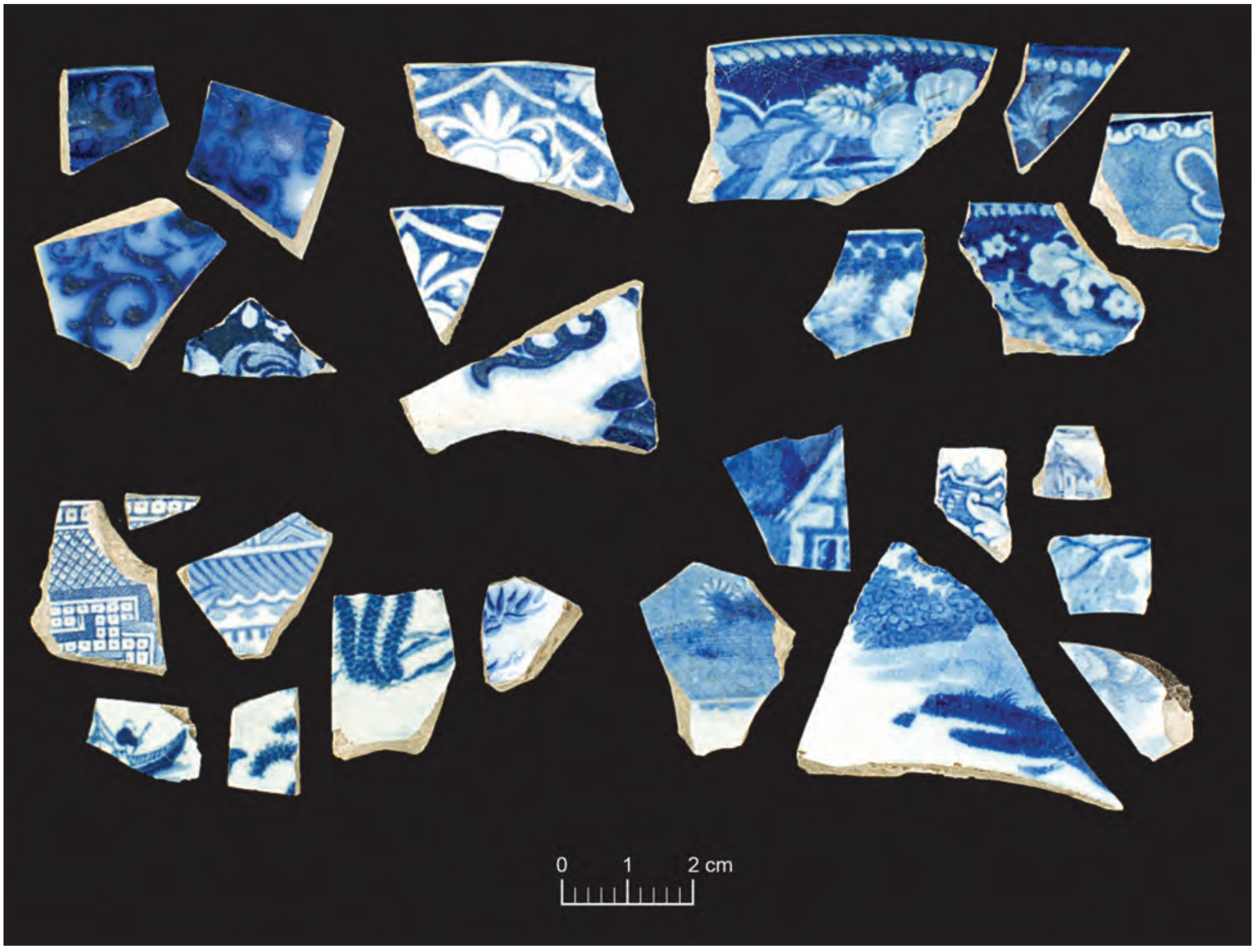

Figure 10.23. Blue and cobalt blue transfer print sherds from the San Gabriel Mission archaeological site.

Transfer prints on white ware occurred to depths of 90 to 110 cmbd (Datum 3) in Area 2, 130 to 140 cmbd (Datum 3) in Area 1, and 150 to 160 cmbd (Datum 12) in the South Midden (see Table 10.5). Within the sampled units, most blue/cobalt blue transfer prints were limited to the upper fill levels. In or around Chapman's Mill, one white ware sherd with a cobalt blue transfer print was found at a depth of 100 to 110 cmbd (Datum 3) in EU 252, and another with a cranberry-colored print at 90 to 100 cmbd (Datum 3) in EU 251. Both excavation units are situated along the north wall of the southern extension to the mill. These two sherds provide a date of deposition after 1828. However, it is unclear if these sherds were recovered from fill deposits or were found in situ. The only other sampled unit associated with the mill that yielded transfer prints was EU 137. This unit was excavated inside the central component of the mill, which largely contained fill.

Within Area 1, several transitional British-period ceramics were found. These include mute blue transfer prints found in Units 121 and 243, both sampled units. These artifacts post-date 1840. Many of these sherds were found at the floor level of building in Area 1 below the roof fall. They are represented by muted blue transfer prints, datable by a manufacture's mark used between 1840 and 1863 (Gibson 2011:18). The mark also names the registered pattern Columbia, a well-known product marketed by W. Adams and Sons (Figure 10.25). Another sherd exhibits a purple transfer print with overglaze painting, a transitional technique that was first employed in the 1840s. It would appear that, while constructed at an earlier date, the building continued in use through the 1840s, perhaps dating its period of abandonment. Sherds post-dating this time frame were not found in situ.

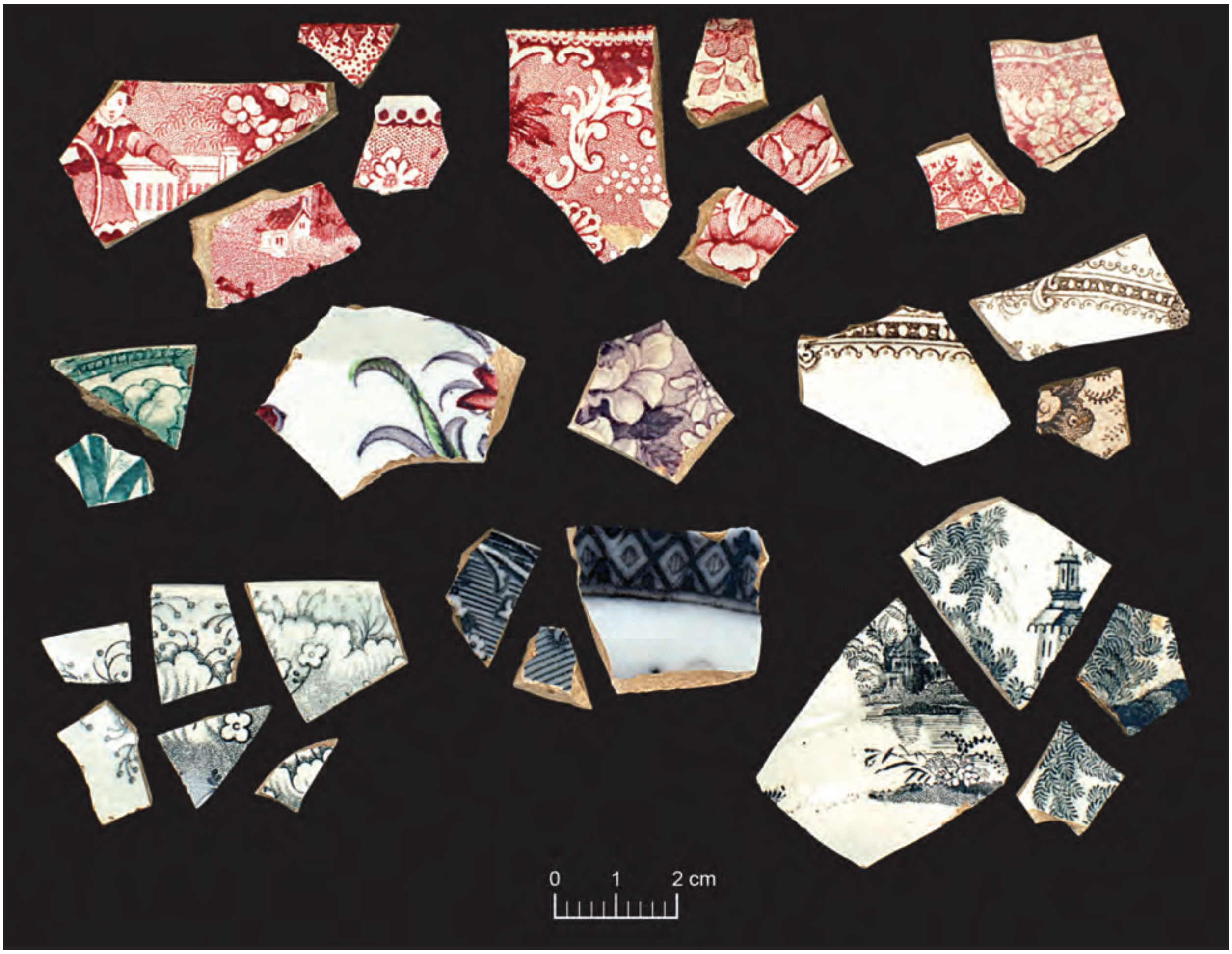

Figure 10.24. Various single colors and styles of transfer print sherds from the San Gabriel Mission archaeological site.

Transfer-printed white ware continues to depths of 150 to 160 cmbd (Datum 12) in EU 273 and to 130 to 140 cmbd (Datum 12) in EU 282, both located in the South Midden. At these depths, the sherds generally display patterns of blue or cobalt blue scenic or floral patterns. They represent the earliest forms of white ware or pearl ware. Deposits in the North and South Middens do appear to be stratified. Cream wares and undecorated pearl ware ceramics were found at the base of excavations in EUs 273 and 282, where depths of 170 and 160 cmbd (Datum 12) were reached, respectively. In EU 118, in the South Midden, the lowest excavation levels of 110 through 126 cmbd (Datum 3) were free of British wares and limited to Majolica and Chinese porcelain.

Sample Units

Nineteen excavation units were selected for detailed ceramics analysis from the three areas of the site, including Area 1, Area 2, and the North and South Middens. Six units were selected from Area 2, seven units were from Area 1, while six units were located in the North and South Middens. Ceramics collected from the refuse pit (Feature 14) within Area 1 were also considered. The historical ceramics from each area and sample unit are described below.

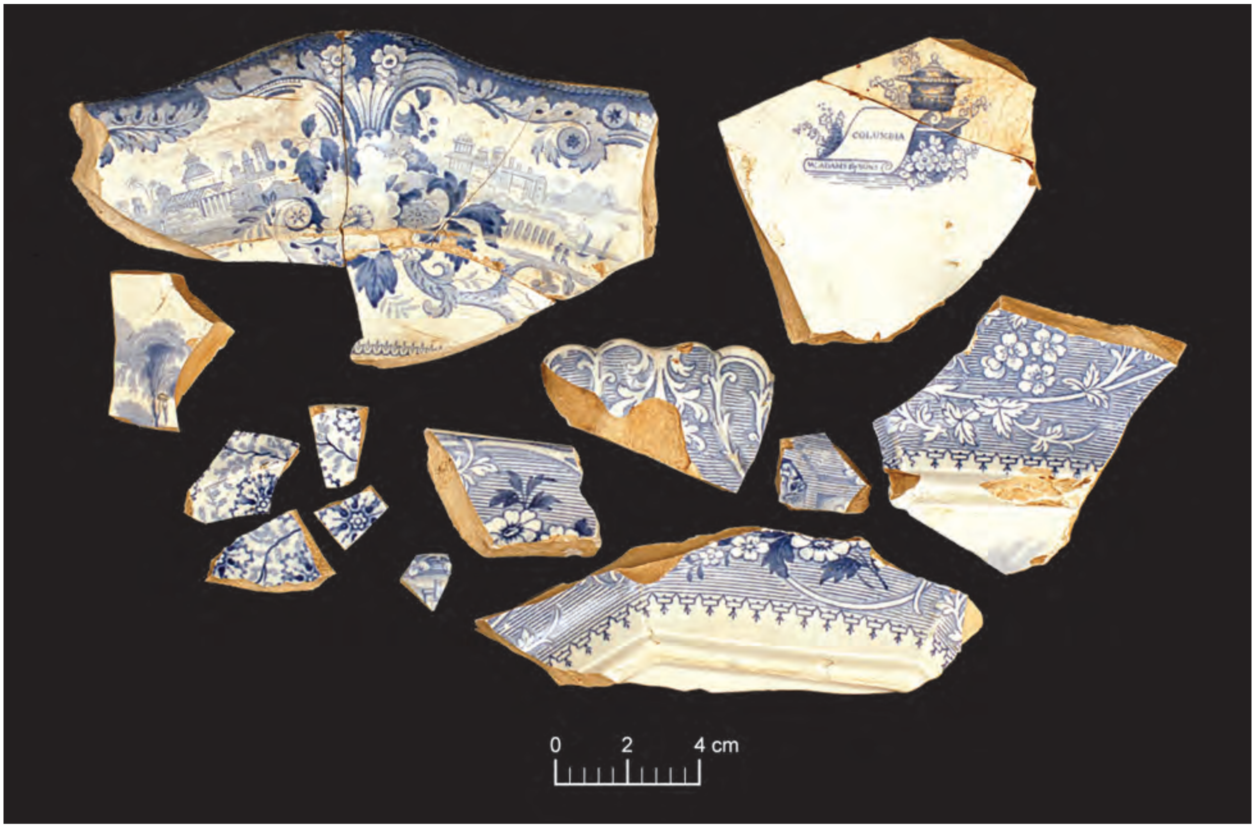

Figure 10.25. Mute blue transfer print sherds from the San Gabriel Mission archaeological site.

Area 1: Building

Seven excavation units were selected for detailed analysis within and immediately adjacent to the Area 1 structure. EUs 121 and 135 were excavated east of the Area 1 structure. Within EU 121, Feature 9 was encountered. This feature represents Spanish tile pavement situated outside of the building. EU 135, situated two meters east of EU 121, was excavated in an area of concentrated artifacts and darkened soil. EUs 243 and 255 were both located within the Area 1 structure walls and beyond the later-period disturbance designated as Feature 14, an 1880s refuse pit. Consideration of the refuse pit (Feature 14), which was quite large, was limited to EU 149. Two units were considered west and outside of the building. Excavated as a block, Units 165 and 166 contained Feature 13, a second area of Spanish tile pavement. EU 272 was located at the northwest corner of the Area 1 structure, north of the railroad tracks. This unit was situated outside of the structure.

EU 121

This excavation unit, excavated just outside of the east Area 1 structure wall, did not yield Mexican import ceramics, Majolica, or Chinese porcelain. Most sherds (nine total), were identified as white ware dating to the transitional period of 1828–1840s through the 1860s. A single sherd of undecorated cream ware and two Annular ware sherds were also found. The latter are painted blue and brown, which dates the sherds to the 1830–1860 period. A single green Shell Edge plate rim was collected, as were nine fragments of white ware. Three derive from saucers and are undecorated. Three plate fragments are painted with multicolor floral designs, dating them to the 1840–1860 period. A single cranberry transfer print found at 80–100 cmbd (Datum 3) provides a date of 1828–1860s. Two scenic transfer-printed sherds of black and mute blue, both recovered at 80–100 cmbd (Datum 3), provide a terminus post quem (TPQ) date of 1840, based on the mute blue sherd.

EU 135

No lead-glazed or unglazed Mexican import ceramics were recovered from this excavation unit. Tin-enameled earthenware includes two undecorated Majolica body fragments found at depths of 77–100 cmbd and 100–110 cmbd (Datum 3), respectively. Early British earthenware was present, including two undecorated cream ware sherds and three undecorated pearl ware sherds. A single blue Shell Edge plate rim and two painted tableware vessel sherds were recovered, including one Sprig floral design painted with blue, green, and red. Other painted sherds recovered came from a bowl painted brown, orange, and green, and exhibiting annular banding. A single pearl ware plate/saucer fragment is transfer printed with a blue floral pattern. Seven white ware tableware sherds were found, four of which are undecorated, with another three displaying transfer prints. These three sherds, a flow blue (77–100 cmbd [Datum 3]), flow black (77–100 cmbd), and brown sepia (100–110 cmbd), provide a date of 1830–1860. Other ceramic fragments include a single crockery jar and a hollow, undecorated ironstone fragment.

EU 165

This excavation unit, situated to the west of the Area 1 structure in an area of tile pavement (Feature 13), yielded no Mexican lead-glazed or unglazed ceramics, no Majolica, and no Chinese porcelain. The ceramic assemblage consists primarily of British earthenware, including a single undecorated pearl ware dish rim, a single yellow ware bowl fragment, two salt-glazed stoneware fragments from an ale bottle, and a storage jar. The total 11 remaining sherds are undecorated white ware; two of these are transfer-printed white ware. The two transfer prints are blue and cranberry floral designs dating the deposit between the 1820s and the 1860s. These sherds were found at depths of 96–110 cmbd (Datum 3). One non-Chinese porcelain hollow ware fragment displays painted traces of blue and orange, but the specimen is too small for identification of the motif or place of manufacture.

EU 166

This excavation unit, also situated in the area of Feature 13, yielded two jar fragments of soft-paste earthenware and a single Majolica sherd. The Majolica was found at 120–130 cmbd (Datum 3) beneath the tile pavement. A Chinese imported brown stoneware fragments as well as two non-Chinese porcelain fragments were recovered between 96 and 110 cmbd. All three of these sherds could not be dated. Early British earthenware includes tableware fragments consisting of four undecorated cream ware sherds found at 96–130 cmbd, three undecorated pearl ware fragments, and a single fragment of a hollow Annular ware vessel found at 110–130 cmbd. This sherd is painted blue but is too small to identify further. Six white ware sherds were recovered, three of which are from a chamber pot characteristic of the Victorian era. The remaining ceramics recovered are tableware, two of which exhibit blue transfer-printed patterns (96–110 cmbd). Other ceramic vessel fragments include two undecorated ironstone sherds and a single unpainted bisque fragment of unknown function. The artifact deposit which overlay the Feature 13 tile pavement contained late-period ceramics. The stratigraphy was clear: older materials were found beneath the tile pavement, while there was modern disturbance above the pavement.

EU 243

This excavation unit yielded a single Puebla Blue-on-white cup body fragment at 110–120 cmbd (Datum 3), but no Mexican lead-glazed or unglazed ceramics and no Chinese porcelain were found. British earthenwares are most prevalent and include two undecorated cream ware plate fragments, two undecorated pearl ware cup fragments, and a single cup body fragment painted in a colorful Peasant style (blue and green), all recovered between 110–140 cmbd. There are two white ware fragments exhibiting blue transfer print, but they are too small for identification of motif or temporal placement. These sherds were found at 130–140 cmbd. A general date of post-1830 can be assigned. A third sherd is printed in mute blue providing a manufacture date between the 1840s and 1860s. It was found at

120–130 cmbd. This unit was placed inside the Area 1 structure near the south end. It is outside of the disturbance created by the refuse pit (Feature 14).

EU 255

This excavation unit yielded one Mexican lead-glazed olive jar fragment. No Majolica or Chinese porcelain was found. Four pearl ware fragments represent the early British earthenware types occurring in this assemblage, dating it to the pre-1820s period. Three of the pearl ware sherds are cup fragments painted in a colorful Peasant style (blue, black, and cranberry or deep red) that yield a date of 1780 to the 1820s. A single pearl ware plate/dish rim exhibits blue Shell Edge decoration, also manufactured before 1820. A very small earthenware hollow body sherd exhibits traces of a cranberry transfer print but is too small to identify further. This would provide a date of post-1828 when the color was introduced. Similarly, a single porcelain fragment is also too small for identification of decorative type. One earthenware rim fragment recovered at 90–100 cmbd (Datum 6) is glazed with a cranberry slip. The specimen is similar to other vessel fragments recovered from the site; fitting in the American ceramics category, the sherd is thought to be late and indicative of ground disturbance. A crockery jar body fragment was recovered from this unit. EU 255 is located inside the Area 1 structure to the north of the disturbance created by the refuse pit (Feature 14). The American-period ceramics could have been introduced at a later period, as other intrusive activities have occurred in the general area.

Refuse Pit (Feature 14), EU 149

The refuse pit (Feature 14) represents just such an intrusion. It was dug into the center of the Area 1 structure. It appears to have been dug into an even earlier disturbance that contained sparsely distributed artifacts. The refuse pit (Feature 14) was a concentration of historical refuse that contained the remains of several dogs. While much of the feature was excavated, only EU 149, dug in roughly the center of the pit, was fully analyzed.

The six ceramic sherds considered from the refuse pit (Feature 14), EU 149, are very fragmentary. They include earthenware vessel sherds, ironstone, and white ware. The two ironstone fragments are from the base and body of a large serving bowl. A single white ware hollow ware base was also recovered, as was a luster ware sherd, which is too small for identification of the vessel type; the manufacturing technique likely postdates 1830. While none of the ceramic sherds from this sample unit evidence manufacturing marks, marked vessels were found in the feature. In addition, a fragment from a serving platter/tureen recovered from EU 149 exhibits a blue transfer print scenic pattern named Columbia, which was manufactured by Adams and Sons between 1840 and 1863 (Gibson 2011:18).

Area 2: Reservoir Complex, Mill, and Millrace

Among the six units associated with the mill and millrace selected for detailed analysis, two were situated outside of the eastern wall of the mill (EUs 105 and 108). EU 206 was located outside of the northeastern corner of the mill, and the remaining three units (EUs 137, 251, and 252) were situated inside of the mill walls. EUs 251 and 252, excavated as a block, were located along an interior wall extending roughly east to west. Generally, the interior units (EUs 137, 251, and 252) contained mixed fill deposits, while EUs 105, 108, and 206 appeared to be largely undisturbed below 50 cmbd (Datum 3). At these levels, deposits were relatively intact, yielding artifacts potentially deposited during construction of the mill or earlier periods of use of the area.

EU 105

EU 105, situated east and outside of the mill, yielded a variety of historic ceramic sherds. These included Majolica, Chinese porcelain, low-fired earthenware, undecorated British earthenware, and later-period ironstone. Three fragments of Mexican low-fire earthenware were recovered from this unit, including one each of Galera, Tonala, and a green glaze stoneware. These sherds were found in levels of 110–120 cm and 130–140 cmbd (Datum

3), indicating a presence of early Mission ceramics at depths below disturbance. A variety of Majolica fragments were also found and included 11 specimens of Puebla Blue-on-white, two of San Augustine Blue-on-white, 18 of San Elizario Polychrome, a single Aranama Polychrome, and a single Monterey Polychrome sherd.

A single bowl base from this unit (found at 140–150 cmbd [Datum 3]) was refitted with a base and body fragment from EU 126 (level 130–140 cmbd [Datum 3]). EU 126 is situated immediately west of EU 105. The majority of Majolica fragments were found in levels below 50 cm, though six fragments were recovered from 30–40 cmbd and 40–50 cmbd. Majolica vessel forms in this context represented plates, cups, and a bowl. A variety of Chinese export porcelain sherds were recovered; these included two blue underglaze Canton sherds, one Famille Rose fragment, and one overglaze rim sherd. One of the Canton fragments was found between 30 and 40 cmbd, while the remainder was found at undisturbed depths greater than 50 cmbd.

British earthenware, which signals later-period deposits, includes undecorated tableware vessel fragments of pearl ware, cream ware, and white ware. The unit contained a single ironstone plate rim fragment from a Southern Pacific Railroad Harriman Blue patterned vessel. It was recovered at 40–50 cmbd, clearly a disturbed context. Similar examples of this pattern were made by Maddock for the Southern Pacific Railroad and date to around 1906 (Dietler et al. 2010:58). Another white ware plate base was recovered from the 40–50 cm level and has been identified as a G. L. Ashworth and Bros., Hanley, Staffordshire, English product. Vessels of this type were manufactured between 1862 and 1890 (Kovel and Kovel 1986:84). The sherd was recovered from what is considered a transitional level between mixed fill and undisturbed context, as observed in EUs 203–206, and EUs 220–225 excavated along the northern wall outside of the mill.

EU 108

The ceramic assemblage from this unit is very fragmentary, with the majority of the sherds only being identifiable to the ware type because they lack other diagnostic attributes. This excavation unit is situated along the eastern exterior wall of the mill. Identifiable sherds include a single fragment of lead-glazed Mexican low-fired earthenware. It is from a brown-glazed jar fragment recovered at 90–100 cmbd (Datum 3). Eight undecorated Majolica body sherds (the majority recovered below 50 cmbd), a stoneware fragment, and an undecorated Chinese porcelain fragment were found. Dates for this deposit derive from early British earthenware, including two undecorated cream ware plate fragments (1762–1810) recovered at 80–90 cmbd, and one pearl ware blue Shell Edge plate rim (1780–1820s) recovered at the transitional level of 40–50 cmbd.

EU 206

This excavation unit yielded a variety of unglazed Mexican import earthenwares, in an assemblage of 19 total specimens. Included are 10 black-and-red-on-cream burnished fragments derived from jars/bowls. These ceramic sherds are decorated with simple lines and dots. Two fragments are of plain cream ware, and another is a single red-burnished sherd, all of which were found at depths of 110 to 160 cmbd (Datum 3). Lead-glazed Mexican earthenware is represented by six Galera clear-glazed sherds from small bowls/jars. Some are painted black. Majolica includes nine undecorated fragments. Others with decorations were identified as Puebla Blue-on-white variants (27 total sherds) and San Elizario Polychrome fragments (12 total). Five additional cup rim sherds and a plate rim fragment were identified as Puebla Blue-on-white variants of Huejotzingo and Wavy Rim patterns; these were found at depths in excess of 140–160 cmbd. Two fragments of Chinese stoneware were found, including a single jar rim and a bowl fragment. Four undecorated white ware sherds were recovered from this unit as well as two ironstone sherds, one of which is painted with black lines. Found at depths of 60–70 cmbd, the ironstone is likely intrusive and was retrieved from the transition layer.

Sherds from EUs 105, 108, and 206 would indicate that an older surface is present below 60 cmbd (Datum 3). It was upon this surface that Chapman's Mill was built between 1820 and 1823.

EU 137

Among the units excavated within the interior of the mill was EU 137. Mexican import lead-glazed items from EU 137 include 10 Galera sherds exhibiting painted geometric designs of lines and swirls. One jar rim is glazed with olive green slip on the exterior. Fragments refitted from between levels (63–130 cmbd [Datum 3]) are from the same vessel (Catalog Numbers 13390.01 and 12360.01). Four tin-enameled Majolica sherds were recovered; these included two undecorated tableware body fragments, one Puebla blue-on-white cup/bowl fragment, and one plate body fragment with elements of a yellow Aranama Polychrome pattern (found at 40–50 cmbd).

Chinese exports include two underglaze blue-on-white Canton; a single base, possibly from a Famille Rose saucer; one overglaze painted sherd; and one Chinese stoneware bowl fragment. British earthenwares include two early British undecorated cream ware and eight pearl ware. The pearl ware sherds include two painted Peasant floral style patterns in black, green, and red. One rim sherd refitted with Catalog Number 05591.01 in the same unit, which was found at a level of 100–110 cmbd. A sherd with an 1880s floral pattern transfer printed on white ware was recovered from 40–50 cmbd and is assumed to be intrusive. Another basal fragment is from a blue transfer print vessel but is too small to determine the decorative pattern or vessel form. This cobalt blue sherd was found at a depth of 80–90 cmbd and dates to between 1820 and 1860s. Based on the materials recovered from this provenience, it would appear the unit was largely mixed.

EU 251 and EU 252

These excavation two units were excavated adjacent to each other along an interior wall of the mill. Only two ceramic fragments were recovered from EU 251, including a single cobalt blue scenic transfer-printed bowl/cup fragment and a single tin-enameled Majolica hollow body fragment recovered at 90–100 cmbd (Datum 3). The British ceramic sherd can be dated to between 1820 and 1860s.

EU 252 yielded a total of six tin-enameled Majolica, including a single undecorated body fragment and blue-on-white plate fragments. Two San Elizario Polychrome sherds (1750–1830s) represent a cup/bowl fragment and a plate rim. A single fragment of undecorated Chinese porcelain was found. British earthenware includes pearl ware painted in the Peasant style on a saucer rim with a floral pattern of blue, black, green, and a deep red or dark cranberry. Of the two white ware fragments, one is transfer printed in cranberry and dates the deposit to the 1830s–1860s, while the second is glazed with a solid cranberry slip and is an American-period fragment. It was found at 140–150 cmbd and is clearly intrusive. A single hollow body fragment identified as undecorated ironstone was recovered at 100–120 cmbd. The presence of these two sherds suggests this deposit represents fill.

North Midden and South Midden

The North and South Middens were defined as the area between the mill and the Area 1 structure, north and south of the Union Pacific Railroad right-of-way (see Figures 4.4 and 4.5) Excavations in the South Midden included the block excavation of EUs 115–118. Of these four units, only EU 118 was considered during detailed analysis. EUs 273 and 282, excavated as a block in the South Midden area of concentrated *tejas* (Mission-period roof tiles) and animal bone, were considered, as were EUs 270, 271, and 283, which were excavated around Feature 34 in the North Midden.

EU 118

This excavation unit yielded a few Mexican lead-glazed earthenware fragments, including a single Galera bowl rim painted black, and a brown-glazed ceramic sherd. Eight Majolica sherds were found, five of which are undecorated and three of which are Puebla Blue-on-white tableware fragments, all recovered below 50 cmbd (Datum 3). Chinese export porcelain was recovered in sparse quantities; examples included a single overglaze Famille Rose sherd from a depth of 130–136 cmbd. This sherd provides a production date of 1720 to 1800. A single example of Provincial ware was found at 110–120 cmbd.

British earthenwares were present and include an undecorated cream ware rim and two basal plate fragments, as well as one undecorated cup body fragment and one pearl ware blue Shell Edge fragment recovered from the 100–110 cm level. Undecorated white ware fragments include a plate base and a hollow body sherd. A bowl fragment is printed in a cobalt blue floral pattern dating to after 1830. One bottle/jug salt-glazed stoneware sherd was also recovered from this unit.

EU 270

This unit yielded a small quantity of ceramic sherds. These included a lead-glazed rim sherd of brown stoneware identified as a Chinese export Provincial ware, recovered at 80–90 cmbd (Datum 8). A Chinese blue underglaze porcelain sherd, identified as Nanking style, was recovered at 35–50 cmbd. The sherd exhibits a section of the butterfly and diaper motif, which dates its manufacture to between 1764 and 1820. It likely was brought in by the Spanish Manila galleon trade. Three sherds, one with a blue transfer print, date to 1780–1830. These were found at depths of 120–130 cmbd. Two small undecorated sherds were identified as ironstone and porcelain; both were recovered at a shallow depth of 35–50 cmbd.

EU 271

This unit, situated north of the railroad tracks, yielded few and very fragmentary ceramic sherds. No Mexican lead-glazed or unglazed sherds were found, and no Chinese export porcelain was recovered. Tin-enameled ware is represented by a single bowl fragment. The remaining five sherds were identified as undecorated white ware (n = 2), porcelain (n = 1), and ironstone (n = 1). The ironstone fragments include one molded sherd that was too small for identification of the pattern; it was recovered at 80–90 cmbd (Datum 8).

EU 283

EU 283 is situated north of the railroad tracks in a block excavation that included EUs 270 and 271. Feature 34 was identified in this combined excavation block and field recorders described it as a cobble foundation and adobe wall that was partially disturbed during railroad construction. Mortar, plaster, and asphaltum were observed during excavations, with the foundation originating between 77 and 94 cmbd (Datum 8). A few very fragmented ceramic sherds were recovered.

No Mexican lead-glazed or unglazed sherds were found. Chinese export porcelain was also absent from this unit. A single Majolica Blue-on-white vessel fragment was recovered at 60–70 cmbd above the feature. The remaining ceramic fragments found include seven undecorated white ware plate fragments and two ironstone fragments. Among the ironstone fragments, one was a cup rim sherd recovered at 35–60 cmbd and the other was a fragment recovered from a depth of 60–70 cmbd. Two porcelain ceramics sherds exhibiting decal floral patterns were recovered at 35–60 cmbd and clearly are later period intrusions.

EU 273

EUs 273 and 282 were excavated adjacent to one another. During mechanical trenching, a concentration of bone and tejas was found at a depth of 116 cmbd (Datum 12). This unit yielded a wide variety of ceramics, and the deposits appeared to be stratified. At the top of the trench to a depth of 60 cm, the deposit and the artifacts it contained appeared to be associated with railroad construction. Below this level, Mission-period deposits were encountered. Two distinct layers of concentrated tejas and bone were separated by a layer that was free of tejas but contained sparsely scattered artifacts. Below the final layer of tejas was a shallow midden containing exclusively Native American ceramics. The ceramics discussed below were all recovered from below the level of railroad construction.

This excavation unit yielded Mexican imported lead-glazed and unglazed fragments. Three sherds of unglazed ware are painted red-on-cream. Four lead-glazed Galera fragments were collected, some of which are painted black. Other Mexican imported sherds include two brown-glazed fragments. Two enameled earthenware fragments were found, one of which is from a Puebla Blue-on-white cup. Most of the lead-glazed earthenware vessel shapes and types were derived from the few rims and base sherds analyzed in the assemblage and recovered at 140–170 cmbd. A single bowl/cup rim of Chinese export porcelain was recovered from 140–150 cmbd and exhibits an overglaze Famille Rose decoration.

Early British ceramics are well represented in this unit, with a total of 21 undecorated cream ware tableware fragments and six pearl ware fragments. A single blue Shell Edge decorated plate fragment, a single blue-painted cup fragment, and a single blue scenic transfer print recovered between 116 and 130 cmbd were identified. Other ceramics recovered from this unit include a black-banded, blue-slipped Annular ware body sherd, as well as eight white ware transfer-printed tableware vessel fragments and a fragment with a transfer print floral pattern of blue, light blue, brown, and black colors. These generally date between 1820 and 1860 and were found at varying depths. The black and brown sherds were only present in the 116–130 cmbd level (Datum 12), while the light blue transfer print was found between 116–130 cmbd and again between 150 and 160 cmbd. These sherds were not those characteristic of the mute blue introduced in the 1840s, but appeared to be lighter shades of blue in a more complex cobalt scenic transfer pattern (perhaps Wild Rose). This places their production after the 1790s. Finally, blue transfer printed sherds were present at 116–130 cmbd and 140–150 cmbd. These sherds are very fragmented and only identifiable as printed earthenware. Excavations continued to 170 cmbd, where the final sediments yielded very fragmented cream ware and undecorated pearl ware.

EU 282

Situated to the north of EU 273, this unit measures 100 × 50 cm and was excavated into the trench wall to verify the observations made in EU 273. Similar stratigraphy was revealed. This unit yielded nine Mexican import lead-glazed earthenware ceramics vessel fragments. Galera is represented by four undecorated sherds, while four brown-glazed jar fragments and a single green-glazed fragment were found. Tin-enameled Majolica is represented by a single Puebla Blue-on-white cup fragment and two polychrome fragments identified as Aranama Polychrome (yellow) found at 90–100 cmbd (Datum 12), and Monterey Polychrome (green and black) found at 100–110 cmbd. No motif was specifically identified because the enameled sherds are fairly small.

Three Chinese export porcelain tableware fragments exhibit both underglaze and overglaze patterns, including blue underglaze Canton/Nanking style patterns. A single overglaze Famille Rose cup rim fragment was recovered at between 100 and 110 cmbd.

Early British ceramics from this unit include a group of six tableware vessel fragments of undecorated cream ware and 14 of pearl ware. Five of the pearl ware fragments are undecorated. The others display a blue Shell Edge rim, and three cup and saucer rim and body sherds exhibiting blue-on-white painted designs. The remaining three sherds are printed with black and purple designs, but are too small for further identification of the decorative motif.

Two painted Annular ware sherds were recovered from this unit. One vessel sherd is black-banded blue and the other is black-banded green. A group of 12 undecorated and decorated earthenware items recovered include tableware vessel fragments. Of these, a green Shell Edge plate rim was found along with six white ware plate, bowl, and cup rim and body sherds exhibiting transfer print decorations. These artifacts were recovered between 100 and 110 cmbd. Transfer print designs include floral patterns, and the colors present include cobalt blue (1780–1830) and blue, brown, and black (1830–1860s). Other ceramics recovered from this unit include a group of very small sherds identified by ware type only as earthenware, and a single undecorated ironstone bowl body found at 70–80 cmbd.

Discussion

The artifact assemblages recovered from California mission sites generally contain five main ceramic ware types: indigenous-made Mission

Brown ware (see Native American Ceramics section below), Mexican Majolica, low-fired Mexican earthenware, Chinese porcelain, and British-made cream wares, pearl wares, and white wares. The relative percentage of these ware types can reflect the age of the assemblage because of historical shifts in transoceanic trade. For example, if Majolica, Mission Brown ware, Mexican low-fired earthenware, and Chinese import porcelains are present in relatively high frequencies and British ceramics occur in low numbers or are absent, then the deposit most likely predates 1810. If British wares dominate and the percentages of Mission Brown ware and Majolica are low, then the deposits likely postdate the eruption of the Mexican War of Independence in 1810. During this period, the Spanish galleon trade faltered and supply ships were no longer sent from San Blas. This shift from dominance of Spanish imports to British wares reflects a period of Hispanic to American transition in Alta California. The lower the percentage of Majolica, low-fired earthenware, Mission Brown ware, and Chinese ceramics, the more complete the transition.

Spanish Trade (1503–1810)

An understanding of the mechanism of trade during the period of colonization of the Americas is critical to understanding this transition in ceramics manufacture and product dispersion. A close examination of Spanish trade from its inception with the American colonies to its suspension on the west coast reveals the distribution networks of goods arriving in Alta California. From the beginning, this trade operated under a mercantile policy. Private merchants orchestrated the commerce and, under Spanish rule, the colonies were permitted to import from and export to Spain alone. Deagan thus characterized Spanish trade in the southeast United States during this time:

> To implement the policy and control commerce, a system of annual trade fleet known as the *Carrera de Indias* was implemented in 1503. The *Carrera* was controlled by a government institution known as *Casa de la Contratacion* which was located in Seville. Through the *Casa,* Seville came to establish a monopoly on the control of Spanish-American shipping and through most of the colonial period the mechanisms for the distribution of goods were designed to work to the advantage of the powerful Sevillian merchant who, in turn, made strategic trading alliances with land- and labor-owning colonists. (Deagan 2003:6)

European goods were traded for America's natural resources, and the *Carrera* system benefitted those who controlled the resources on both sides of the trade. Spanish exports included wine, raisins, olives, almonds, silk, metal, and china goods. These goods were exchanged for America's bullion, sugar, dye wood, otter and beaver pelts, and cattle hides and tallow. Piracy, inclement weather, length of voyage, shipwrecks, warfare, and trade restrictions all contributed to the system's unpredictability, resulting in widespread dissatisfaction in the colonies that depended on the arrival of old world goods. When goods were scarce, colonists responded to the inadequacy of the Spanish exclusionary trade by producing European-style goods. The production of Majolica in Mexico and manufacture of mission tile in Alta California are outstanding examples of the emergence of crafts developed in the absence of supply. While merchants attempted to suppress local production, craftsmanship flourished. This was the status of commerce as the missions were established along the west coast of California. As they grew, the missions began to produce their own wines, establish fruit orchards including olive groves, and develop local crafts, particularly in leather goods.

Significant to western trade in the late 1500s through early 1700s was the rise of the Spanish Manila galleon trade. Through this avenue, Spain acquired spices, silks, and Chinese porcelain. China, eager for New World silver, manufactured a variety of exports catering to the tastes of the New World market. Beginning in 1565, Spanish galleons sailed along the west coast of North America and returned to Acapulco in New Spain for an annual trade fair. Manila (Spanish East Indies) quickly became the primary maritime port for the Spanish galleon trade (Madsen 2008:D). During the late sixteenth century, Spain sought a northern interim port on the west coast to repair and provision the galleons. Sebastian Vizcaino discovered just such a port at Monterey Bay in 1602.

By the turn of the nineteenth century, the balance of trade had clearly changed. Russian and American commerce, attracted by trade in otter skins, grew aggressive in the Pacific Northwest. As a result, Spain began to fortify the west coast of California in the 1770s. This expansion was conceived of as a military maneuver, but was aided by Franciscan missionaries. In 1770, Gaspar de Portolá reestablished the northern port at Monterey. In the 1780s, because of Spanish trade monopolies, settlements in Alta California were economically dependent on New Spain and Spain itself (Perissinotto 1998:18). The port of San Blas was established in 1768 on the west coast of Mexico by José de Gálvez, *visitator-general* of the Spanish Naval Department. Situated in the present-day state of Nayarit, it became the principal port protecting the Manila galleon trade and the Gulf of California. Perissinotto (1998:18–19), in the *Memorias y Facturas* for Santa Barbara Presidio, notes that "the Department of San Blas served as a supply depot and administrative center for the colonization of Alta California." Citing Robert Archibald, he relays, "For California, San Blas was the only source of supplies in the early years and the most significant until 1810" (Archibald 1978:27).

Despite this effort, the first American ships from the Atlantic seaboard entered the Pacific Ocean in the 1780s (Miller 2001:2). As a result of the American Revolution, trade with the British Isles and the West Indies closed. Then, the Napoleonic wars (1789–1815) made transatlantic shipping extremely precarious. The American colonies limited trade to avoid becoming embroiled in European wars and in 1807 passed the Embargo Act, which forbade American vessels from sailing to foreign ports or exporting American goods. The Non-Intercourse Act soon followed (1809–1810), further restricting importation of French and British goods (Miller 2001:1–3). British and American traders had few options but to seek trade along the west coast, which was only marginally guarded. Alta California was ripe for a steady source of goods. As Spanish shipments became less predictable, a clandestine trade sprang up at ports where there was little or no military presence.

Imported Ceramics from San Gabriel Mission Archaeological Site

The changing dynamic of trade on the western coast of California between 1805 and the 1810s was a direct result of a disruption in Spanish trade on several fronts due to war. One such result was the suspension of the San Blas shipments to Alta California. It was during this time that British and American traders intruded on the Pacific maritime trade. There is little question that British goods were arriving in Alta California in large numbers after 1810, and perhaps as early as 1786 (Archibald 1978:270; Perissinotto 1998:18).

Summary

San Gabriel Mission serves as an example to explore the dynamics of this trade. With 12,379 ceramic sherds collected during Extended Phase I testing, Phase II testing and Phase III data recovery, 65 percent represented Mission Brown ware, while the remaining 35 percent is a mixture of Mexican and British earthenware and Chinese porcelain. The dominance of Mission Brown ware and a high occurrence of Majolica (21 percent of all earthenware, porcelain, and stoneware) strongly suggests that use of the portion of the site excavated predates the British/American intrusion and suspension of Spanish trade.

But the picture at San Gabriel Mission is perhaps more complex. Sherds were collected from three separate areas of the site: 1) those found in and around Chapman's Mill and Millrace; 2) those from the Area 1 structure; and 3) those found between the two buildings, in the North and South Middens. The majority of the Majolica, low-fired earthenware, and Chinese porcelain came from Area 2; while a larger number of British earthenware sherds were found in Area 1. The North and South Middens yielded early British ceramics immediately below a layer disturbed by railroad construction; these specimens included edge-decorated pearl ware sherds and blue, sepia, and black transfer printed white ware, suggesting a date at the transition of marketing pearl wares and the emergence of transfer printing (1790–1820s). Majolica and low-fired earthenware sherds were recovered from deeper strata, and the base of excavations was free of British trade wares, suggesting a date of 1770s to the 1790s for these deeper deposits.

The San Gabriel Mission archaeological site imported ceramic collection appears to represent four discrete occupations or periods of time. These are represented by early mission ceramics dating to the time of construction of the mission in 1775, materials dating to the rebuilding of the mill in the 1820s and continued use through the 1830s and 1840s (Dietler and Hoffman 2011:10), materials corresponding to the period of railroad construction, and intrusive refuse disposal in the post-1880 period.

Native American Ceramics

In all, 8,040 Native American sherds were recovered from the San Gabriel Mission archaeological site, representing one of the largest Native American ceramic assemblages in the region. A sample of 1,246 of these was analyzed in detail and is described here. This sample was derived from excavation units representing the various areas and depositional contexts across the site. Units were selected for analysis based on their likelihood to provide a representative sample of the range of types and wares composing the larger assemblage across the site. Table 10.6 presents the units that were selected and the total counts of Native American ceramics analyzed from these units.

This section begins with a discussion of the definition of Native American ceramics and descriptions of the various types and wares present in the San Gabriel Mission assemblage. It is argued that a new type of Southern California Brown ware—Mission San Gabriel Brown—be defined. A short background of ceramic studies in the region is then provided, followed by the various hypotheses that have developed out of this previous research and that will be addressed by the San Gabriel Mission assemblage analysis. Sample selection and analytical methods are discussed next, followed by the results of the analysis.

Ceramic Wares and Types Recovered at San Gabriel Mission

Native American ceramics are those ceramic artifacts, primarily pottery, made and used by Native Americans, and possibly by nonnative people as well. Southern California Native American ceramics consist of brown ware and buff ware. The distinction is based on the color of the paste and presumed origins. Brown wares are made of self-tempered residual clays dug near their place of origin often in mountainous areas; these clays burn shades of orange to red brown, brown, and gray brown due to the amount of iron oxides present in the clay and the degree of oxidation in open pit firings. Residual clays often contain varying amounts of naturally occurring mica that is visible on the sherd surfaces. Buff wares are made of finely sorted sedimentary clays to which nonplastics must often be added to temper the clay to give it strength during vessel forming. They characteristically turn pink, salmon, beige, buff, tan, and cream colors during firing due to the lack of iron oxides in sedimentary clays which have been transported from their place of origin. All of the California missions were located in coastal areas, often in valleys surrounded by mountains, with access to residual clays. Hence the term Mission Brown wares and similar terms have been applied to ceramics made by Native Americans under the influence of the Spanish mission system.

Three definable wares are represented in the San Gabriel Mission Native American ceramic assemblage: Southern California Brown, California Desert Intermediate Brown, and Lower Colorado Buff. Given that San Gabriel Mission was a way station on the trails between the coast and the desert regions to the east, northeast, south, and southeast, ceramics found at the mission may have derived from a multitude of locales by traders and travelers. Most, however, were made locally at San Gabriel Mission. Table 10.7 describes the ceramic types thought to be likely or possibly present at the mission. Data for the table were taken from the original published ware/type descriptions supplemented by personal observations of type collections and ceramic assemblages.

Table 10.6. Counts of Native American Ceramic Types and Wares by Excavation Unit

Ware	**California Desert Intermediate Brown**		**Southern California Brown**		**Lower Colorado Buff**			**Wheel-thrown**	**Indeter.**	
Type	**Indeter.**	**Indio Brown**	**Indeter.**	**Mission San Gabriel Brown**	**Hedges Buff**	**Ocotillo Buff**	**Red-on-buff**	**Indeter.**	**Indeter.**	
EU										**Total**
105	16	–	22	319	–	–	–	3	87	**447**
108	3	–	17	16	–	–	–	–	11	**47**
118	1	1	22	11	1	–	–	3	5	**44**
121	–	–	8	–	–	–	–	–	–	**8**
135	–	–	1	–	–	–	–	–	–	**1**
137	3	–	12	13	–	–	–	3	6	**37**
149	2	–	9	3	–	–	–	1	1	**16**
165	–	–	–	–	–	–	–	6	–	**6**
166	–	–	–	–	–	–	–	3	1	**4**
206	2	–	2	442	–	–	–	–	17	**463**
243	–	–	4	–	–	–	–	–	–	**4**
255	1	–	1	1	–	–	–	–	–	**3**
269	3	–	12	24	–	–	–	3	9	**51**
273	–	–	40	1	–	–	–	5	8	**54**
282	3	–	41	3	1	1	1	1	10	**61**
Total	**34**	**1**	**191**	**833**	**2**	**1**	**1**	**28**	**155**	**1,246**

Table 10.7. Attributes of Native American Ceramic Wares and Types in the Los Angeles Basin

Ware	Type	Thinning Method	Surface Treatment	Color	Clay Source	Fracture	Temper	Non-Plastics (NP)	NP Shape / % Texture	NP Visible?
Lower Colorado Buff[1]		Paddle-and-Anvil (PA)	Smooth-wiped, burnished; painted, incised; stucco	Gray to pink	Sed	brittle	Varies	Q, F, jasper, H, Grog, occasional M	R, SR/ 5–50% Fine–Coarse	Varies
	Black Mesa Buff	PA	Rough–Smooth	Dark gray rare scum coat	Sed	med- brittle	No	Unpulverized clay, occasional Q, Biotite	SR/ Fine–Coarse	No
	Tumco Buff	PA	Smoothed	Pink, light buff	Sed	med-brittle	No	Unpulverized clay	Occasional sand grains or freshwater snail/ Fine	No
	Colorado Buff	PA	Smoothed; cream scum common	Pinkish buff to tan	Sed	Brittle (hi fired)	No	Sands: Q, F, opaque spars	R/ Very fine <10%	No
	Colorado Beige (and Colorado Red)	PA	Rough–Burnished; occasionally red-slipped	Beige to brown gray; rare scum coat	Sed	Crumbly-med (dull sound)	yes	Q, F, M	R–SA/ 5–55% Fine–Coarse	Yes
	Salton Buff	PA	Wiped	Buff to red	Sed	Brittle		Sands: Q, F, black/red jasper, mollusk shell	R/ 15–50% Coarse–medium	Yes Often sand-blasted
	Topoc Buff	PA	Rough; cream scum crackle	Buff to slate gray	Sed	Brittle		Crystal Q, F, H, some M	SA–SR/ 30–50% Coarse–medium	Yes
	Parker Buff	PA	Wiped	Pink to Gray	Sed	Brittle		F, Q, H, no M; Natural sands	A–SA/ >50% Medium–fine	No

Table 10.7. Attributes of Native American Ceramic Wares and Types in the Los Angeles Basin

Ware	Type	Thinning Method	Surface Treatment	Color	Clay Source	Fracture	Temper	Non-Plastics (NP)	NP Shape / % Texture	NP Visible?
	Hedges Buff[2]	PA	Smoothed	Light buff, pink, gray	Sed	Med-brittle	Yes	Contrasting colored grog	SA-A/ Fine	No
	Palomas Buff	PA	Smoothed	Pink to gray	Sed	Crumbly		Sands: colored F, opaque Q, rock	Fine	Yes
	Octotillo Buff[6]	PA	Smoothed; crazing and pitting also possible	Gray to buff	Sed	Medium hard	Yes	Q and dark sands, gray–brown grog	R Fine–medium "waxy appearance"	Occasional
Southern California Brown (Tizon Brown)[3]		PA	Smoothed–Rough	Brown to dark red, black	Res	Crumbly	no	Q, F, Q/F, M, H	A–SA/ Coarse	Occasional
	Palomar Brown[4]	PA	Smoothed, some wiping marks	Gray, dark gray/ grayish brown, darkish brown	Res	Crumbly	No	Q, F, M, H, occasional tourmaline	A–SA/ Medium–Fine	Mica visible in light
	San Diego Brown[6]	PA	Smoothed	Dark gray to very darkish gray	Res	Crumbly	No	Q, F, sands, varying mica	SA–A Fine–medium	Occasional
	Hakum Brown[6]	PA	Smoothed	Gray, dark gray	Res	Crumbly	No	M, Q, F, trace B	SA–R Medium	Extremely micaceous
California Desert Intermediate Brown[5]		PA	Smoothed–Rough	Tan, dark brown, black	Inter	Crumbly	No	Q, F, M	R–SR/ Fine, grainy	varies
	Salton Brown[2,6]	PA	Smoothed-Rough	Brick red–dark brown	Inter	Crumbly to medium hard	No	Q, F, H, low to moderate M	SA–R/ Inter. [finer=Coachella coarser=Tizon]	Yes –gritty surface

Table 10.7. Attributes of Native American Ceramic Wares and Types in the Los Angeles Basin

Ware	Type	Thinning Method	Surface Treatment	Color	Clay Source	Fracture	Temper	Non-Plastics (NP)	NP Shape / % Texture	NP Visible?
	Tahquitz Brown[2]	PA	Smoothed–Rough	Light brown to gray	Sed	Crumbly	No	Natural Q,F, M	SR/ Fine silty micaceous	Fine mica in light
	Coachella Brown[6]	PA	Smoothed–Rough	Gray-dark gray	Inter	Crumbly	No	Q, F, trace M	SA/ Fine "sugary appearance"	No
	Indio Brown[7]	PA	Smoothed–Rough	Tan-buff	Inter	Crumbly	No	Q, F, M Grog	SA Fine–medium	Occasional
Inter-mountain Brown[8]		Scraping	Rough	Dark brown to black	Res	Crumbly	No	Q, F, M, H	SA-SR/ Coarse	Yes
Owens Valley Brown[8]		Scraping	Rough, roughly smoothed	Reddish brown–brown, Light Gray to Black	Res	Crumbly	No	Q sand, M variable, occasional iron pyrites	R/ Fine–Coarse	Occasional Distinctive horizontal wiping on ext.; diagonal on int.

Shaded wares and types are present in the San Gabriel Mission assemblage. [1] Based on Waters 1982, supplemented by observations from type sherds; [2] Schaefer 1995 but placed in California Desert Intermediate Brown by Griset; [3] Euler and Dobyns 1958; [4] Meighan 1959; [5] Griset 2013; [6] May 1978; [7] Griset 2007; [7] Pippin 1986; [8] Riddell 1951 and personal observation.

Abbreviations:

A – angular
B – biotite
F – feldspar
Grog – ground sherd
Inter – between residual & sedimentary
H – hornblende
M – mica
PA – paddle-and-anvil
Q – quartz
R – rounded
Res – residual
SR – subrounded

For this analysis, we have used Southern California Brown Ware (and the type Mission San Gabriel Brown), rather than Tizon Brown Ware, to describe the brown ceramics made with residual clays in the southern California cismontane region (Frierman 1982; Griset 1996). For the intermediate clays found east of the mountains in the southern California desert, California Desert Intermediate Brown Ware is used to provide an overarching description of the ware and to avoid confusion between Salton Brown Ware and Salton Brown Type. For Lower Colorado Buff Ware, in addition to the types identified by Waters (1982) and used most frequently by ceramic analysts, we have added types that better describe some of the variety seen in the assemblages from the Coachella Valley.

In addition to the wares described above, some sherds were identified as wheel-thrown. While some brown-ware vessels in the assemblage were made using a combination of techniques, including starting a vessel by hand and finishing it on a wheel (see below), "wheel-thrown" vessels are built entirely on the wheel. These items were not typed more specifically than this.

Finally, a new Southern California Brown Ware type was defined for this assemblage, Mission San Gabriel Brown. These sherds differ from typical southern California brown and buff wares in that they look similar to Owens Valley Brown, which is a dark brown Paiute coil-and-scrape ware made in Owens Valley and which exhibits distinctive finishing marks on the interior and exterior. Mission San Gabriel Brown subsumes a combination of techniques used on the same pot, something that might be termed wheel fashioning: hand-modeling to begin the pot, then putting it on a slow wheel to shape and finish it, producing surface features that are the result of several forming processes. A more detailed description of this new type is presented below.

Mission San Gabriel Brown

A new pottery type is defined here as Mission San Gabriel Brown (MSGB) (Table 10.8). It was hand-built using a variety of techniques with local silty clays containing varying amounts of naturally occurring sub-rounded non-plastics and possibly chaff. The chaff may have been purposely added, incidentally included because the pots were made in the same area as adobes and ladrillos, or resulted from lack of cleaning or levigating the clay (soaking it in water to size-sort the particles) to remove the floral materials that were natural inclusions. The latter was the case in two of the four clay samples collected by SWCA from the vicinity and prepared as small pinch pots for comparison to the collection.

If fired in an oxidizing atmosphere, the local clay appears to be bright orange to orangey brown (Munsell 2.5YR 5/6, 5/8, and 6/6, red and light red), but this is restricted to a thin layer of the exterior and sometimes also the interior surface. The cores in the highly oxidized sherds are gray or light orange. Most sherds have dense black cores that extend the entire thickness of the sherd to just beneath either surface, or occasionally as carbon streaks in the middle of the paste. These dark cores suggest the presence of large amounts of carbonaceous materials that are never completely oxidized during firing, as would be expected in the common Historic-period practice of using animal dung (manure) to fire pottery, rather than the prehistorically preferred oak fuel: dung fires hotter than wood, but burns out quickly; oak does not reach as high a temperature as dung, but it burns longer and oxidizes the paste more thoroughly.

Ceramic Research Background

Although the missions in Alta California were managed as a single system, variation in Native American cuisine and technologies affected how these were incorporated, modified, or rejected by the Spanish missionaries. For example, ceramics were not universally used or produced throughout pre-Hispanic California but instead were generally restricted to the southern coast and interior desert of Alta California and the northern portion of what is now Baja California. These areas had extensive ceramic traditions nearly 700 years old before the Spanish intrusion in the last quarter of the eighteenth century. Yet, prior to the establishment of San Gabriel Mission, pottery making was generally not practiced in the Los Angeles Basin.

Table 10.8. Mission San Gabriel Brown Ceramic Type Description

Synonym:			None
Described by:			Suzanne Griset (2013)
Type Site:			San Gabriel Mission, CA-LAN-184H
Type Specimens:			UCLA Fowler Museum, A955
Distribution:			Los Angeles Basin, southern California
	Time:		A.D. 1776–1835?
	Range:		Unknown beyond original Mission area
Construction Methods:			Hand-modeled from a single lump of clay (pinch pot) or using multiple hand-forming techniques, e.g., the vessel base is formed by a pancake of clay that is either hand-modeled into a round form, or placed over an existing vessel and thinned/shaped by paddling and removed from the form. Vessel walls are built by adding coils of clay. A slow turnette may be used to rotate the pot while adding, melding, and smoothing coils. Coils may have been scraped to thin vessel walls. Final smoothing varied from very rough with many vugs (voids) from floral and non-plastic inclusions, to very smooth when the silty clay formed a self-slip in the wet stage.
Firing:			Fired in uncontrolled atmosphere using dung as fuel, as the core is often very dark and carbon-filled. Floral fragments are usually completely oxidized leaving vugs; occasional silica phytoliths remain. Rarely are vessel walls oxidized completely.
	Carbon-core:		Entire core black to light gray, or carbon streak
	Fire clouds:		Sometimes present
Fracture:			Crumbly
Core:	**Clay:**	**Type:**	Residual clays that have been transported, likely by water, as many of the grains are sub-rounded. The clay contains organic materials that were sometimes removed, sometimes not. In some cases chaff may have been added to give the clays greater strength during the vessel-forming process and to prevent cracking during drying. These appear as small grass or seed impressions on the surfaces and in the core; rootlets appear as tiny circular vugs running throughout the core, often in one direction. There appear to be two versions of clay that reflect differences in clay preparation: one is silty in appearance, dense, with occasional large non-plastics, and softer surfaces; the other is more grainy in appearance. Both contain the sub-rounded non-plastics described below, and varying amounts of the described organic materials.
		Texture:	Ranges from dense and silty, to grainy if non-plastics are abundant; the latter presents a very uneven surface on a fresh break. In some cases, the clays presents a layered appearance parallel to the surfaces.
		Color:	Dense black cores that extend to either surface; occasional carbon streaks; and gray to light orange cores in highly oxidized sherds
	Non-Plastics:	**%:**	50–75

Table 10.8. Mission San Gabriel Brown Ceramic Type Description

		Size:	Average 0.25 mm, or 0.25–0.50 mm, with occasional 1.0–4.0 mm; rarely > 5.0 mm
		Shape:	Sub-rounded to sub angular
		Constituents:	Wide variety of rock as rounded small grains < 0.2 mm and sub-rounded to sub-angular grains ranging from 0.5 to 1.0 mm with occasional grains 2–4 mm and in one instance 8 mm. Small linear vugs from floral inclusions or seeds that were completely oxidized may be few or abundant. Small round vugs running laterally through the paste appear to be left by oxidization of rootlets that were not removed during clay preparation. Rounded vugs left when non-plastics were removed from either or both surfaces during the final finishing or as a result of use-wear are the same diameter as the non-plastics remaining in the paste and suggest that the clay was not very wet (which would raise a self-slip) when the vessel was smoothed or that it was smoothed using the flat edge of a scraping tool.
Surface:	**Finish:**	**Exteriors:**	Partially smoothed often leaving horizontal undulations that can be seen and felt with the hand; floral vugs may be present as grass impressions or seed impressions.
		Interiors:	Partially smoothed, smoothed, or scraped leaving approximately 1 cm-wide bands; similar vugs may be present.
	Color:		Most exteriors are gray-brown dark gray, dark grayish brown, gray, and grayish brown (Munsell 10YR 4/1, 4/12, 5/1, and 5/2); oxidized versions are bright orange to orangey brown (Munsell 2.5YR 5/6, 5/8, 6/6, red and light red) usually restricted to a thin layer on either or both surfaces; rarely extends into the core.
	Decoration:		Rare red-wash on either or both surfaces; one example of a bowl with red-slip on both surfaces
Vessel Forms:			Bowls; small cups or individual serving bowls; medium to large bowls for cooking; jars; plates or soup bowls.
	Rim Shape:		Bowls usually have direct rims that are incurving, slightly everted, or vertical. Jars have direct or slightly recurved shape.
	Lip Shape:		Rounded or rounded flat; occasionally beveled on one or both surfaces, or an everted flange.
	Wall Thickness:		Bases are generally thicker that the adjoining wall, and quickly taper to thin necks/rims/lips.

Indeed, the Gabrielino, like the Chumash to the northwest, favored stone boiling in baskets and stone bowls carved from soapstone, granite, or sandstone. While ethnologists have generally concluded that ceramics were not produced by the Gabrielino, archaeologists have recently excavated small numbers of ceramic sherds at late prehistoric sites in Orange County, suggesting that ceramics were just beginning to be used and possibly produced in the southern portion of the Gabrielino area where it abutted that of the pottery-making Juaneño (Boxt and Dillon 2013). But this technology was not wide-spread among these groups and most did not produce pottery.

As a result, missions from the Los Angeles Basin northward had to teach pottery making to the neophytes. They did this by transferring Native American potters from missions to the south (including Baja California) to the new missions to the north, or by importing potters among the settlers and soldiers who immigrated to California from Sonora, Mexico. The latter were a mixture of Hispanic, black, mestizo, and Native Sonorans who had their own ceramic traditions that included wheel-thrown, molded (where liquid clay is poured into forms then hand-finished), or hand-modeled vessels. Guadalupe Vallejo (1890:184), remembering ranch and mission days in Alta

California, reported, "It was between 1792 and 1795, as I have heard, that the governor brought a number of artisans from Mexico, and every Mission wanted them, but there were not enough to go around. There were masons, millwrights, tanners, shoemakers, saddlers, potters, a ribbonmaker, and several weavers."

Southern California ceramic traditions consisted of small hand-modeled or pinched vessels, including small bowls, scoops, and pipes, and a variety of bowls and jars (or *ollas*, as they are commonly known throughout the Southwest). These were begun with a hand-formed or molded vessel base upon which coils of clay were added, pinched together. A ceramic or stone anvil was then held on the inside of the pot, and a wood paddle was used on the exterior of the pot to thin and shape the walls. This coiled/paddle-and-anvil technique originated in northern Mexico and spread north into southern Arizona and westward across the Colorado River until it reached the coast around A.D. 1000 (Griset 1996). Southern California vessel forms consist of bowls and jars in small, medium, and large sizes, with apertures that also range from narrow to medium-wide to wide-mouth.

After its establishment at its current location in 1775, San Gabriel Mission drew converts from the surrounding area in an ever widening radius, including villages in what eventually became the territory serviced by San Fernando Mission, which was built in 1797. By 1805, the San Gabriel missionaries were forced to draw from non-Gabrielino tribes further east and northeast, among the Pass and Mountain Cahuilla, the Serrano in the San Bernardino Mountains and the Mohave Valley, and the Luiseño to the south. By the 1820s, the majority of the population at San Gabriel Mission was Serrano and Cahuilla, and peoples of four languages were resident: Western and Eastern Gabrielino, Serrano, Cahuilla, and Luiseño (NEA and King 2004:40).

With the secularization of the missions in 1834, Native populations again relocated distant from their natal homes. Hugo Reid, whose wife was a Gabrielino neophyte from San Gabriel Mission, assumed control of the lands around the mission in 1846 along with his partner, William Workman. Reid (1978 [1852]) reported in a series of letters to the Los Angeles Star newspaper in 1852 that most of the Serrano and Cahuilla who had been living at the mission returned to their home villages, while the Gabrielino from the Los Angeles Basin moved northward because their home villages had been granted or sold to settlers and ranchers. Only a few local Gabrielino families remained living on the small parcels immediately surrounding the mission, until it was returned by the United States government to the Catholic Church in 1859.

Indian Agent B. D. Wilson's 1852 report on the status of southern California Indians noted that those who returned to mountain villages after the missions were secularized, manufactured blankets, "a kind of urn to hold water and keep it cool in summer (called olla)," and horse blankets made from maguey fiber for sale to non-native consumers (Caughey 1952). Greenwood et al. (1983) observed a gradual decline in Native American ceramics at Los Angeles ranchos by 1860, once other types of ceramic and metal vessels were more readily available as imports. Native ceramics continued to be produced at Rancherias for local consumption and for sale to tourists into the early twentieth century (Griset 1990, 1996).

Research Hypotheses

From the inception of San Gabriel Mission in 1771 up until approximately 1805 it is likely that mission residents were taught how to make ceramics by the Spanish. There is no written or oral evidence that a Native American potter was brought to the mission. Rather, instructors were probably found among the soldiers or their families whose ceramic traditions comprised wheel-thrown, molded, or hand-built forming techniques.

From the beginning, introduced foods, cooking techniques, and vessel forms altered and augmented the traditional bowl/olla forms of southern California. Wheat, barley, corn, and beans replaced acorn as the principal crops. Forms such as cups (for drinking hot chocolate), frying pans (*comals* to make tortillas), and handled pitchers were introduced along with the cuisine, and rounded vessel bases were replaced by flat bases that could sit on a table (Griset 1990). Vessel shapes during the early years of the mission may have been those of the Spanish-influenced pottery traditions, made with introduced technologies. Is there a correlation between manufacturing technique and vessel forms? Were specific forms and sizes of vessels produced concurrently using the different techniques?

After 1805, the Cahuilla and Serrano people brought to the mission would have brought with them their knowledge of pottery making and probably advocated for continuing their traditional pottery manufacturing techniques. Their traditional manufacturing techniques included hand-modeled small vessels, and a combination of a modeled base (either formed by hand, by placing clay over the exterior base of an existing vessel, or placing clay in the bottom of a basket to start the vessel) to which coils of clay were added and shaped using a paddle and anvil to form larger bowls and jars. If this is the case, after 1805 the ceramic assemblage should include a greater number of traditional bowl and jar shapes typically produced by native potters to the north, east, and south.

How do the vessel forms from San Gabriel Mission, the mission with the largest variety and production of agricultural crops, vineyards, and orchards, compare to those recovered from missions in other areas of southern, central, and northern California? Finally, does the distribution of Native American ceramics—the forms, wares, and types—indicate activity, depositional, or temporal variation across the site?

Analytical Methods

Sherds were assigned catalog lot numbers by excavation level as they were received by the laboratory and in some cases, a single excavation level has more than one catalog number. Sherds were counted and weighed by catalog lot number. Rims and unusual sherds were assigned unique catalog numbers by adding a .01, .02, etc. to the catalog number. During the ceramic analysis, additional rim sherds and unusual pieces were identified, and counts were revised to reflect conjoining sherds broken during excavation.

A sample of units was selected for detailed analysis. These were selected judgmentally to ensure an adequate sample from each area of the site (see Table 10.6). Sherds to be analyzed were washed to remove sediment. Sherds with potential residue deposits were not washed. Sherds from all levels within a unit and any immediately adjacent units were examined for cross-mends. Each sherd was measured and examined macroscopically and microscopically using a 10x and 30x magnification binocular scope. Munsell color readings were taken for interior and exterior surfaces and paste colors when these were not obscured by carbon or other residues. Notes were made on evidence of manufacturing techniques, including method of manufacture (hand modeled; coil and scrape; coil; paddle and anvil; wheel thrown), firing atmosphere (oxidized, reduced, carbon streak), fracture (hard, crumbly, intermediate), decorative techniques (incised, painted, burnished, slipped), as well as any evidence of use or post-deposition deposits. The paste was coded for type of clay (residual, sedimentary, intermediate), texture and degree of mixing, presence and kind of vugs, and the percent, shape, size, and kind of non-plastics. Rim sherd analysis focused on reconstructing vessel dimensions to examine the distribution of vessel forms.

Results of the Analysis

In total 8,040 sherds classified as Native American ceramics were recovered from the San Gabriel Mission archaeological site. This represents 65 percent of the total number of ceramic sherds recovered. Two-thirds (67 percent) of the Native American ceramic assemblage consisted of Mission San Gabriel Brown, a new type of Southern California Brown Ware defined as a result of this project; 15 percent of the assemblage consisted of traditional California Brown Ware, and a smaller number of California Desert Intermediate Brown Ware, Lower Colorado Buff Ware, and wheel-thrown sherds were identified (see Table 10.6).

As seen in Table 10.9, 17 units account for 3,979 sherds, almost half of the total assemblage, and all are from units surrounding the stone reservoir/millrace features in Area 2. Six are immediately north of the triangular reservoir (Features 31 and 39B), two are north and northeast of the millrace (Feature 1B), two are on the east wall of the millrace (Feature 1B), six are east of the millrace (Feature 1B), two are about 2 m west of the northwest corner of the triangular reservoir (Feature 39), and one is between the south wall of the triangular reservoir (Feature 12) and the north wall of the rectangular reservoir (Feature 21E). The three units with more than 400 sherds per unit are along the northeast/east side of the millrace (EUs 206, 105, and 106).

The excavation units with the most ceramics tended to have the densest concentrations of ceramics in the deepest levels. For example, EU 105 had an even distribution between 30 and 120 cmbd (Datum 3), then an exponential increase in the number of sherds between 120 and 150 cmbd; a similar discard pattern is seen in EU 126, with a dramatic increase in sherds between 130–160 cmbd (Datum 3). This suggests that this area was a general discard area prior to the construction of the reservoir and millrace. The units with the highest number of sherds are concentrated along the northeastern side of the millrace; this may be due to their having been removed from the millrace as it was excavated, and discarded immediately to the east. These units may represent sherds from contexts elsewhere at the mission that were deposited as trash in this area, or they may represent in situ primary deposition of these items.

Most of the vessels in the ceramic sample were manufactured from local silty clays that contain a wide variety of sands and crushed grains. If fired in an oxidizing atmosphere, this clay takes on a bright orange to orangey brown hue, but this is restricted to a thin layer of the surface; most cores are unoxidized and exhibit carbon streaks. The predominant color of sherds from local clays is gray-brown. Many of the finer clays have abundant grass vugs in the paste and on both surfaces. These are very fine, and do not appear to be straw, rather the natural inclusions in the local clay, as observed in the four samples that were collected onsite. There are sherds that are distinctly wheel thrown sherds, probably using a better processed form of the local clays. There are also sherds that are typical Southern California Brown Ware; these may have been imported to the mission. The majority of the sherds are made from the local clays that were poorly prepared and often have very uneven surfaces on the exterior and sometimes on the interior as well. Many grass vugs, oriented in a variety of directions, are visible on the surfaces. When first observed, they reminded me of unsmoothed coil junctures that are often visible on the exteriors of Owens Valley Brown Ware vessels, but these are much less regular. Possibly these are remnant basket impressions that have not been completely smoothed. Three examples of a basket impressed tray are described below; molding inside a basket would be a much easier technique for novice potters. The distribution of vessel forms within the analyzed units analyzed are listed in Table 10.10.

Traditional vessel forms at prehistoric sites in southern California usually include jars and bowls that can be sorted into small, medium, and large forms based on the exterior diameter at the rim. Jars are classed as narrow mouth (diameter of 6 cm or less), medium-wide mouth (6–12 cm), and wide mouth (greater than 12 cm). Bowls are small (diameter of 5–10 cm), medium (10–20 cm), and large (diameter greater than 20 cm and height greater than 15 cm). Based on the reconstructed vessel data in Table 10.10, the San Gabriel mission assemblage consisted mostly of bowls and appears to have been related primarily to serving and cooking functions. Plates, trays, jars, and cups were also present (Table 10.11).

Table 10.9. Excavation Units Having the Largest Number of Native American Ceramics (Shading Indicates Units included in the Ceramic Sample Analysis)

100-199 Sherds			200-299 Sherds			300-399 Sherds			400-499 Sherds		
EU	**Sherd Count**	**Location**	**EU**	**Sherd Count**	**Location**	**EU**	**Sherd Count**	**Location**	**EU**	**Sherd Count**	**Location**
109	126	W of Triangular Reservoir (Feature 39)	154	232	E of Millrace (Feature 1B)	-	-	-	105	447	E of Millrace (Feature 1B)
110	157	W of Triangular Reservoir (Feature 39)	184	275	E of Millrace (Feature 1B)				106	440	E of Millrace (Feature 1B)
126	187	E Wall of Millrace (Feature 1B)	225	281	N of Triangular Reservoir (Feature 31)				206	463	NE of Millrace (Feature 1B)
142	111	E Wall of Millrace (Feature 1B)									
155	188	E of Millrace (Feature 1B)									
158	105	Between Triangular Reservoir (Feature 12) and Rectangular Reservoir (Feature 21E)									
203	172	N of Triangular Reservoir (Feature 31)									
205	150	N of Millrace (Feature 1B)									
220	116	N of Triangular Reservoir (Feature 39B)									
221	159	N of Triangular Reservoir (Feature 39B)									
223	115	N of Triangular Reservoir (Feature 31)									
224	155	N of Triangular Reservoir (Feature 31)									
235	100	E of Millrace (Feature 1B)									

Table 10.10. Reconstructed Vessel Forms from Ceramic Sample with Estimated Diameters

Project Location	EU	Depth (cmbd)*	Catalog Number†	Ceramic Type‡	Form and Size Class§	Rim Form	Lip Form, Thickness (mm)#	Base Form, Thickness (mm)**	Exterior Dimensions (cm)††	Wall Thickness (mm)	Function‡‡	Comments
Millrace East Exterior	105	50–60	3015.01	MSGB	Tray, shallow	D, SE	B exterior, 6–7	N/A	D: 20–22	8	Se	Slow wheel?
		70–80	3267.01	MSGB	Bowl?, medium	D	R (lip folded over) 7	N/A	D: 12	5.5–6.6	Se?	Salts on lip
		100–110	04871.01 & 04871.02	WT?	Jar, MW	D	B interior, 5.5	N/A	D: 10	6.5	Se	Collared
			4871.03	MSGB	Bowl, medium, shallow Tray?	D, E	R, U, 6.5	N/A	D: 12-14	8	Se?	Slow wheel; both surfaces are very uneven and undulate
		110–120	4827.01	MSGB	Tray/ plate, large	D, E	RF, 4.5–5	N/A	D: >38	7–8	Se	Tiny black deposits (manganese?) on both surfaces
		120–130	04681.01/ 5858.01	MSGB	Jar, WM	R	R, 4	N/A	D: 16 N: 3 Min: 14 at 1.5	6	St/ Tr	Broken before deposited; yellowish deposit on all surfaces; burnish on both surfaces of rim/neck
			5858.02	MSGB	Bowl	D/SR	R, 4.5 Lip incised with line parallel to vessel walls	N/A	n/a	6	Se?	Interior surface not entirely smoothed; if orientation is incorrect, may be a restricted bowl
			5858.04	MSGB	Bowl, medium	D, SI	RF, 4	N/A	D: 14 Max: 16 at 2	6–6.5	Se?	Very uneven exterior; yellowish deposits especially on interior
		130–140	05367.02 & 5916.03	MSGB	Bowl, medium	D, SI	R, U, 4-7	N/A	D: 20	8–10	C	Specimens do not conjoin, but derive from same vessel. Undulating exterior; carbon on exterior below rim; distinctive chunks of feldspar
		140–150	05557.09 and similar sherds 05557.04, 05557.11	MSGB	Cup	D, SI	R, 4	N/A	D: 4	7	Se	None

Table 10.10. Reconstructed Vessel Forms from Ceramic Sample with Estimated Diameters

Project Location	EU	Depth (cmbd)*	Catalog Number†	Ceramic Type‡	Form and Size Class§	Rim Form	Lip Form, Thickness (mm)#	Base Form, Thickness (mm)**	Exterior Dimensions (cm)††	Wall Thickness (mm)	Function‡‡	Comments
Millrace East Exterior	105	140–150	6139.01	MSGB	Bowl, medium (25% present)	D, SI	R, 3.5	R, 14	D: 12 Max: 14 at 3 H: 7.5 B: 4	9–15	Se	Pinch pot; salts on lip; chipped on rim interior; poorly smoothed
			6139.02	MSGB	Jar, MW	SR	B rounded, 7	N/A	D: 10 N: 3.2 Min: 9 at 3.5	12	St/Tr	Slow wheel; lip poorly smoothed and chipped; exterior surface undulating with grass vugs; interior grass vugs
			6139.03	MSGB	Bowl/plate/ scoop?	D	R, 5	N/A	D: >18	6.5	Se	Grass vugs both surfaces; possibly slipped
			6139.04	MSGB	Bowl	D, I,	RF, 3	N/A	D: 12?	7.5	Se	None
			6139.05	MSGB	Bowl, small	D, I	RF, 7	N/A	D: 10	5.5	Se	None
			6139.07	MSGB	Miniature jar	D, SR	R, 3	N/A	D: 5–6	5	?	None
		150–160	5916.01	WT	Jar, WM	SR	R, 4.5–6	N/A	D: 16 Min: 15 at 1.5	8.5	St/Tr	Exterior undulating with grass vugs; interior wheel marks with grass vugs
			5916.02	MSGB	Bowl, medium	D, I	R, 3.5–4.5	N/A	D: 13 Max: 16 at 3	13	Se	Grass vugs both surfaces
			5916.03	MSGB	Bowl, medium	D, I	R, U, 6	N/A	D: 13 Max: 15 at 3.5	8	Se	Both surfaces uneven
			5916.04/ 6133.06	MSGB	Bowl, medium, shallow	D, SE	R, 4–5	N/A	D: 11 H: est. 3–4	5.5	Se	Grass vugs both surfaces
			06133.01/ 6133.04	MSGB	Bowl, large	D, SE	R, U, 8–10	N/A	D: 24		C	Carbon on both surfaces; roughly smoothed both surfaces while wet; iron deposit on exterior near lip

Table 10.10. Reconstructed Vessel Forms from Ceramic Sample with Estimated Diameters

Project Location	EU	Depth (cmbd)*	Catalog Number†	Ceramic Type‡	Form and Size Class§	Rim Form	Lip Form, Thickness (mm)#	Base Form, Thickness (mm)**	Exterior Dimen-sions (cm)††	Wall Thickness (mm)	Function‡‡	Comments
Millrace East Exterior	105	150–160	06133.02/ 6133.05	MSGB	Bowl, large	D	RF, U, 6–7	N/A	D: 21	5.5	Se? C?	Roughly finished and grass vugs on both surfaces; carbon on all surfaces may be post-use
			6133.03	MSGB	Tray/ plate	D, E, SR	B, 6.5–8.5	N/A	D: 23 H: est 7	7.5	Se	Roughly made exterior; smoothed interior with grass vugs.
			6133.06	MSGB	Bowl, small	D, SE	B, R, 3.5	N/A	D: 8 H: est. 3	5.5	Se	Exterior rough with grass vugs; interior smoothed, with grass vugs
			6133.07 6133.15	MSGB	Bowl, large	D	E, F, 10	N/A	D: 26	6.5–7.5	Se	Chipped along exterior lip; grass vugs on exterior
	108	40–50	2827.01	MSGB	Bowl/Cup, small	D, I	R, 5.5	N/A	D: 7	7	Se	Undulating exterior and seed vugs on both surfaces
Millrace Northeast Exterior	206	80–90	10647.01	MSGB	Bowl or Comal	D	F, 5	N/A	D: 12	5.5	C	Direction of rim is unclear, but heavy carbon/soot on exterior
		120–140	15594.02/ 15594.11 and similar 15594.06 and 15594.12	MSGB	Jar? WM Bowl? large	D, I	F, 7.5–8	N/A	D: 36	9.5	Se?	None
			15594.07 and 15594.05	SCB	Jar, WM	R	R, 7	N/A	D: 20	12	St/Tr	Shape reminiscent of water storage ollas
			15594.09	MSGB	Plate	D, E	IB, 6	N/A	D: 12	6.5	Se	None
			15594.14	MSGB or WT	Bowl/Plate/ Scoop?	D	R, narrow collar 1 cm wide on exterior, U, 4.5	N/A	D: 18 H: est. 5–7	4.5	Se	Small thin-walled shallow bowl with red-washed interior and splatter on exterior

Table 10.10. Reconstructed Vessel Forms from Ceramic Sample with Estimated Diameters

Project Location	EU	Depth (cmbd)*	Catalog Number†	Ceramic Type‡	Form and Size Class§	Rim Form	Lip Form, Thickness (mm)#	Base Form, Thickness (mm)**	Exterior Dimensions (cm)††	Wall Thickness (mm)	Function‡‡	Comments
Reservoir Interior	137	80–90	5259.01	MSGB	Jar? MW Bowl? medium	D, I	R, E, 5.5–7	N/A	D: 16	8.5	C	Carbon on exterior surface
			05259.04/ 5259.05	MSGB	Bowl	D, I	RF, 4	N/A	D: 22	7.5–8.5	C?	Some carbon on exterior
		110–120	6172.01	WT? or SCB?	Jar,	D, I	R collar, 13 × 16	N/A	D: 8	6	St/Tr	Rim profile shows rim folded over to exterior to form round ring around neck similar to that seen on Spanish storage jars and soapstone vessels in historical photograph (Figure 9.3).
Garden	118	83–90	2743.01	MSGB	Bowl/Plate/ Tray? Tray?	D	BE, 12	N/A	D: 8? H: est. 3–4	6.5	Se	Rim direction is unclear; bevel is polished from use which would favor it being a plate
		130–136	03220.01 (Feature 8)	MSGB	Tray? Shallow Bowl?	E, tapered	RF, 4.5	N/A	D: 20	7.5–8	Se?	Slow wheel; rim added as additional coil; made of local clay but well smoothed both surfaces
			03220.02 (Feature 8) & non-feature 04432.01 similar	MSGB	Bowl, large	D	B, RF, 3.5	N/A	D: 22	6.5–7	C	Carbon on exterior
	273	116–130	15902.01	MSGB	Bowl, shallow, or	D, SE	B, 7	N/A	D: 8	9	Se?	Scratches on both surfaces; only exterior is oxidized

Table 10.10. Reconstructed Vessel Forms from Ceramic Sample with Estimated Diameters

Project Location	EU	Depth (cmbd)*	Catalog Number†	Ceramic Type‡	Form and Size Class§	Rim Form	Lip Form, Thickness (mm)#	Base Form, Thickness (mm)**	Exterior Dimen-sions (cm)††	Wall Thickness (mm)	Function‡‡	Comments
Garden	282	100–110	14595.01	WT?	Plate/ Soup Bowl?	D, E	R with flat-tened area on interior, 4	N/A	D: 20	9	Se	Fine sedimentary clay
			14595.02	SCB	Bowl?, medium	D	R, 7	N/A	D: >20	7	Se	Coil juncture in paste
		130–140	14748.01	SCB	Bowl, large or Jar, WM	R	RF, 8	N/A	D: 22 N: ?	9	Se	Carbon streak, wiping marks for PA
			14748.02	SCB	Jar, WM	R	RF, 8	N/A	D: 16 N: 3 Min: 13 @ 1.5	11	St/Tr/WJ?	None
Area 1 Structure East Exterior	121	100–110	3241.01	SCB	Jar, MW	D, SI	F, 8	N/A	D: 10	8	Se/Tr	None
		110–120	7530.01	SCB	Jar, MW	D, I	F, 8	N/A	D: 8 est.	7	Se	None
Trash Pit inside Area 1 Structure	149	160–170	9021.01	SCB	Plate/Tray	D, SI	R with wear bevel, 8	N/A	D: 24	9	Se	None
		270–280	20644.01	WT	Bowl, small, shallow or Cup?	D, SI	R, 4.5	N/A	D: 13 H: est 3–4	6.5	Se	None

* EUs 105, 108, 118, 121,137, 149, and 206 reference Datum 3; EUs 273 and 282 reference Datum 12

† / = conjoined sherds; & = same vessel

‡ MSGB = Mission San Gabriel Brown (local silty clay; hand modeled pinch pot or coil/scrape/ slow wheel); TB = Tizon Brown (residual clay; paddle-and-anvil); WT (wheel thrown; unknown origin; fine intermediate clay; fine parallel rills); SCB = Southern California Brownware

§ NM = Narrow mouth; MW = Medium wide; WM = Wide mouth

¶ D = Direct; I = Inverted; E = Everted; R = Recurved; SI = Slightly inverted; SE = Slightly everted; SR = Slightly recurved

\# R = Rounded; RF = Rounded flat; F = Flat; B = Beveled both surfaces; BE = Beveled exterior; BI = Beveled interior; BC = Compound bevel; E = Everted; U = undulating or uneven

** R = Rounded

†† D = Diameter at rim; N = Neck height; Min = Minimum diameter @ x cm below rim; Max = Maximum diameter @ x cm below rim; B = Base diameter; H = Height

‡‡ Se = Serving; Tr = Transport; C = Cooking; WJ = Water ar

Table 10.11. Counts of Refitted Vessel Forms by Size

Vessel Form	Size				Use(s)	Total
	Small	Medium	Large	Unknown		
Plate/Tray	–	–	1	6	Serving	**7**
Bowl	4	10	4	6	Serving/cooking	**20**
Jar	1	8	–	1	Storage/transport	**10**
Cup	–	–	–	1	Serving	**1**

Vessel Assemblage by Manufacturing Method

Paddle-and-Anvil Vessels

Vessel Forms, Distribution, and Functions

Traditional paddle-and-anvil vessels are distinct from the hand-modeled vessels that constitute more than half of the assemblage. Their exterior surfaces are smoothed, as are the interiors of bowls. Faint horizontal wiping marks are visible near the rim/neck areas on both surfaces. Non-plastics include more mica in the residual clay vessels than is seen in the vessels made from local clays. There are a few examples of vessels imported from the California desert (see description of the two painted sherds below), but most paddle-and-anvil pots are residual clays consistent with Serrano or other mountain dwelling tribes of inland southern California south of the Los Angeles Basin. They include vessels with direct, recurved, and incurving rims; wide-mouth jars dominate the vessel assemblage.

Paddle-and–anvil vessels were not identified in the ceramic sample units analyzed from Chapman's Millrace, other than one tentatively identified jar from EU 206. In contrast, they dominate the assemblages in the garden, the west exterior of the Area 1 structure, the interior of the reservoir, the North Midden, and the refuse pit (Feature 14); many of these post-date the construction and operation of the mill.

Decorated Sherds

Only three decorated sherds were identified in the sample of traditional Native American vessels: two painted designs and one incised design (Figure 10.26).

Both of the painted sherds are Lower Colorado Buff Ware sherds recovered from different levels of EU 282, the stratified deposit between Areas 1 and 2. Both sherds are from jars (their interior surfaces have anvil marks and have not been smoothed). A red-on-buff shoulder sherd (Catalog Number 14622.03) was found at the 110–120 cmbd (Datum 12) level; it contains portions of two vertical rows of three red "V" shapes (Rogers 1936:Plate 10, Desert Cahuilla design element 24). The paste is a fine buff sedimentary clay with abundant small flecks of muscovite and an occasional grog grain. A black-on-buff wall fragment was found in the 140–150 cmbd level (Catalog Number 16422.01). It has portions of three sun designs on the exterior, suggesting that it may have been covered with this design element (Rogers 1936:Plate 10, Desert Cahuilla design element 35). It is also made from a fine buff sedimentary clay, but has abundant grog temper and mica visible on both surfaces. Rogers (1936:29) noted that Pass Cahuilla were reported by Barrows (1900:46) as having used a black pigment, though Rogers was skeptical. This sherd does not appear to have been overfired; it appears to have an intentionally black design.

A single incised decoration example was found on the lip of a rim sherd from EU 105, at 120–130 cmbd (Datum 3). It is a single line inscribed on the lip, parallel to the surfaces of a thin-walled bowl of undetermined dimensions. This is a surprisingly low number of decorated sherds given the more than 8,000 sherds recovered from the study area.

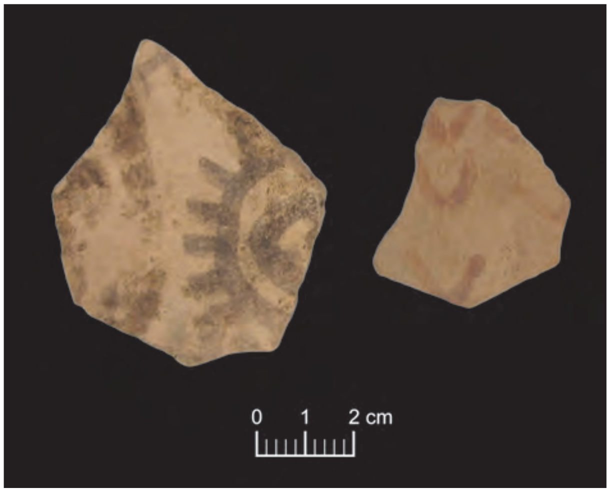

Figure 10.26. Painted buff ware from EU 282. Catalog Number 14622.03 at left and Catalog Number 16422.01 at right.

Worked Sherds

Three examples of sherds recycled as tools (disks and scrapers) were identified. Some ceramic disks were intentionally manufactured from clay, and may or may not have included a central perforation. Disks were also formed by grinding the edges of vessel wall sherds into the desired shape; if a perforation was desired, it had to be drilled either conically or biconically. Ground disks required considerably more effort to manufacture and ran the risk of fragmenting during the drilling process; however, they are usually as prevalent as intentionally manufactured disks. Suggested uses for ceramic disks include vessel lids, game pieces, and toys, and in the Southwest they are usually called spindle whorls.

Two examples of ground disks (Catalog Numbers 06626.01 and 15594.15; Figure 10.27) were found. The first fragment was recovered from EU 158, north of the mill wall and west of the reservoir, at 150–160 cmbd (Datum 3). It measured 4 cm in diameter, 10.5 mm thick, and had the beginning of a conical drill hole, that apparently cracked the sherd. It is from the base of a Tizon Brown pot. The other ground sherd disk fragment was found in EU 206, 120–140 cmbd (Datum 3), northeast of the Mill Race. It has an estimated 5 cm diameter, is 8 mm thick, and has a biconically drilled hole. It was manufactured from a Tizon Brown cook pot, as evidenced by the thick carbon layer on the exterior surface of the disk.

Sherds could also be reworked to make scraping tools, e.g., to scrape away excess clay in the final vessel forming process, or they could be used to scrape other items. A Parker Buff jar wall fragment (Catalog Number 11175.01) was ground into a tabular form and used as a scraper. The exterior sherd surface was originally polished and the interior surface was only roughly smoothed; both surfaces are presently somewhat obscured by calcium carbonates, suggesting that the vessel may have been a water olla before a wall fragment was recycled as a scraper, or that the scraper sherd has been deposited in moist contexts. The paste is very fine (10 R 6/6, light red), with inclusions of finely ground grog and occasional quartz and flecks of mica. It has a rounded tabular shape, with fine grooves perpendicular to the lip on both the interior and exterior of the ground edge, indicating scraping motions. It was recovered from 220–230 cmbd (Datum 3) in EU 151, east of the interior of the Area 1 structure's west wall.

Hand-Modeled/Molded Culinary Vessel Forms, Distribution, and Functions

It is difficult to definitively distinguish vessels that were formed by hand-modeling from those that were wheel thrown. Part of the difficulty is that there is no difference in the clay used for either manufacturing process, and the vessels identified as hand-modeled may, in fact, be very poorly thrown/smoothed vessels. These vessels have undulating rough exteriors with many tiny grass vugs scattered randomly across both the interior and exterior surfaces and throughout the paste. An alternate explanation may be the use of basket molding to start the vessels and final finishing by hand smoothing (see discussion of Sherds with Basket Impressions below). The grass may have been used to provide a physical barrier between the basket stitches and the clay to facilitate the removal of the vessel from the basket as it dried, and it may have been used to make the paste easier to handle.

Figure 10.27. Ceramic disks from San Gabriel Mission archaeological site. Catalog Number 15594.15 at left, Catalog Number 06626.01 at center, and Catalog Number 11175.01 at right.

Hand-modeled vessels are predominantly bowls, and primarily medium-sized bowls. Several of the large bowls (greater than 21 cm in diameter) were tentatively identified as hand-modeled or wheel-thrown. Only one medium-wide mouth jar was identified as hand-modeled.

Sherds with Basket Impressions

Rogers (1936:25) thought that basket-molding was used especially by the Kamia in Imperial County to make bowls, parching trays, and plates, and was done on the exterior, not the interior of the basket. Our observations of sherds throughout southern California suggest that basket impressed sherds are infrequent, but appear nearly everywhere.

Three examples were recovered from EU 154, east of the millrace, at the 190–200 cmbd level (Datum 3), although none conjoin. All contain impressions from a coiled basket, probably a tray, and the impressions are on the exterior surfaces of the sherds, suggesting that the tray was lined with clay, the clay was air dried until it shrunk sufficiently to remove it easily from the tray, then fired without obliterating the impressions. If the clay is left too long, it dries leather hard and it is difficult to obliterate the coils without rewetting the clay and running the risk that it will not retain the desired shape. This may explain why many of the vessels of local clay appear to be very poorly finished, with undulating surfaces: they were formed inside a basket (e.g., the flat based bowl with incurving restricted rim that is ubiquitous in Mission basketry), removed when partially dry, and partially smoothed while the clay was sufficiently wet.

In contrast, these three examples have impressions that have not been obliterated. Catalog Numbers 11346.04 and 11346.05 average about 6 mm in thickness and are very flat. Each specimen contains impressions of four rows of tightly curved basket stitches near the start of the basket. The stitch length is about 3.5 mm and the stitch width is about 3.0 mm.

Catalog Number 11346.04 was molded at the base of the interior basket wall as it began to curve upward. The sherd is 5 cm wide and 3.7 cm tall; it contains eight rows of coiled stitch impressions which are the same size as the stitches near the start. The impressions are on the sherd exterior, indicating that the clay was placed inside the basket and hand smoothed. The thickness of Catalog Number 11346.05 is 10 mm near the base of the wall, and 8 mm at the upper end. No attempt had been made to obliterate the stitches on the sherd exterior. The interior has an unidentified white residue. The paste appears to be local clay with tiny grass impressions on both surfaces and as vugs in the paste; non plastics include sub-angular granitics and occasional flecks of mica. The sherd was oxidized on the interior surface; the rest of the sherd is reduced.

Decorated Sherds

One shallow bowl rim sherd from EU 206, 120–140 cmbd (Datum 3), was identified as hand-modeled or wheel-thrown. It has a red-washed interior. The bowl is made of local clay, and is estimated to have a diameter of 18 cm and height of 5–7 cm based on the projected wall curvature; given the predilection for shallow bowls, it may be shorter than that.

Other Hand-Modeled Forms

Miniatures

Two hand-modeled miniature vessels include a small bowl or plate (Catalog Number 14982.01) measuring 4 cm in diameter and only 1.2 cm tall, from EU 185, east of the millrace, and a small-handled jar (Catalog Number 09509.01) 5 cm in diameter at the neck and at least 6 cm tall, from the area just east of the paved brick surface on the east side of the Area 1 structure (Figure 10.28). Only one-third of the jar is present—both the rim and the base are missing—and it has a single vertically oriented loop handle. It has a thick carbon deposit on the exterior and a very rough, slightly less carbonized interior. Both were manufactured from local silty clays.

Figure 10.28. Miniature Vessels from the San Gabriel Mission archaeological site. Catalog Number 14982.01 at left, Catalog Number 09509.01 at right.

Candlesticks

Two examples of individual candlesticks hand-modeled from local clays were identified. Fragments of one example, conjoining Catalog Numbers 11964.02, 11964.03, and 07403.01, were found at 100–110 cmbd (Datum 3) in adjacent EUs 223 and 224, along the exterior of the north wall of the reservoir (Figure 10.29). Fragments of a very similar specimen (Catalog Numbers 13380.01 and 13380.03) were found east of the reservoir, at 140–150 cmbd (Datum 3) in EU 235. Both examples have shallow dishes with flattened bases and a single candle holder the middle of the dish. Insufficient portions remain to determine whether or not they had handles.

Figure 10.29. Candlestick. Catalog Numbers 11964.02, 11964.03, and 07403.01 from EUs 223 and 224, 100–110 cmbd (Datum 3).

The first specimen is more complete and has a flattened based, nearly 15 mm thick. The dish is 10–11 cm in diameter, with a very irregular rim/lip that varies in thickness from 8–10 mm. The interior depth of the base is approximately 5 cm. The candle holder projects 2.3 cm above the interior of the base and is not truly round; its diameter measures 1.9–2.1 cm, with a lip thickness that varies from 4.5–6 mm and an interior depth of the candle well of about 2 cm. The rim of the dish projects about 1 cm above the interior surface of the middle of the base. The fine silty clay has extensive fine vugs, suggesting that the clay was not as well prepared.

The second specimen is very similar but larger, slightly more regular in shape, and the clay was better prepared. The dish diameter is 16 cm with an estimated candle holder height of 3 cm above the interior of the dish. The interior diameter of the holder for the candle is 2.3 cm at its lip, the lip averages 5–6 mm in thickness, and the interior depth of the candle holder is estimated at 2.5 cm. The rim of the dish has been well smoothed on the interior, less so on the exterior. The dish lip is direct with an exterior flattened bevel and average thickness is 7.5 mm. The clay has notably fewer vugs than the first specimen, and the surfaces of the candlestick were much better smoothed. The exterior color of both candlesticks is 7.5YR 5/2, brown, and the paste appears to be local.

One additional example (Catalog Number 06035.01) was recovered from EU 106 at 140–150 cmbd (Datum 3). It is the exterior portion of the candlestick, though the base of the candle holder can be seen near the center of the sherd. Its projected diameter is 7 cm, with a height of 1.4 cm at the rim, and an interior height of 0.9 cm.

Wheel-Thrown Vessels

Vessel Forms, Distribution, and Functions

As stated above, in the majority of cases, it is difficult to clearly distinguish wheel-thrown vessels. Two clear examples are seen in Figure 10.30, which employ local clays and have clear wheel-thrown ridges. It may well be that the vessels that have been classified as hand-modeled due to their extremely rough surfaces and plentiful grass vugs, were actually wheel-thrown.

Footrings

Seven examples of footrings on flat-bottomed bases, probably plates or large soup bowls, were identified in the collection. All are from wheel-thrown vessels made from fine clay (Figure 10.31). Four were found in the reservoir, one just west of the reservoir, one inside the Area 1 structure, and one adjacent to the wall fragment north of the railroad tracks. All derive from similar depths below ground.

Handles

Only three handle fragments were identified in the laboratory as exotics; none were found in excavation units analyzed in the ceramics sample (Figure 10.32). They include one loop that was placed horizontally on the exterior of a wheel-thrown direct-rimmed bowl of 18 cm diameter, from the mill's west wall (EU 249, 80–90 cmbd [Datum 3]); a fragmentary loop handle from EU 251, 90–110 cmbd [Datum 3] on the east-west running wall of the mill; and the third handle was on a miniature vessel that is described with the other hand-modeled miniature vessels above (see Figure 10.28).

The handles observed in the San Gabriel Mission Archaeological Site assemblage are not the tab handles that are commonly found on *cazuelas* (casserole bowls) from Historic-period sites throughout

Figure 10.30. Wheel-thrown vessels.

Figure 10.31. Footrings on wheel-thrown vessels.

the Southwest; they are loops of flattened coils of clay, attached to the finished vessel exteriors. And, they are very few in number which suggests that this modification of vessel form was not widely adopted by the residents of San Gabriel Mission.

Figure 10.32. Handles. Catalog Numbers 15642.01 at left and 16938.01 at right.

Decorated Sherds

Red-washed sherds appear to coincide with vessels influenced by Spanish forms and manufacturing techniques. Catalog Number 11104.01 is from 130–140 cmbd (Datum 3) in EU 215, at the northeast exterior corner of the mill's north wall. It is a small rim fragment from a wheel-thrown plate with an estimated 22 cm diameter and a direct, flattened lip with an exterior bevel. It is made from local clays with chunks of decomposing granite and vugs throughout the paste; some small grass impressions are visible on the exterior surface. It was fired in a reducing atmosphere and the paste is dark brown (10YR 2/2). Only the interior has been covered with red pigment; the undecorated exterior surface is grayish brown (10YR 5/2).

Conclusions

Most of the ceramics analyzed in the San Gabriel Mission ceramic sample are from units that represent trash deposits without stratigraphic contexts. The units north and east of the reservoir/millrace may have inverted deposition due to the deposition of sherds from the bottom of the water feature excavations onto the top of adjacent areas. Hence, deposition context is not necessarily a good indication of which vessels, manufactured with which techniques, occurred at the beginning or end of ceramic production at San Gabriel Mission, nor how those different vessel forms may have co-occurred in daily use. Yet the fact that they were deposited in the same trash deposits suggests that they were being used contemporaneously, perhaps in the same areas of the mission. Examination of the vessel forms manufactured with each technique also suggests retention of traditional vessel shapes and production of new shapes by hand and by wheel.

Three units in center of the site contained relatively high proportions of paddle-and-anvil pottery with the exception of sherds in the two deepest layers in EU 282, at 140–150 and 150–160 cmbd (Datum 12). All of the other levels in EUs 273 and 282 contain paddle-and-anvil specimens representing at least one thick-walled olla (probably a water jar) (Catalog Number 14748.02), a recurved rim from a large bowl (Catalog Number 14595.02), and another recurved rim of insufficient size to distinguish between bowl or jar (Catalog Number 14748.01). The rims are all completely oxidized, while basal sherds in these levels suggest at least one of the vessels (perhaps the recurved large bowl) was a cooking pot with a rounded flat base and carbon and soot deposits on both surfaces. Interestingly, two large sherds in the deepest ceramic-bearing level of EU 282 (150–160 cmbd [Datum 12]) are not paddle-and-anvil; both have undulating exteriors with grass impressions, and their pastes contain tiny vugs, aligned in a lamellar fashion parallel to the vessel walls, suggesting that they were wheel-thrown. Yet the interior surface has depressions similar to anvil marks. No matter their actual manufacturing technique, it appears that these units may have some stratigraphic integrity and the sherds do fit the hypothesized pattern of paddle-and-anvil occurring later than the hand-built/wheel-thrown techniques taught to the Tongva neophytes when the mission was first established.

There does not appear to be a correlation between vessel form and production technique at the San Gabriel Mission archaeological site. Most of the vessels are simple, direct-rim bowls with rounded lips, and these are found in vessel assemblages throughout the Mission period and into the Historic period. One notable form is the shallow medium-sized bowl with a beveled rim and thick base and diameters clustering between 12 and 14 cm. There are both wheel-thrown and hand-modeled examples. These may be the individual ration bowls mentioned by Ginn (2009) for northern missions.

Summary

Native American ceramics composed two-thirds of the ceramics recovered from the excavations at San Gabriel Mission, and two-thirds of these were classified as San Gabriel Mission Brown, a locally produced type of Southern California Brown Ware defined as a result of this project. Lesser numbers of typical Southern California Brown Ware, California Intermediate Brown Ware, Lower Colorado Buff Ware, and wheel-thrown sherds were recovered as well. Most of the vessels recovered for which reconstruction was possible were bowls that appear to have been related to serving and cooking functions. Plates, trays, jars, and cups were also present, as were small numbers of ceramic disks (n = 2), basket-impressed sherds (n = 3), miniature vessels (n = 2), candlesticks (n = 2), and footrings (n = 7).

Non-Vessel Ceramics

A total of 73 non-vessel ceramic artifacts from the 15 sample excavation units were analyzed (Table 10.12), including the 21 beads discussed in Chapter 9 and the 52 items discussed in this section. These include 13 buttons, of which 11 are Prosser buttons that date to the period after 1840. These are mostly four-hole sew-through buttons. One button (Catalog Number 14724.01) is decorated with a transfer printed lattice pattern. Five of the Prosser buttons were recovered from Feature 14. Several personal items made of ceramic were among the analyzed materials. These include two fragments of kaolin tobacco smoking pipes.

Table 10.12. Diagnostic Non-vessel Ceramic Analysis Summary

Artifact Group	Item	Count
Consumer	Lid	1
Garment	Button	13
Household	Candleholder	2
	Doorknob	1
	Flower pot fragments	6
	Glaze drip	1
	Insulator	2
	Insulator or socket	3
	Light fixture	1
	Socket	1
	Knob	1
	Telephone spool	1
Personal Items	Smoking pipe	2
	Bead*	21
	Gaming piece	1
	Doll parts	4
	Figurine	2
	Frozen Charlotte	1
	Marble	5
Indeterminate		5
Total		**73**

*Ceramic beads are discussed in the bead section of Chapter 9.

Earthenware Building Materials

Substantial quantities of Mission-period building material, including bricks (*ladrillos*), roof tiles (*tejas*), and ceramic water pipe segments (*caños*), were encountered during excavation at the San Gabriel Mission archaeological site, representing the most common class of materials. For the most part, these materials were quantified in the field, but not collected (see Chapter 4 for discussion of collection protocol). This includes more than 11,868 kg (26,165 lbs) of ladrillos, 1,392 kg (3,070 lbs) of caños, 13,106 kg (28,894 lbs) of tejas, and 10,949 kg (24,141 lbs) of indeterminate earthenware building materials, which include small fragments of ladrillos, caños, and tejas (Table 10.13). In total, the study quantified 37,316 kg, or more than 41 tons, of building materials from controlled excavation. For the sake of comparison, the 20-foot section of Chapman's Millrace that the project moved in 2012 weighed over 15 tons (see Chapter 4). It is clear that the materials described below represent the substantial architectural remains of several Mission-period buildings. Samples of complete or nearly complete specimens of ladrillos, caños, and tejas were collected for analysis.

Like table ceramics, earthenware building materials were locally produced to meet the needs of the missions and presidios throughout Alta California. Fired tile is known to have been used as early as 1776 at Mission San Antonio (Schuetz-Miller 1994:42), and both roof and floor tiles were being produced at the Santa Barbara Presidio by 1785 (Imwalle 2014:114). Artisans and craftsman were recruited from Mexico to train residents of the Alta California missions in several different craft trades. Training neophytes in such skills allowed for local production of key materials as needed. While it is possible that some need for earthenware materials could have been supplied by trade, the weight and fragility of roof and floor tiles and ceramic pipes would have made it impractical to transport these items overland long distances (Reyes 2014:96). Recent research employing neutron activation analysis and the discovery of archaeological remains of kilns at several mission sites suggest that these materials were made on site from local clay sources (Skowronek et al. 2014).

A total of 21 complete ladrillos were analyzed. Complete ladrillos ranged from 21.3 to 37.4 cm long, with an average length of 27.1 cm, although incomplete samples up to 56.5 cm in length were observed. The complete ladrillos sampled ranged from 13 to 26.7 cm wide, with an average width of 20.2 cm. Incomplete samples up to 29.8 cm wide were observed. The thickness of the complete ladrillos ranged from 4.5 to 6.4 cm, with an average thickness of 5.5 cm. Incomplete examples up to 9.7 cm in thickness were observed.

Baer and Rudinger (1958) described two predominant sizes of ladrillos at California missions, reflecting their use. Bricks for masonry were about 24 cm square and 7.6 cm thick, while those for the floors were 28–38 cm square (Baer and Rudinger 1958:19). Similarly, Imwalle (2014) noted that early Hispanic California floor tiles were typically 28 × 28 × 5 cm. Schuetz-Miller (1994:45), discussing the reconstruction of the San Francisco Presidio in 1795, indicates that bricks conformed to the "Mexico City standard" of the time, which was one-third *vara* long by one-sixth *vara* wide (about 23 × 11.7 cm).

The complete ladrillos from the San Gabriel Mission archaeological site display substantial variation in dimensions, including those observed in the intact tile floors associated with the Area 1 structure (see Chapter 6). The ladrillos in Feature 13, for example, displayed no apparent pattern in their dimensions or layout, and included examples measuring 30 × 18 cm, 20 cm square, and 27 × 14 cm. However, two distinct clusters are evident in the measurements (Figure 10.33). One cluster consists of tiles approximately 28 cm square. The second cluster consists of examples measuring approximately 30 × 19 cm. These clusters suggest that there was some standardization in ladrillo manufacture at the mission, likely produced through the use of wooden molds.

A ladrillo impressed with two superimposed canine paw prints (Catalog Number 06098.01; see Figure 8.2) was recovered from EU 185 in Area 2. The size and basic characteristics of the paw print indicate that it was produced by either a canine or feline.

Table 10.13. Summary of Earthenware Building Materials

Building Materials	Bulk Count (fragments)	Bulk Weight (kg)	Sample Count (fragments)*	Sample Weight (kg)*
Ladrillos (Bricks)	3,336	11,868.28	2,225	3,824.78
Caños (Pipes)	2,660	1,392.32	353	1,605.64
Tejas (Tiles)	15,053	13,106.04	1,944	743.20
Indeterminate Earthenware Building Materials	64,673	10,949.98	n/a	n/a
Total	**85,722**	**37,316.62**	**4,522**	**6,173.62**

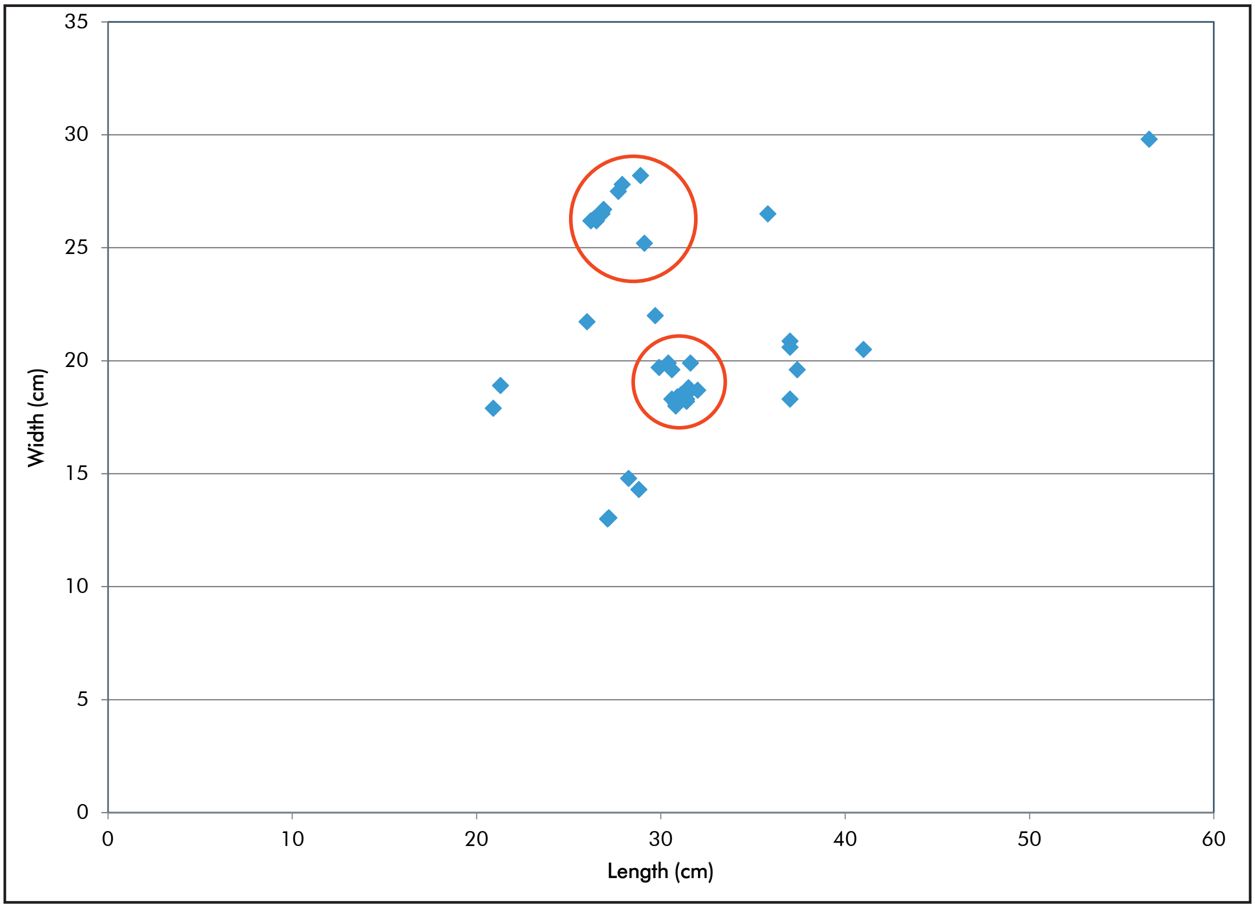

Figure 10.33. Distribution of ladrillo dimensions. Clusters indicated with circles.

Canine paw prints have definite claw marks, one lobe on the front of the heel pad, and two lobes on the rear of the heel pad. In contrast, feline paw prints rarely show claw marks, the front of the heel pad has two lobes, and the rear of the heel pad has three lobes. Canine paw prints are typically longer than they are wide, while feline paw prints have more of an equilateral shape or the track is wider than it is tall. The paw print exhibits all of the signs of having been produced by a canine.

In the late eighteenth and early nineteenth centuries, the Los Angeles basin supported three canine species: coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), and domesticated dog (*Canis familiaris*). Gray fox paw prints are significantly smaller than the preserved print, so that species can be ruled out. Distinguishing between the tracks of a coyote and a domesticated dog is a little more difficult. The length-to-width ratio of coyote tracks are typically greater and there less space between the digits, with the depth of the print in the toes greater than in the palm. In contrast, domesticated dog paw prints typically have a lower ratio between length and width, relatively greater spacing between digits, and relatively even depth between the toes and palm. While a domesticated dog cannot be entirely ruled out as the creator of the paw prints, the characteristics of these paw prints are more coyote-like.

Samples of ceramic water pipe (*caños*) selected for analysis ranged from 11.5 to 14.4 cm in exterior diameter, and from 8.7 to 11.7 cm in interior diameter. Examples of caños collected from the San Gabriel Mission archaeological site (Figure 10.34) were fragmentary; no complete examples were identified. The greatest length of segment recovered was 34 cm in length, an example that weighed 17.4 kg.

Figure 10.34. Caño fragment recovered from the San Gabriel Mission archaeological site.

CHAPTER 11: SPATIAL ANALYSIS

James M. Potter

This chapter explores the spatial distribution of various artifact and ecofact types in an attempt to document and understand potential chronological, depositional, and behavioral variation across the study area. Primary categories investigated are metal, glass, earthenware construction materials (e.g., bricks and roof tiles), faunal bones, ceramics, beads, and lithic artifacts; these represent the major groupings of materials encountered in the course of the study.

The first part of this chapter explores the relative densities of major artifact classes with large sample sizes (n > 200). These categories consist of *Metal*, *Glass*, *Earthenware Building Material*, *Fauna*, *Ceramics*, and *Other Historical Items*. Due to small sample sizes, items such as floral remains and shellfish were not included in the analysis. Metal includes nails, cans, building materials, and other metal items. Glass includes all items made of glass, most of which are containers. Earthenware Building Materials comprises water pipes, flat tiles, and roof tiles made of fired clay. Fauna is composed of all vertebrate faunal remains, the majority of which are cattle and sheep bones (see Chapter 8, Animal and Human Remains). Ceramics include both Native American and nonnative ceramics. And Other Historical Items includes all European-made items that do not fall within the categories of Glass, Ceramic, or Metal, such as plastic, rubber, cement mortar, and asphaltum. These basic classification categories were made for all 169 Phase III Data Recovery 1 × 1–m and 1 × 0.5–m excavation units across the site. All of these units were included in the density analysis. These distributions mark major material and depositional differences across the study area.

The second section presents an analysis of these categories using a statistical technique called correspondence analysis. Based on the observation and analysis of multiple variables (i.e., multivariate analysis), this technique allows researchers to identify patterns and relationships that exist among a number of variable and case groups, which are presented on a scatterplot graph. The primary goal of this analysis is to identify meaningful patterns and relationships among variables.

The third section consists of a density distribution analysis of more specific artifact categories that are subsumed within the major artifact groupings. For example, this section explores separately the distribution of the various Earthenware Building Material types (water pipes, flat tiles, and roof tiles) in an attempt to pinpoint specific structure types. Native American and nonnative ceramics are also analyzed separately in attempt to identify areas in which Native Americans conducted activities and deposited refuse. In addition, this section explores the distribution of artifact assemblages exhibiting relatively small sample sizes, such as flaked and ground stone items and shell, glass, and ceramic (Prosser) beads.

The final section of this chapter presents a chronological sequence, or seriation, of ceramic types across the site. The excavation unit assemblages included in this analysis are only those that received detailed analysis; therefore, the results include more types and categories, but fewer individual units. Results of this analysis suggest that the deposits in the study area may be stratified spatially, with the deposits on the study area's east side being older than those on the west side.

Density Distributions of Major Artifact Classes

Density distributions are presented in ordinal form, ranked lowest to highest, and represented in this order from lighter to darker shading on density distribution maps. Densities are presented as artifact counts per cubic meter. These maps are single-variable distributions. Thus, the densities of each artifact category across the site are displayed on a single map.

Figures 11.1 to 11.6 present the density distributions of the major artifact classes across the study area. Ceramic artifacts were concentrated in the northeastern portions of the millrace and reservoir complex (Area 2), and to a lesser extent, in Area 1 (Figure 11.1). Faunal remains exhibit a similar pattern but are also well represented in the center portion of the study area (the South Midden), and within Feature 14 in Area 1 (Figure 11.2). Glass, by contrast, is more evenly distributed among Areas 1 and 2 but is less common in the center of the study area (Figure 11.3). Metal is most common in Area 2, particularly within Feature 14 (Figure 11.4). Other Historical Items and Glass are equally abundant in both Areas 1 and 2 (Figure 11.5). Earthenware Building Materials are most abundant in Area 2, in association with the millrace and reservoir complex (Figure 11.6).

Multivariate Analysis of Major Artifact Classes

In an attempt to explore artifact type distributions at a multivariate level, frequencies of various artifact types are also analyzed using a multivariate exploratory technique called correspondence analysis. Correspondence analysis uses counts of types to generate chi-square coefficients of similarity based on row and column marginals. It has become a popular method to seriate (date/correlate) cases based on artifacts or type frequencies due to the straight-forwardness of its calculations, its circumvention of the closed-sum problem (as opposed to simple frequency seriation based on percentages), and because similarity coefficients are generated for both cases and variables, allowing one to plot them on the same two-dimensional scatter plot and visually discern variables that cause any apparent patterning among the cases (Baxter 1994). It should be noted that the dimensions that are plotted are summary variables accounting for a portion of the variation of any assemblage (similar to components in a principal components analysis). The first two dimensions are usually plotted because they have the highest eigenvalues (i.e., they account for the greatest proportion of the variation in the assemblage). This is what is presented in this analysis. The correspondence analyses reported here were performed using Statistica Version 7, a data mining and statistical analysis software program.

The results of a correspondence analysis performed on count data for these categories are presented in Figure 11.7. Dimension 1 of the analysis (portrayed along the x-axis of Figure 11.7) accounts for 47 percent (almost half) of the variation in the total assemblage. This dimension distinguishes primarily between those assemblages associated strongly with Metal (negative along the x-axis) and those associated with other categories (positive along the x-axis, in opposition to Metal). Dimension 2, which accounts for 37 percent of the variation in the total assemblage, distinguishes between units associated with Other Historical Items (positive along y-axis) and Fauna, Ceramics, and Earthenware Building Materials, all of which are negative along the y-axis and positive along the x-axis. Glass appears to be a neutral variable (i.e., close to the zero-zero point) but is slightly positive along the y-axis and negative along the x-axis. The fact that Dimensions 1 and 2 account for 84 percent of the total variation indicates that the patterns and associations among the variables, particularly the close association among Ceramics, Fauna, and Earthenware Building Materials, are highly significant.

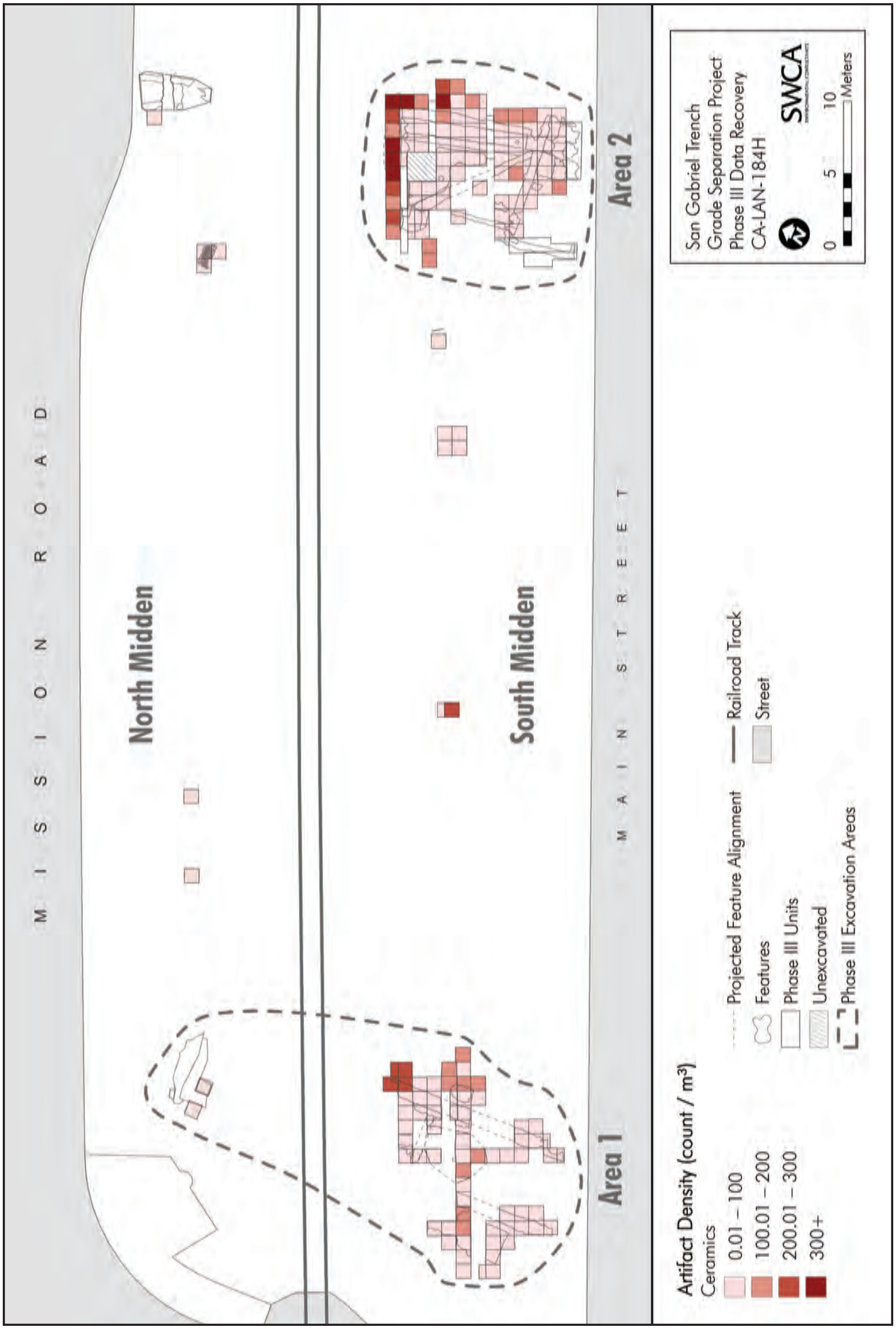

Figure 11.1. Density distribution of Ceramics category.

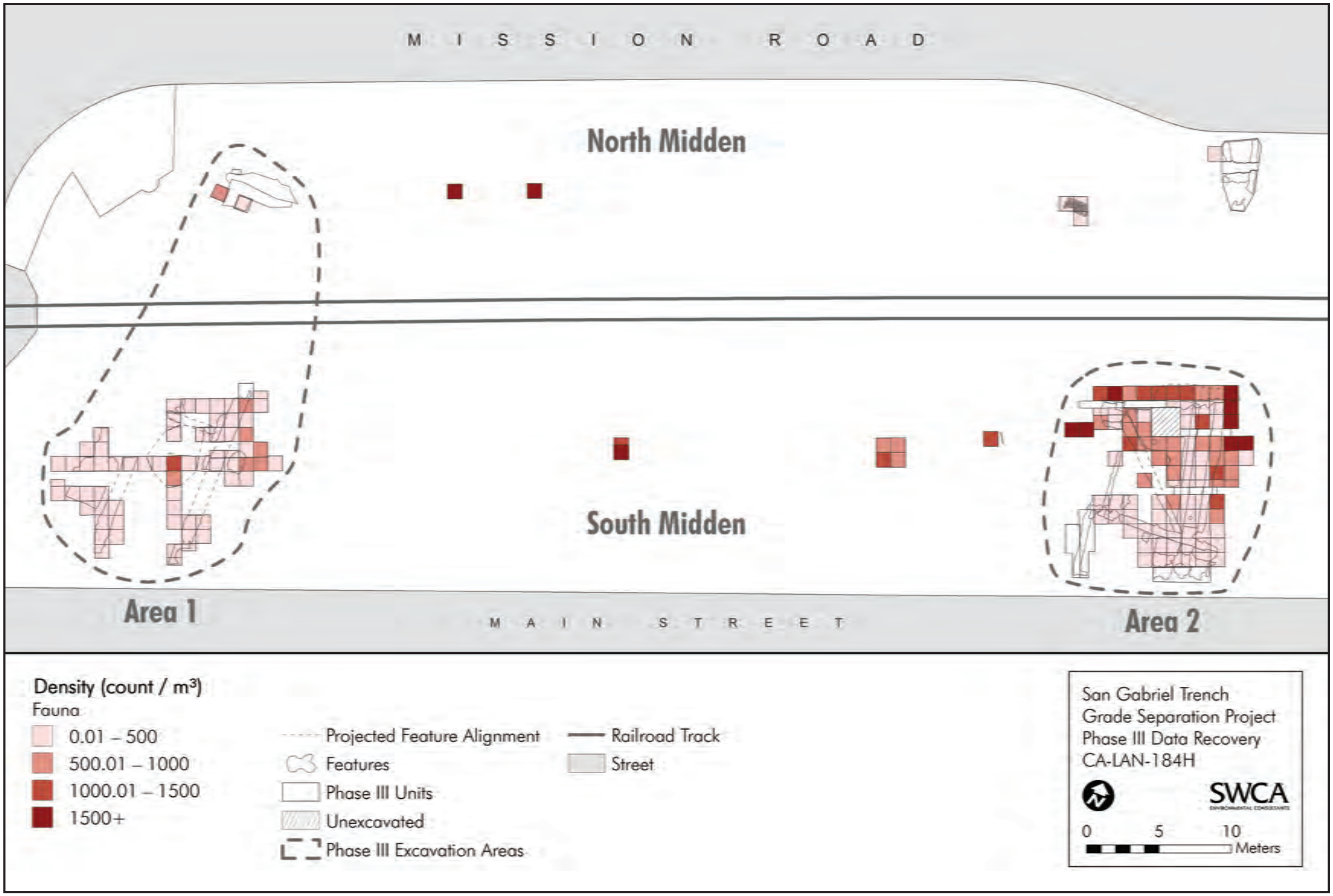

Figure 11.2. Density distribution of Faunal category.

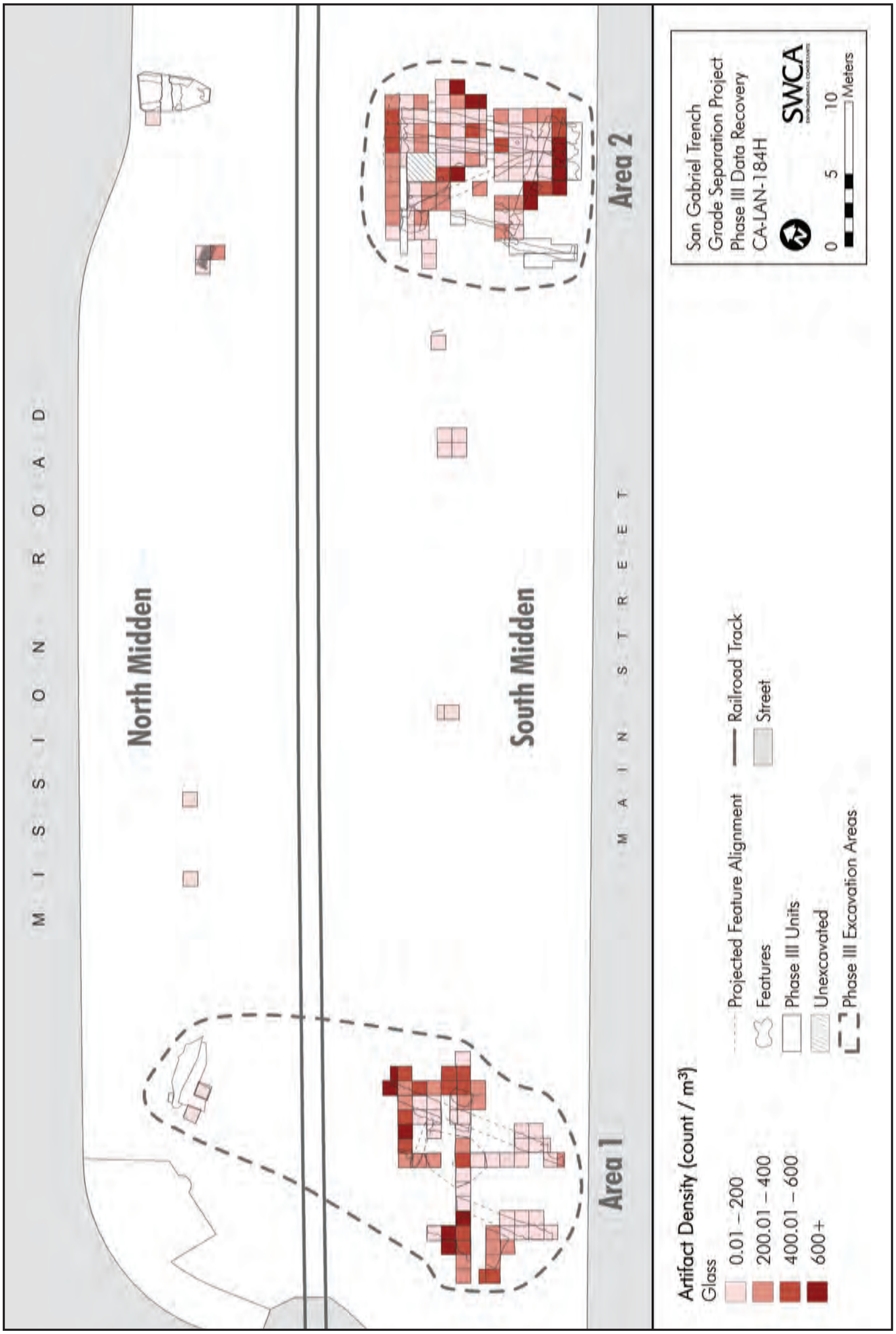

Figure 11.3. Density distribution of Glass category.

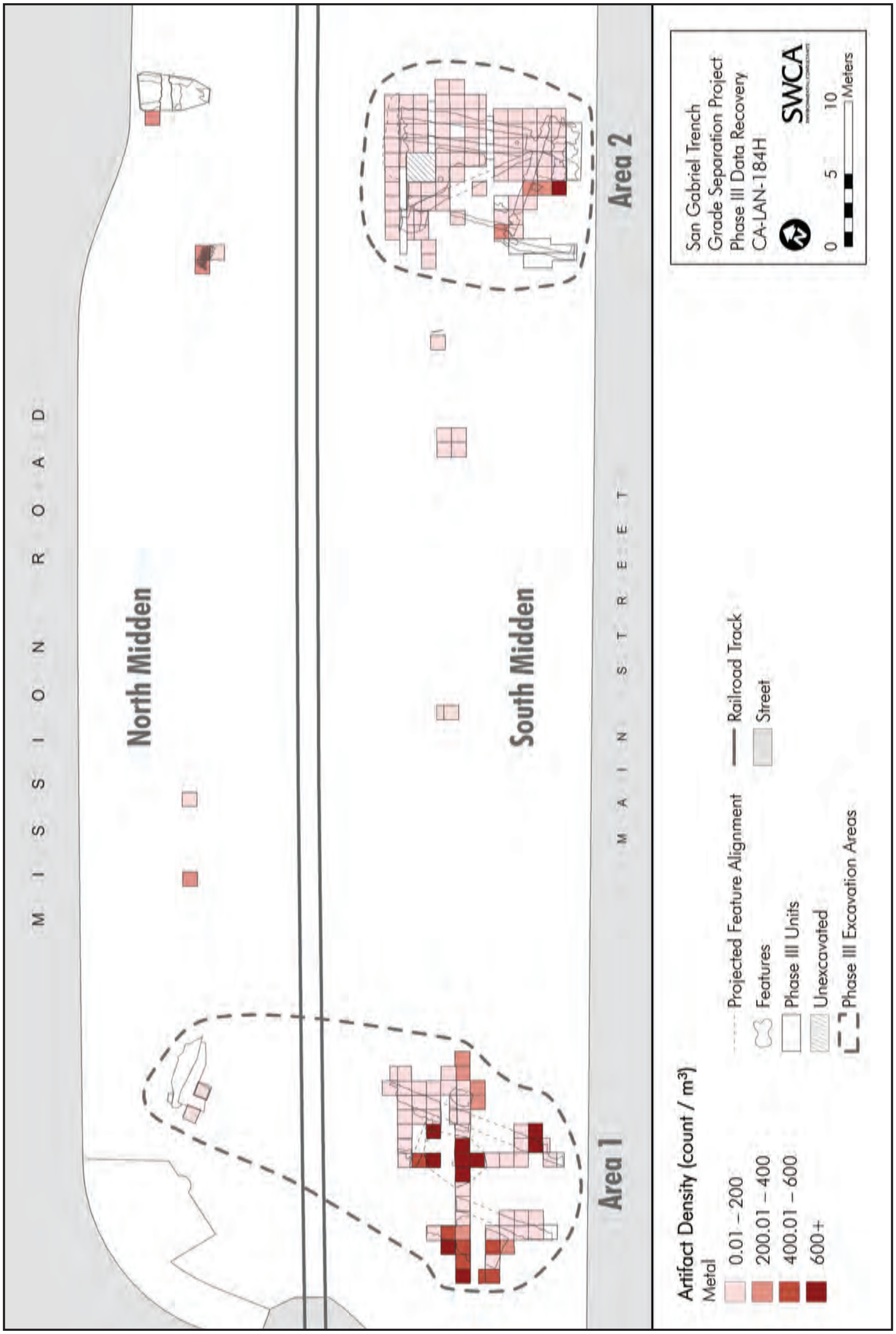

Figure 11.4. Density distribution of Metal category.

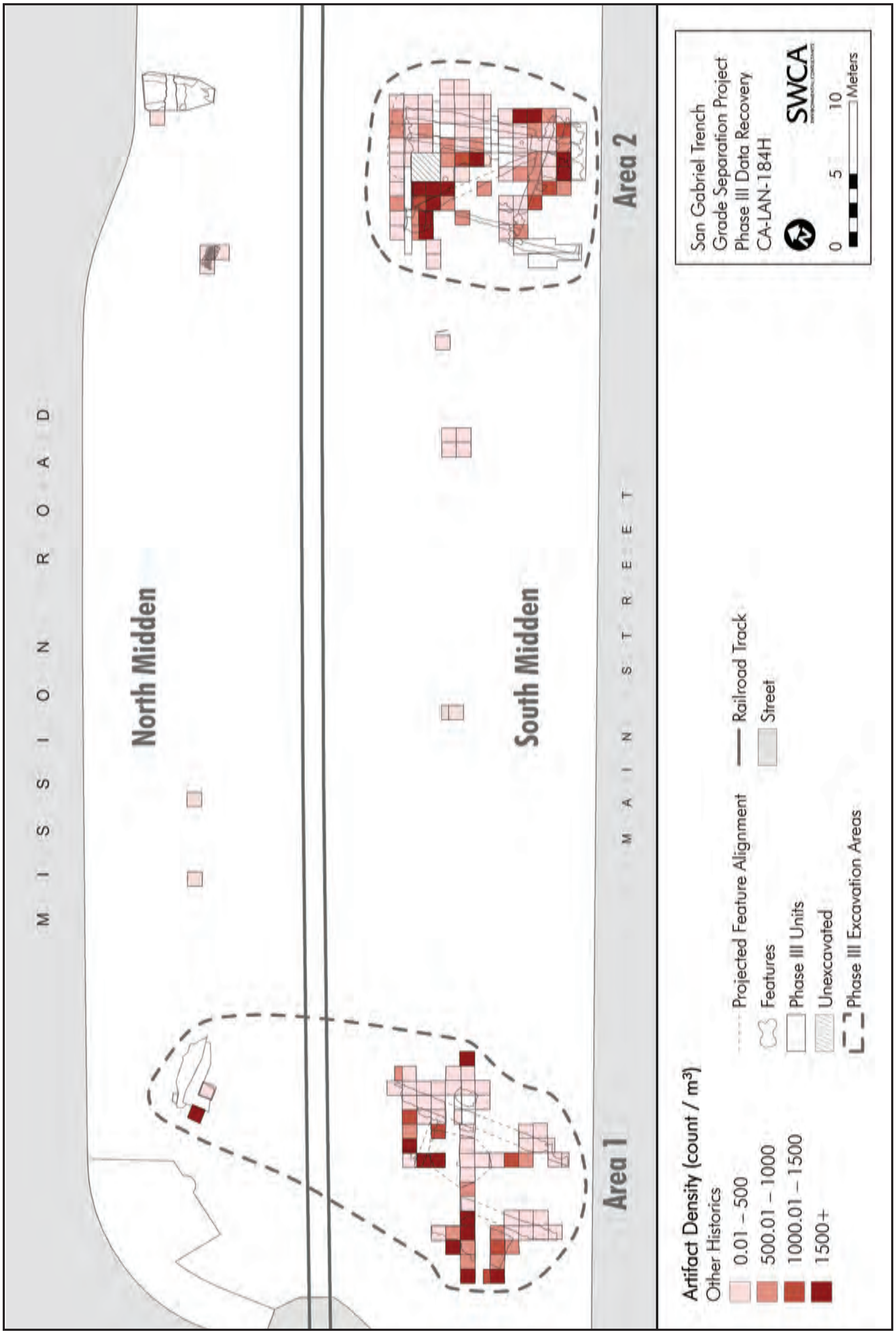

Figure 11.5. Density distribution of Other Historical Items category.

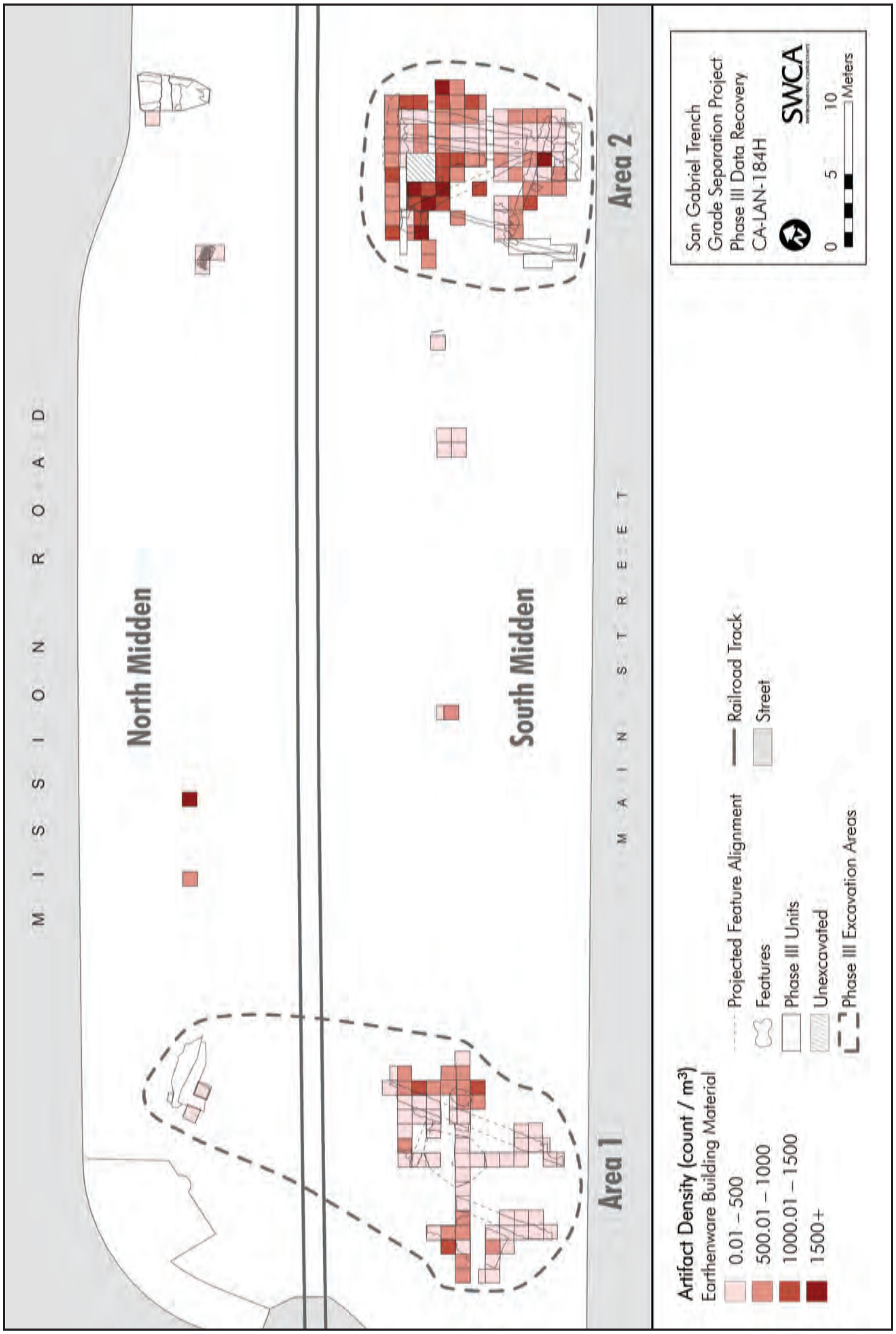

Figure 11.6. Density distribution of Earthenware Building Material category.

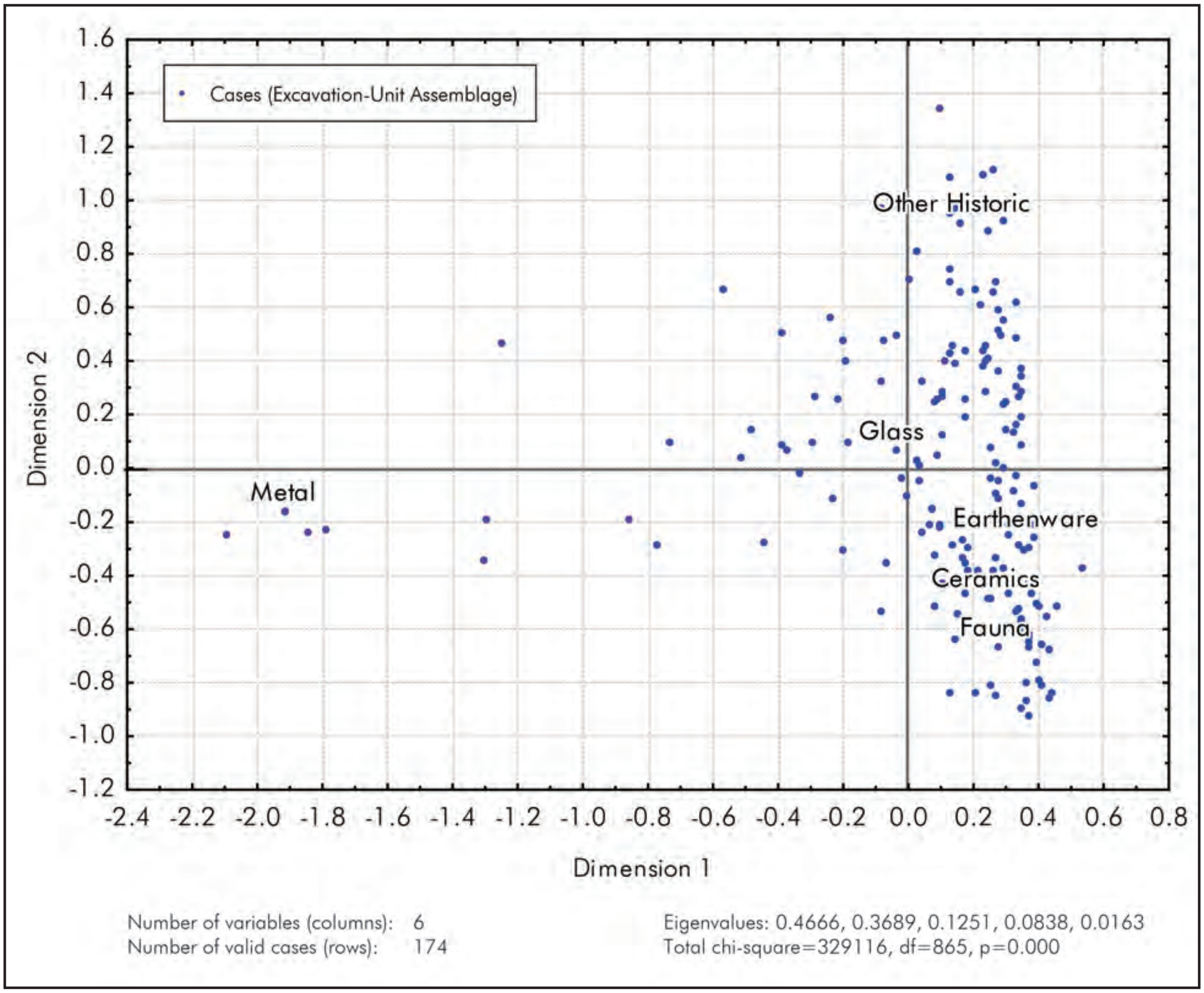

Figure 11.7. Correspondence analysis plot for major artifact classes.

Figure 11.8 plots these values spatially; the various colored units represent the quadrants depicted in Figure 11.7. Blue units represent those plotted in the lower right quadrant of Figure 11.7 and are associated positively with Ceramics, Fauna, and Earthenware Building Materials, for example. These units are strongly represented in Area 2, in the South Midden, and in the northeastern portion of Area 1. Purple units contain a relatively high proportion of Metal, and these are situated disproportionately in association with the large refuse pit (Feature 14) in Area 1. Red units contain high incidences of Glass, primarily bottle glass; Light Blue units are highly associated with Other Historical Items and may represent areas of historical disturbance.

The strong association of Metal with the large refuse pit (Feature 14), which dates to the American period, is not unexpected; since this association dominates much of the above analysis, a separate analysis that excludes excavation units associated with this feature was performed. Figure 11.9 plots these data. Note the more even separation of variables, the separation of Fauna and Earthenware Building Material, and the association of Glass and Metal in the upper left quadrant. Ceramics are equally associated with Fauna and Earthenware Building Materials, though slightly more strongly with Fauna (the label is above the actual data point). A spatial representation of these patterns is presented in Figure 11.10, which maps the different quadrants as various colors. Note that Fauna and

Ceramics (blue units) are associated primarily with Area 2 and the South Midden, while Earthenware Building Materials (light blue units), now separated from these artifact classes, are represented strongly in both Areas 1 and 2. Glass and Metal (red) are concentrated together in portions of both Areas 1 and 2. And Other Historical Items (purple) are distributed rather evenly across the study area, although there are some pockets where these items are concentrated in a few contiguous units.

Spatial Distributions of Items of Interest

Ladrillos, Tejas, and Caños

The Earthenware Building Materials category consists of *ladrillos* (flat tiles), *tejas* (roof tiles), and *caños* (water pipes). Ladrillos represent the remains of floors and walls, tejas represent the remains of tiled roofs, and caños represent the remains of water distribution systems. Thus, ladrillos should be associated with interior or exterior floors and walls, and tejas should be associated with roofed structures. Caños are expected to be associated with the reservoir complex in Area 2 and to be distributed more randomly than structure-related materials (i.e., they should be less constrained spatially), possibly linearly.

Figures 11.11 to 11.13 present the density distributions of these materials. Tejas are most common in Area 2 and most likely represent the remnants of Chapman's Mill (Figure 11.11). Area 1 contained a relatively high frequency of tejas as well, but these are concentrated in an area outside the Area 1 structure. It is unclear whether these materials are related to the roof of the structure.

Caños, as expected, are most numerous is Area 2 and are likely related to the various reservoirs associated with this area (Figure 11.12). Ladrillos are present in small concentrations in both Areas 1 and 2 (Figure 11.13).

Ceramics

A density analysis of Native American ceramics shows that their distribution is quite restricted to the northeast portion of Area 1 and the north and east sections of Area 2 (Figure 11.14). This pattern appears to have greatly influenced the overall pattern of ceramic distributions presented in Figure 11.1, and it appears that Native American ceramics are strongly correlated with the distribution of faunal remains on the site (see Figures 11.2 and 11.10). Nonnative ceramics are present in Area 2 as well, but they appear to be more numerous in Area 1 (Figure 11.15).

Beads

Beads were recovered primarily from Area 2 (Figure 11.16). Although there does not appear to be much patterning or clustering of beads within Area 2, patterning is evident when shell and glass beads are analyzed separately. Shell beads are more prevalent in the northern portion of Area 2 (Figure 11.17), whereas glass and ceramic (Prosser) beads are more prevalent in the southern portion of Area 2 (Figure 11.18). The relatively high occurrence of shell beads in areas containing a high incidence of faunal remains (see Figure 11.2) and Native American ceramics (see Figure 11.14) is noteworthy.

Lithics

Flaked stone artifacts were most numerous in Area 2, particularly in the northern portion of Area 2 (Figure 11.19). This pattern is consistent with other Native American artifacts such as Native American ceramics and shell beads and further corroborates this portion of the study area as dominated by Native American artifacts. Ground stone items, on the other hand, appeared to be distributed randomly across the study area, but these items are extremely rare and patterning is therefore difficult to identify and interpret (Figure 11.20).

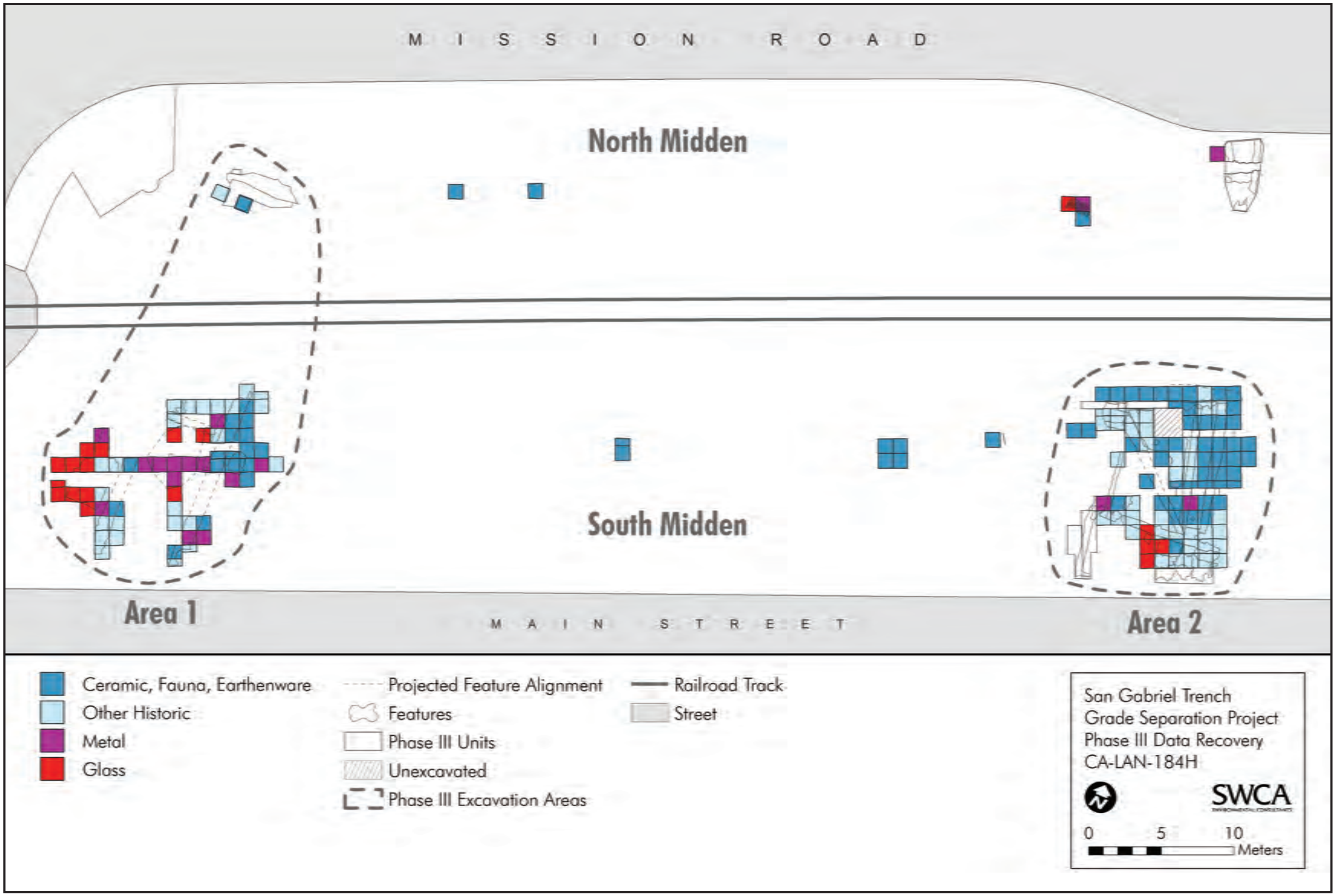

Figure 11.8. Map showing the spatial distribution of dimension values plotted on Figure 11.7.

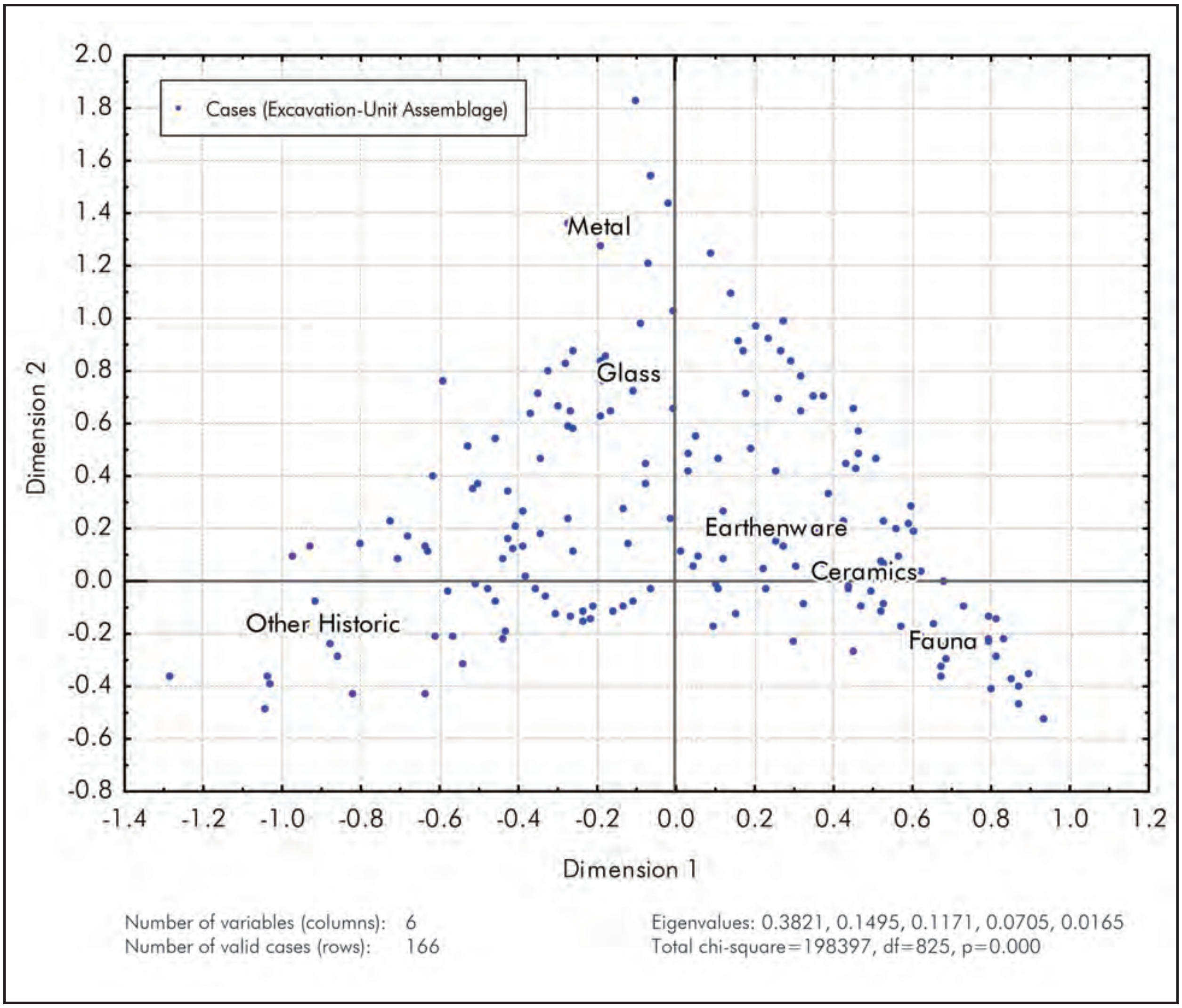

Figure 11.9. Correspondence analysis plot showing major artifact classes, excluding large refuse pit (Feature 14).

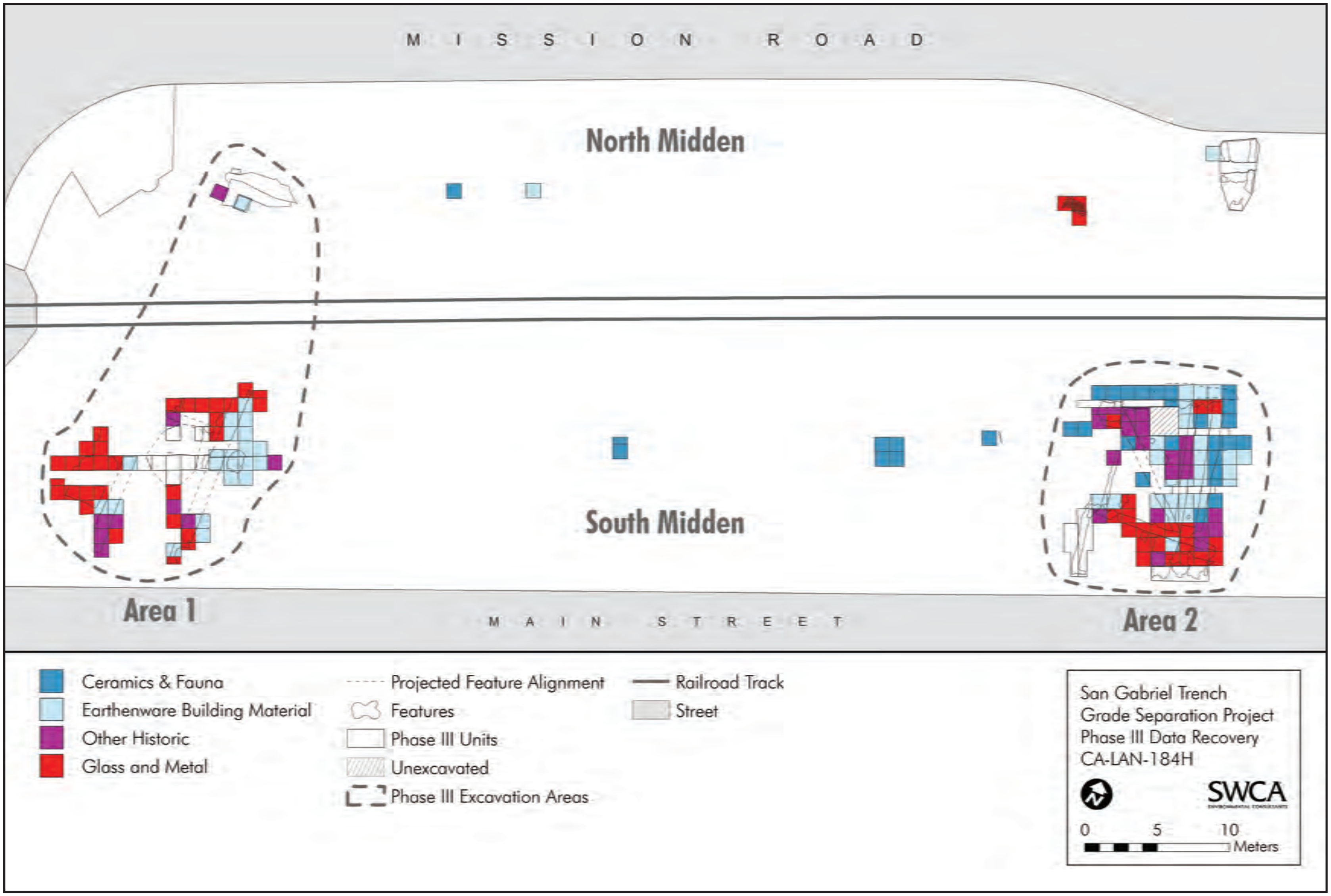

Figure 11.10. Map showing the spatial distribution of dimension values plotted on Figure 11.9.

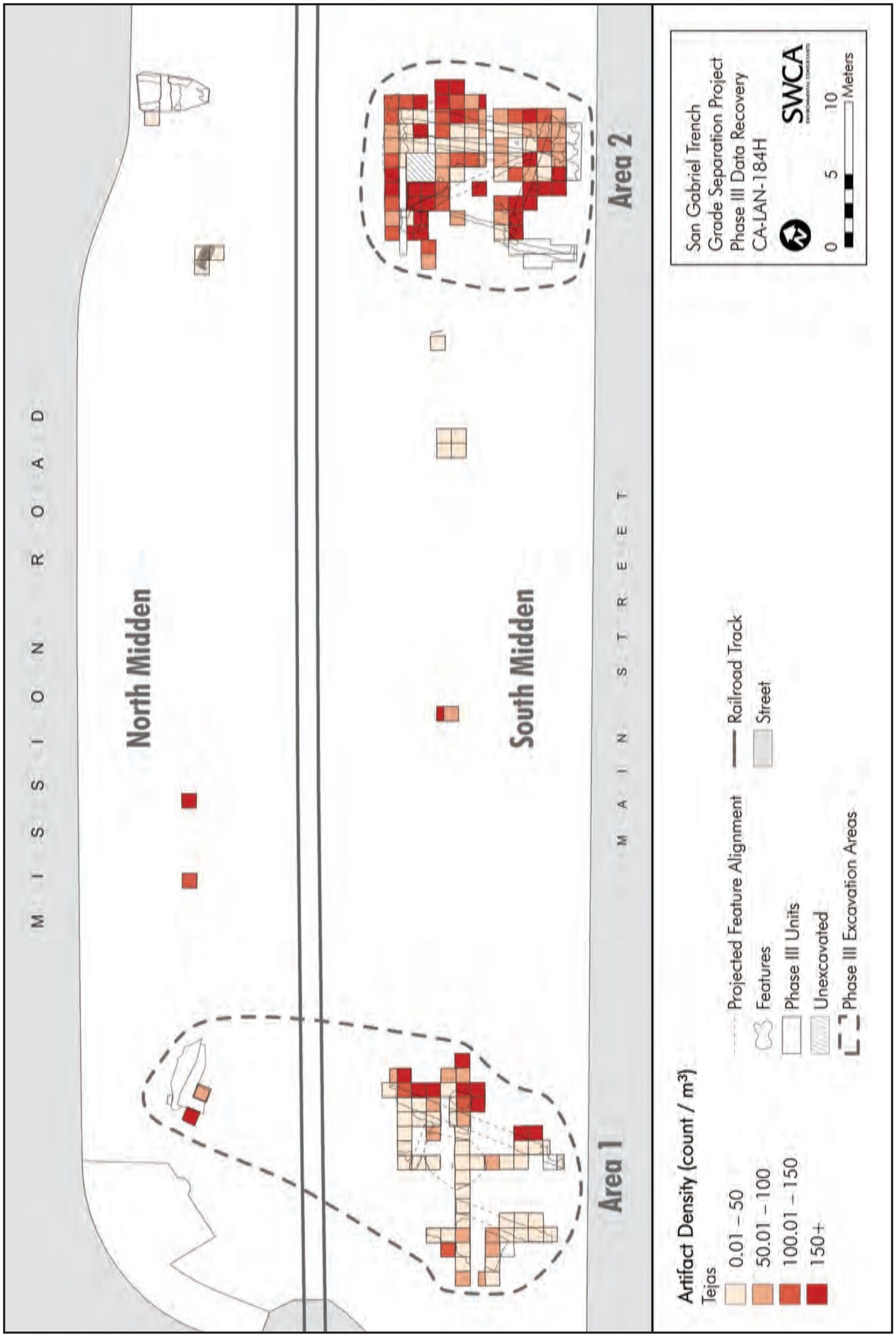

Figure 11.11. Density distribution of *tejas* (roof tiles).

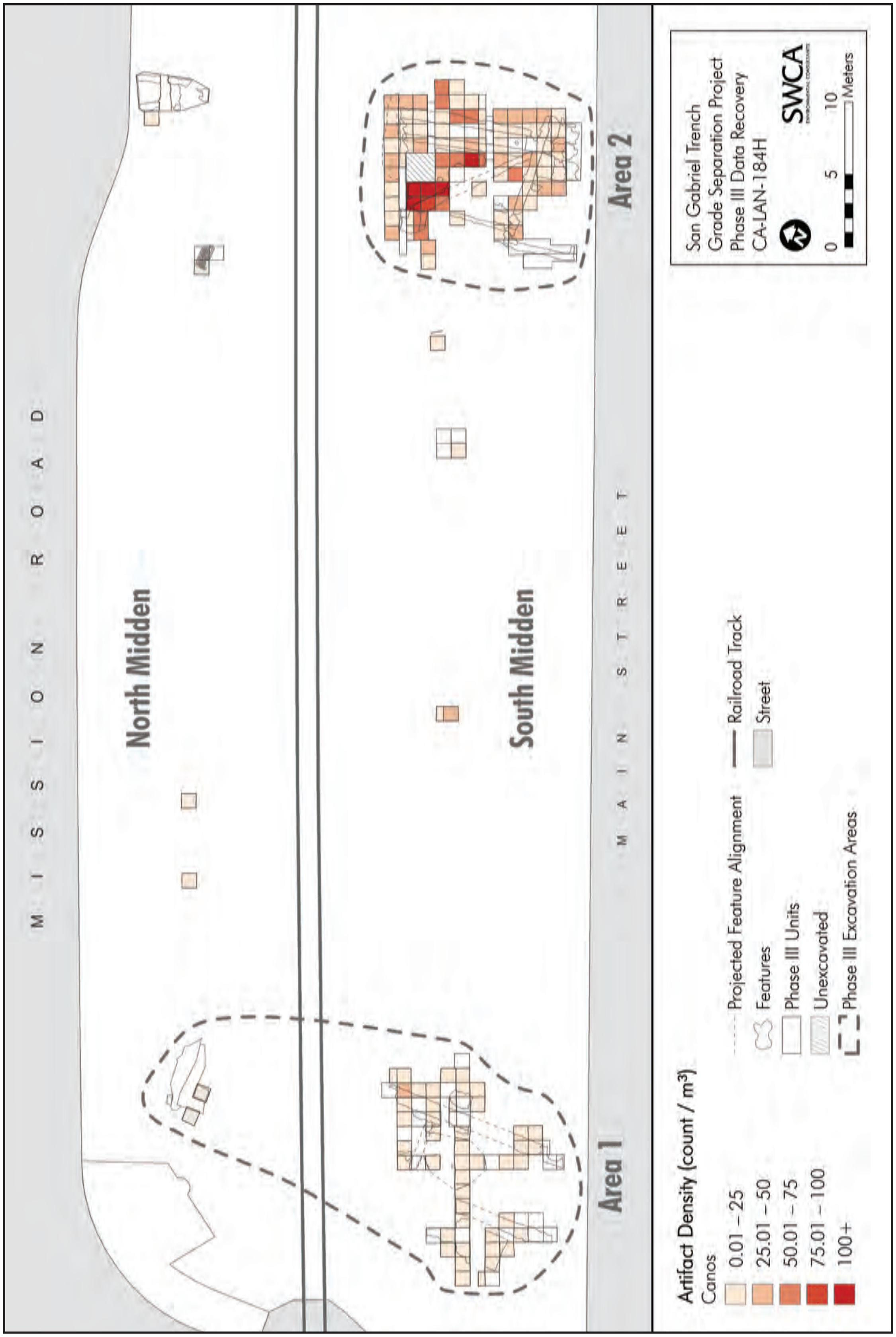

Figure 11.12. Density distribution of *caños* (water pipes).

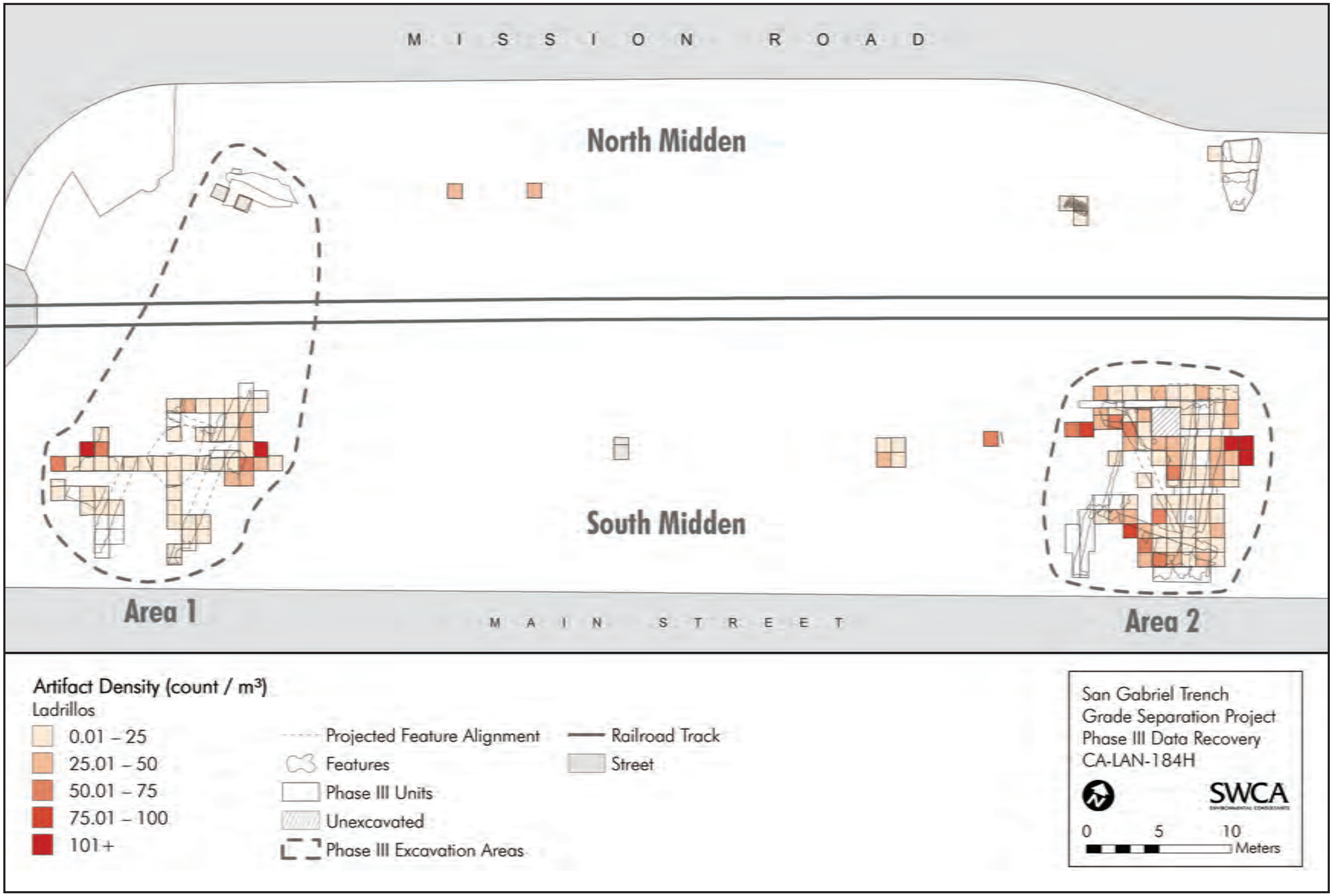

Figure 11.13. Density distribution of *ladrillos* (flat tiles).

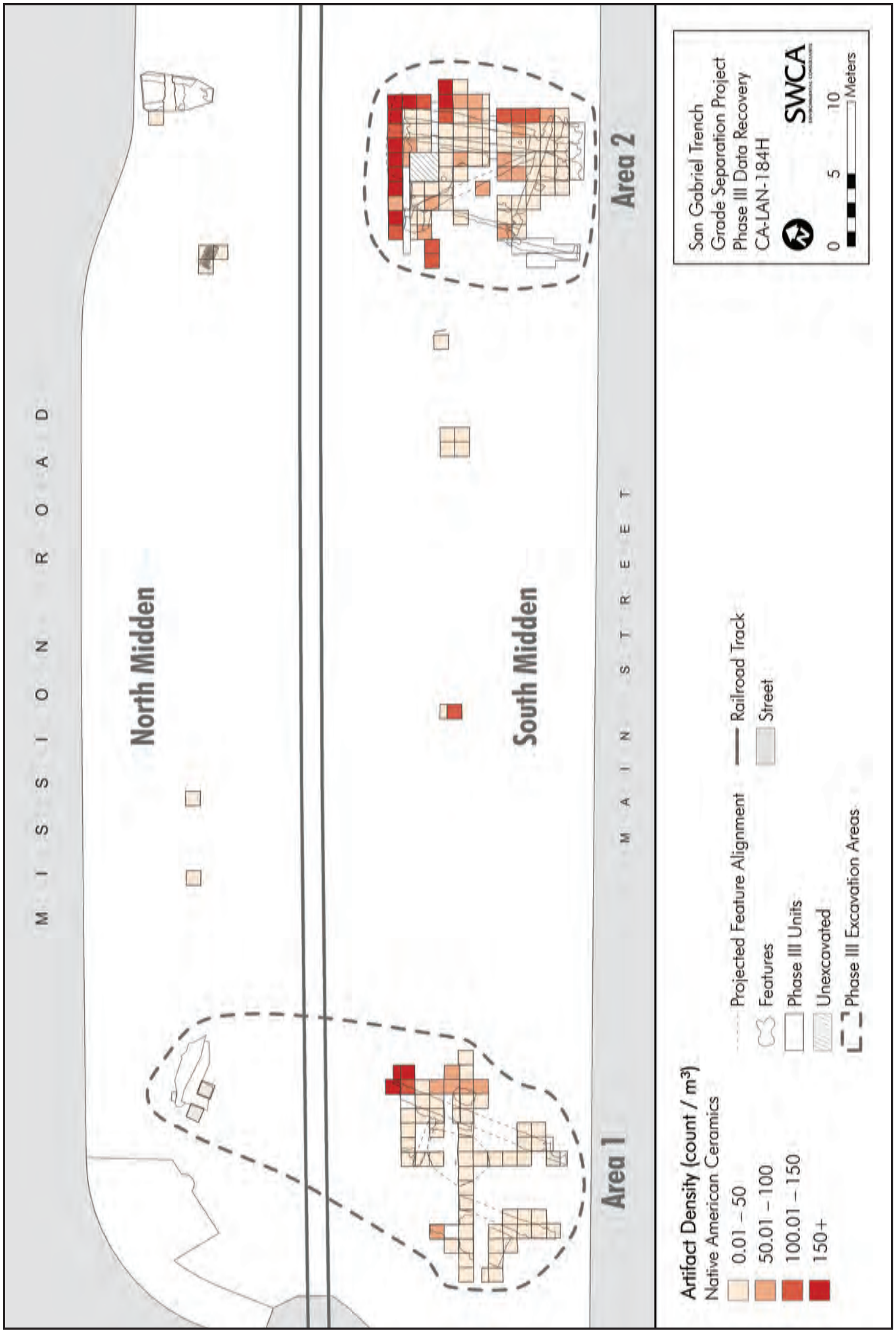

Figure 11.14. Density distribution of Native American ceramics.

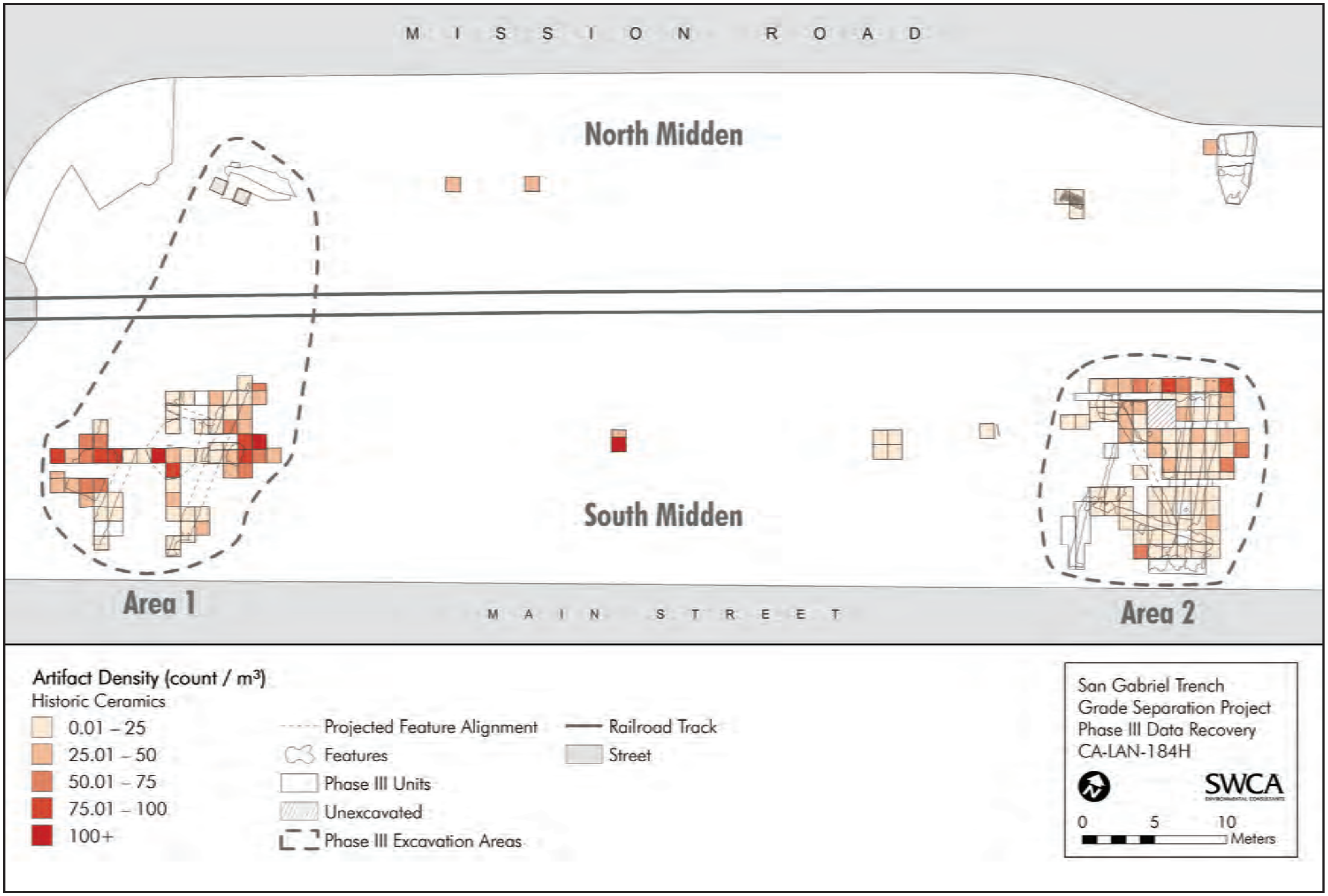

Figure 11.15. Density distribution of nonnative ceramics.

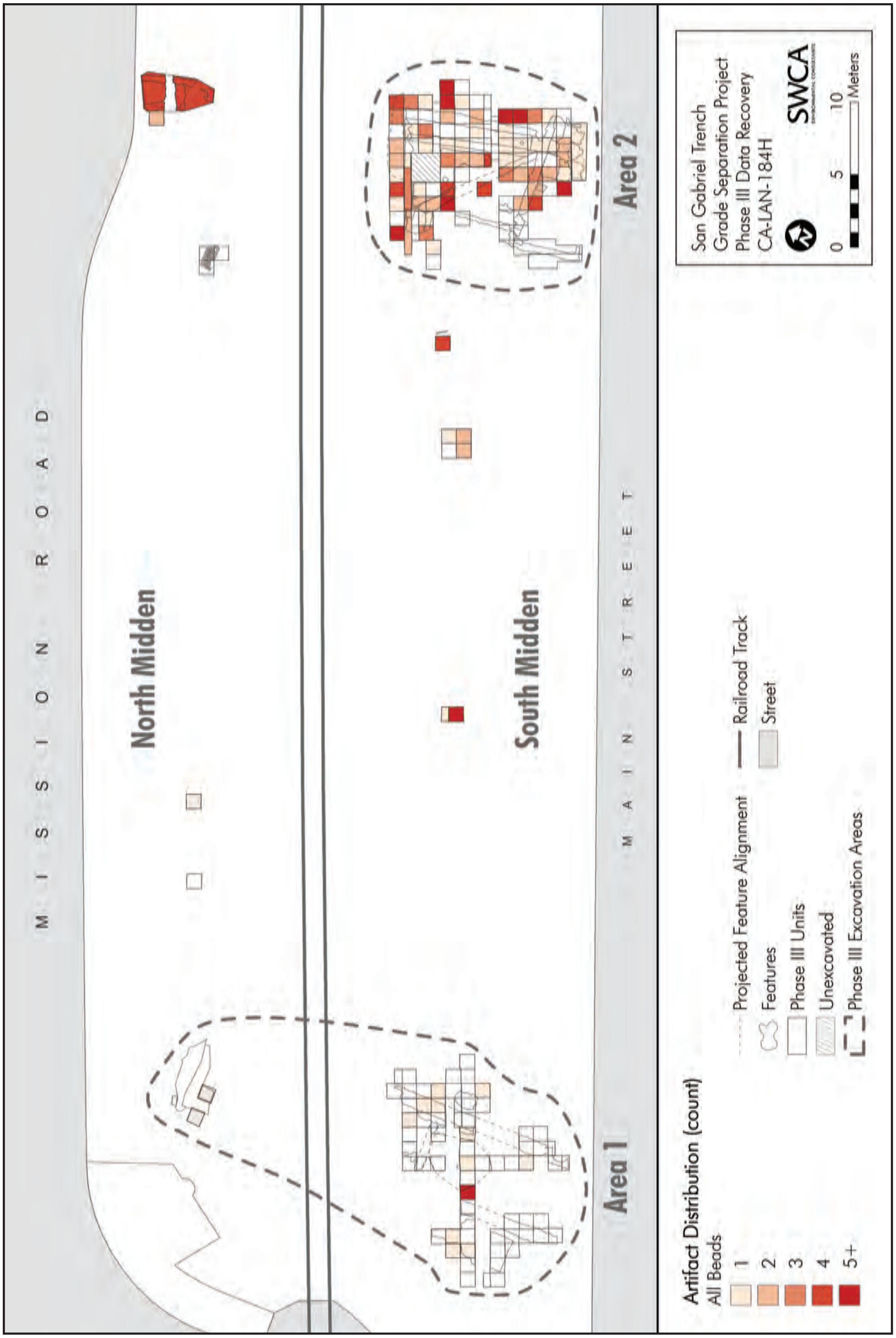

Figure 11.16. Distribution of shell, glass, and ceramic (Prosser) beads.

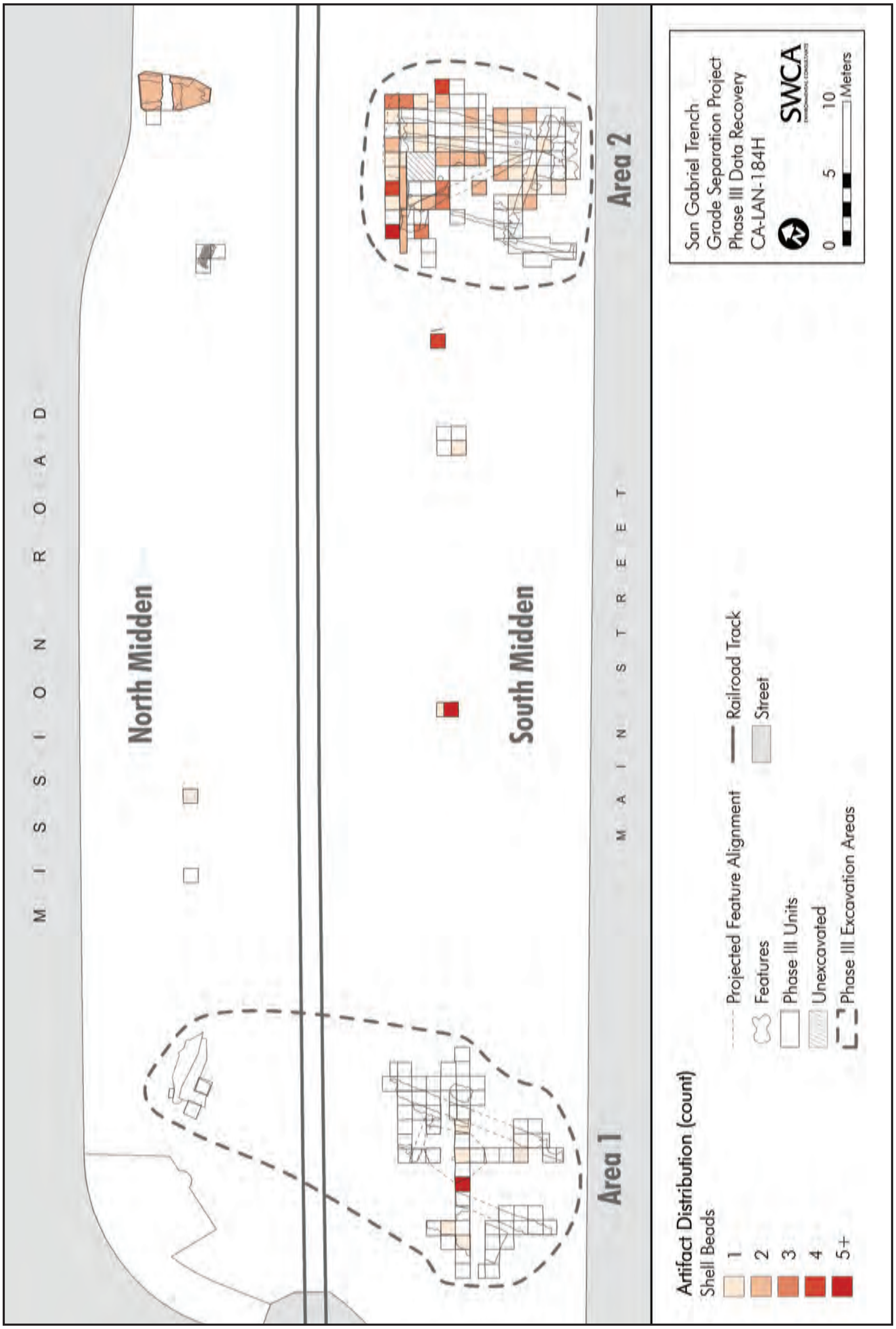

Figure 11.17. Distribution of shell beads.

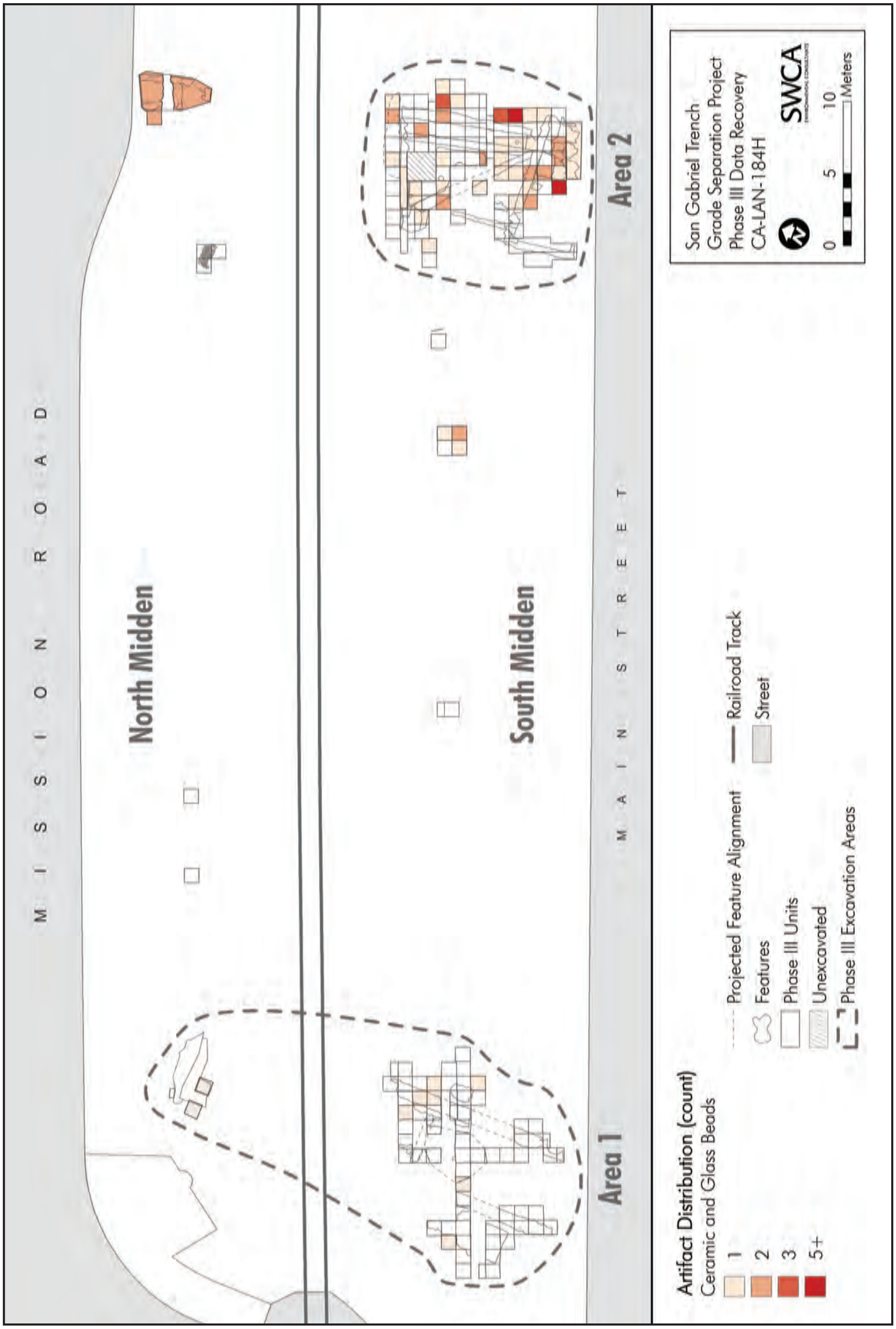

Figure 11.18. Distribution of glass and ceramic (Prosser) beads.

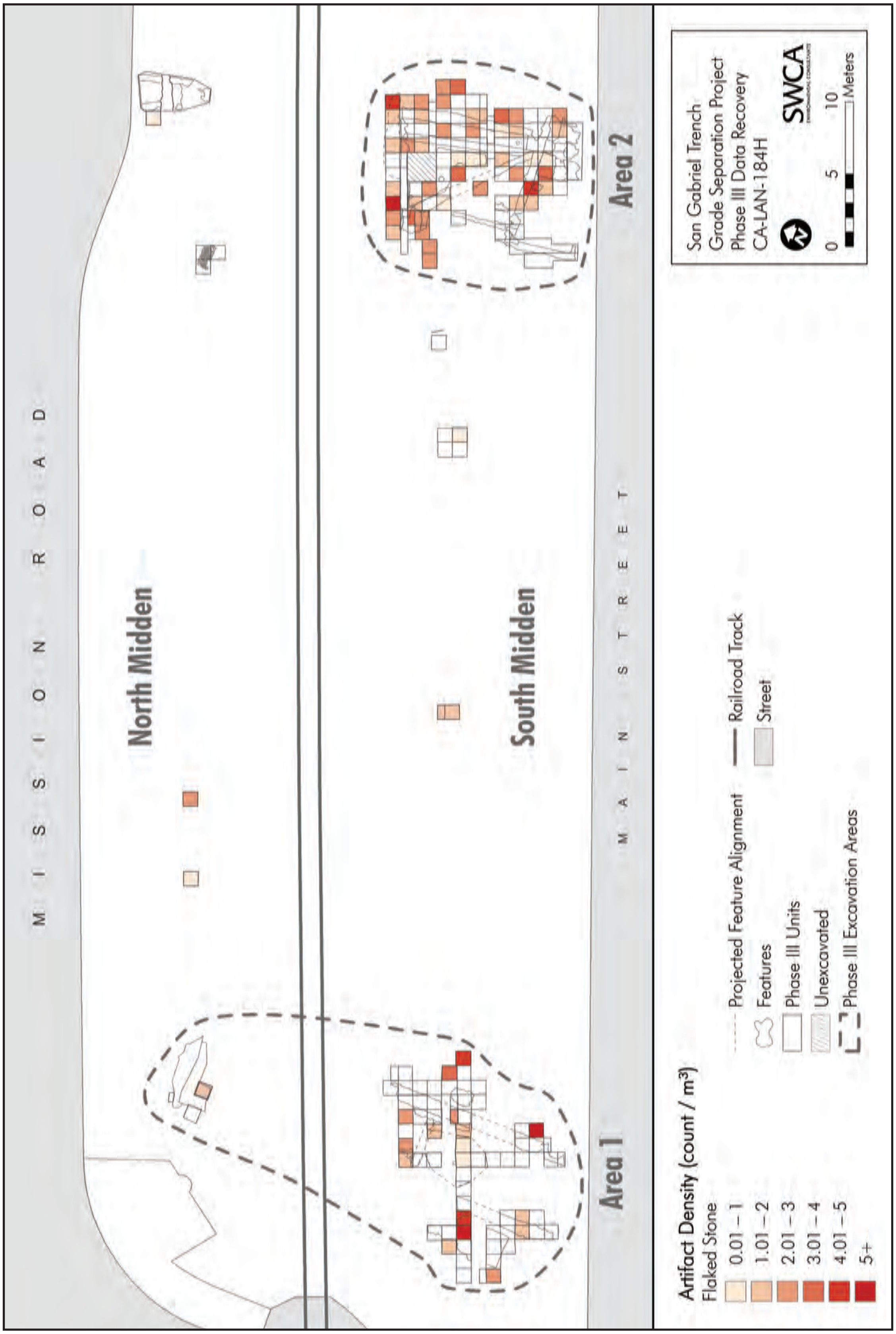

Figure 11.19. Density distribution of flaked stone artifacts.

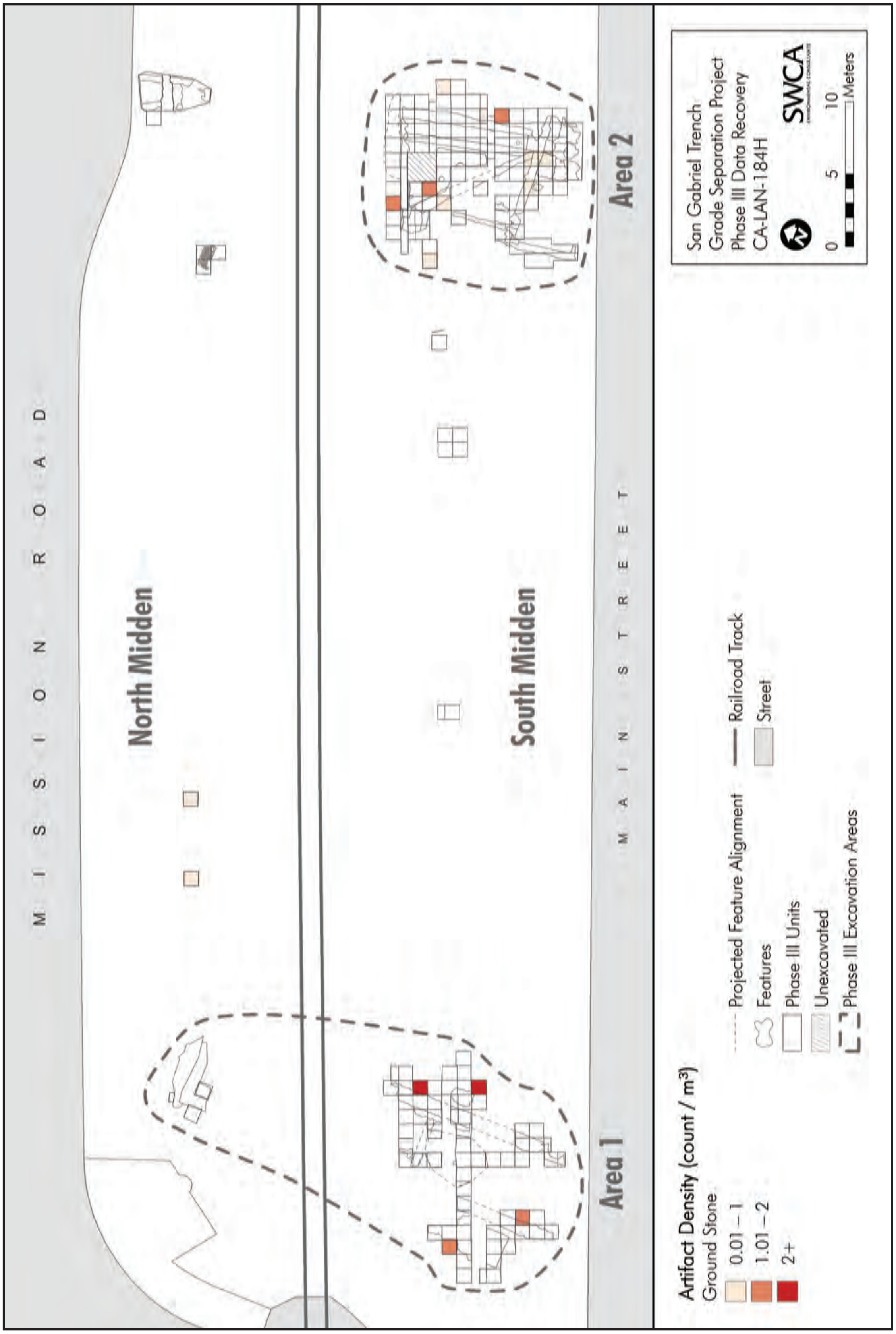

Figure 11.20. Density distribution of ground stone artifacts.

Discussion of Spatial Analyses

Artifacts and items associated with food preparation and consumption (flaked stone artifacts, fauna, and ceramics) were most abundant north and east of the millrace and reservoir complex in Area 2. Ceramics most strongly associated with this area are Native American pottery. Shell beads are also relatively abundant in this portion of the study area, further indicating a concentration of Native American material culture in this deposit.

Earthenware Building Materials were also highly abundant in the northern and eastern portion of the millrace and reservoir complex, as well as the western portion of Area 1. Earthenware Building Materials associated with the millrace and reservoir complex included caños and tejas. Glass items were heavily concentrated in the southern part of the millrace and reservoir complex and the far western part of Area 1 (i.e., the westernmost part of the study area). Metal was present in high quantities within the large refuse pit (Feature 14) and in Area 1, on the far western edge of the site core. The category of Other Historical Items is less patterned and represented relatively evenly across the site.

Areas where an abundance of flaked stone items, fauna, and ceramics were deposited may be indicative of nearby food preparation and consumption, depending on disposal practices and the influence of post-depositional processes. The strong association of Native American ceramics with faunal remains in these areas, particularly immediately north and east of the Millrace and Reservoir Complex, suggests that these were areas of Native American preparation and consumption that involved the consumption and processing (primarily) of cattle (see Chapter 8, Animal and Human Remains). These assemblages likely represent the primary deposition of these materials and activities that occurred close to where these materials were recovered archaeologically (see Chapter 5, Site Stratigraphy).

By contrast, the categories of Glass and Metal, often co-occurring, appear to mostly represent secondary refuse dumping. Feature 14 contained an inordinate amount of these materials, as did the area immediately west of the structure in Area 1 and the area just south of the reservoir complex in Area 2. In each of these cases, glass and metal refuse appears to have been deposited in a pit, as in the case of the large refuse pit (Feature 14), or in depressions or trenches from previous excavations (e.g., the area south of the reservoir complex where Edith Webb excavated; see Chapter 2, Site Context).

Finally, Earthenware Building Materials—tejas, ladrillos, and caños—most likely reveal the locations of past structures, floors, and water pipes. The concentrations noted in this analysis likely relate to the directly adjacent building/reservoir remains. The contrasting sparseness of these items in the center and northeast portions of the study area suggests that there were no major structures, floors, or pipes that used earthenware building materials in nearby areas.

These patterns suggest a complex history of formation processes in the study area, involving primary and secondary refuse disposal and the in situ deterioration of structures and pipes, as well as post-abandonment disturbance. Despite this complexity and the degree of vertical mixing in the stratigraphy (see Chapter 5, Site Stratigraphy), there appears to be enough spatial integrity of the study area to identify broad patterns representing activity or functional differentiation. The following section presents a seriation that suggests some chronological differentiation across the study area as well.

Ceramic Seriation

The seriation presented here uses two analytical methods. The first, correspondence analysis, is described above. When this method is used to seriate assemblages, earlier and later assemblages are often plotted at either end of Dimension 1 (x-axis), and the variation exhibited along the y-axis often gives the seriation a U-shape (Baxter 1994). In contrast to other seriation methods, it takes all variables into account in ordering the assemblages. A second method used here is simple battleship curve seriation based on a single primary variable.

This analysis was performed using the Frequency Seriation Tool 3.0 software program, written by Tim Hunt and Carl P. Lipo. This version of the software presents both percentages (white bars) and beta distribution to calculate the exact confidence intervals for the error term (black bars).

Eight broad ceramic categories were included in the seriation analysis. These are described in detail in Chapter 10, Ceramics, and their dates of likely use at San Gabriel Mission are summarized below. Non-vessel ceramics, like Prosser beads, were not included in the analysis. Note that the mission's establishment in this area in the 1770s and its secularization in the 1830s are used as the start and end dates for ceramics that were in use elsewhere beyond the Mission period. The eight ceramic categories included in the seriation analysis are as follows:

- Mexican low-fired earthenware, 1780–1830;
- Majolica tin-enameled earthenware, 1770s–1830s;
- Chinese export ceramics, 1770s–1850s;
- Early British and British earthenware, 1770s–1820s;
- Transitional British earthenware, 1840–1860;
- American earthenware, 1770s–1890s; and
- Native American earthenware, 1770s–1860.

The Sample

The assemblages included in this seriation are those that received detailed ceramic analysis (see Chapter 9, Artifacts). Five of these assemblages derived from Area 2, in and around the millrace and reservoir complex: Excavation Units (EUs) 105, 108, 118, 137, and 206. Six were from units in Area 1, in and around the building interpreted as a granary: EUs 165 and 166 (which, due to low sample sizes, have been combined), as well as EUs 121, 135, 243, and 255. Two assemblages were recovered from units located in the between these areas, in the center of the study area (the South Midden): EUs 282 and 273. One assemblage was from EU 269 in the North Midden. It should be noted that the assemblage from EU 149 from the large refuse pit (Feature 14) was not included in the seriation due to its solid dating to the American period; inclusion of this assemblage would have made this analysis redundant for this feature and would potentially mask or overwhelm trends elsewhere.

Results of the Seriation

The results of correspondence analysis on the relative frequencies of nonnative wares from across the site show a pattern of separation of Area 1 and Area 2 excavation units (Figure 11.21). Area 2 units, represented in teal, tend to cluster with generally earlier Majolica, Mexican soft paste earthenwares, and Chinese porcelains. Area 1 units, on the other hand, represented in maroon in Figure 11.21, cluster with generally later wares including early British wares, British transitional wares, and American types. EUs 272 and 283 cluster with these Area 1 units while the North Midden EU 269 plots between the two areas. Note that the American wares are associated with several Area 1 assemblages, as expected from the incidental occurrence of these sherds due to the positioning of a large American-period feature (large refuse pit, Feature 14) in the western portion of the study area and intrusive to the Area 1 structure.

When the analysis includes both nonnative and Native American pottery sherds, a similar pattern is produced (Figure 11.22). Indeed, although the plot is reversed, the pattern holds, producing a distinct U-shape that is commonly generated by well-sorted deposits. This pattern suggests that Native American ceramics were more common in the early part of the occupation of this site. A simple seriation based on the relative frequency of the various types corroborates this pattern as well (Figure 11.23). Note the increase in British, American, and transitional wares relative to Native American ceramics and Chinese wares (with the exception of EU 165/166, which has one Chinese sherd).

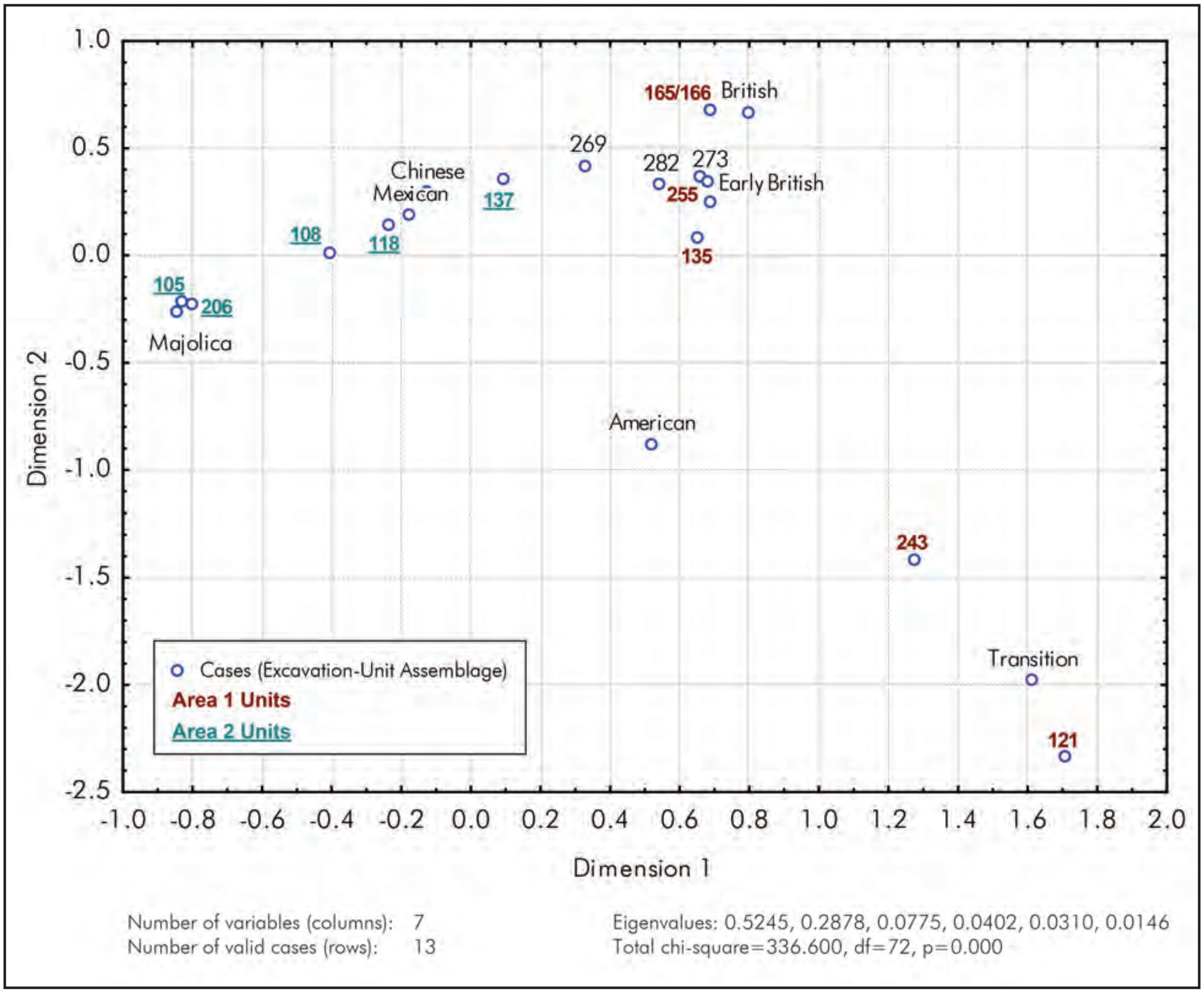

Figure 11.21. Correspondence analysis plot of imported ceramics.

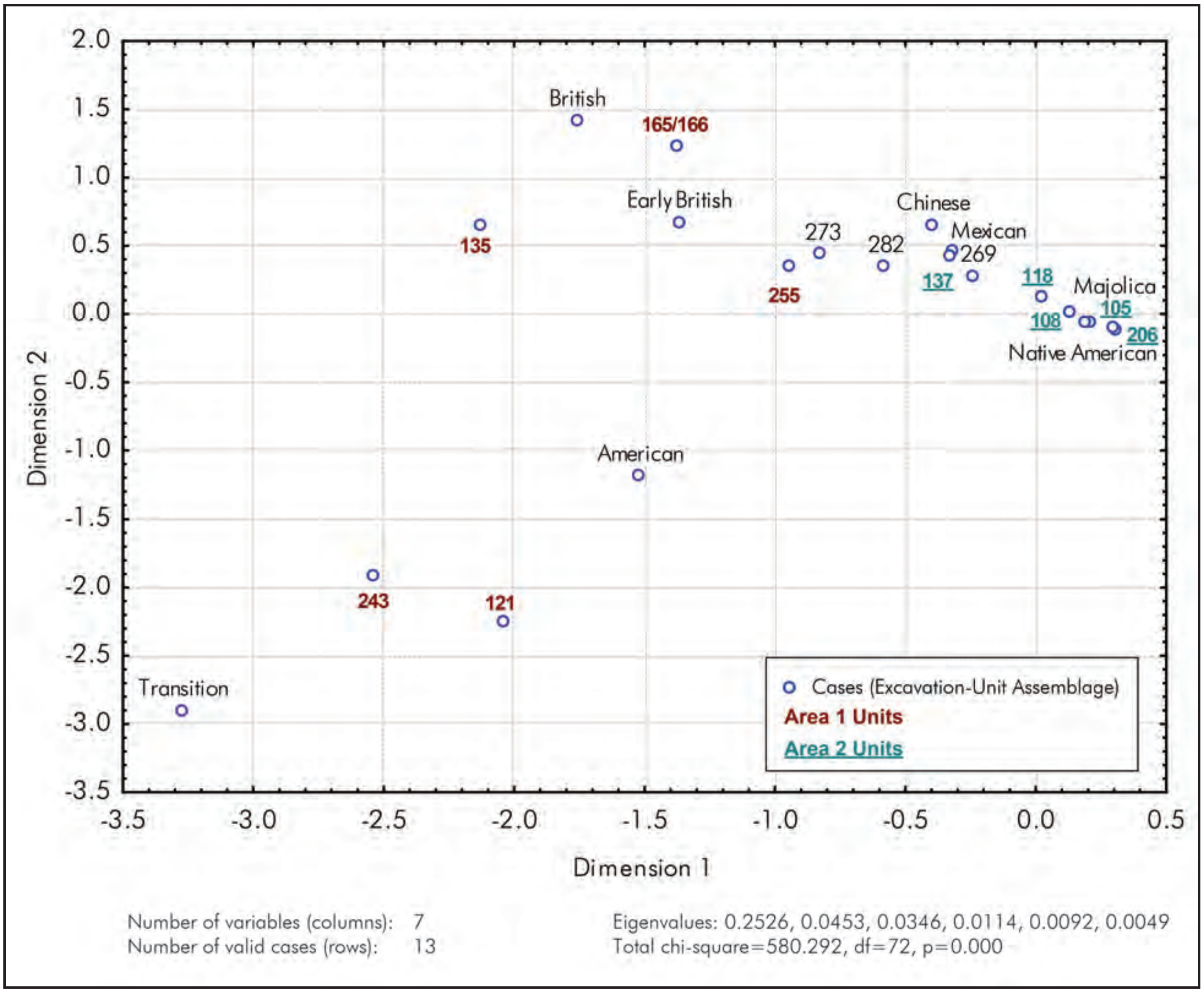

Figure 11.22. Correspondence analysis plot of Native American and imported ceramics.

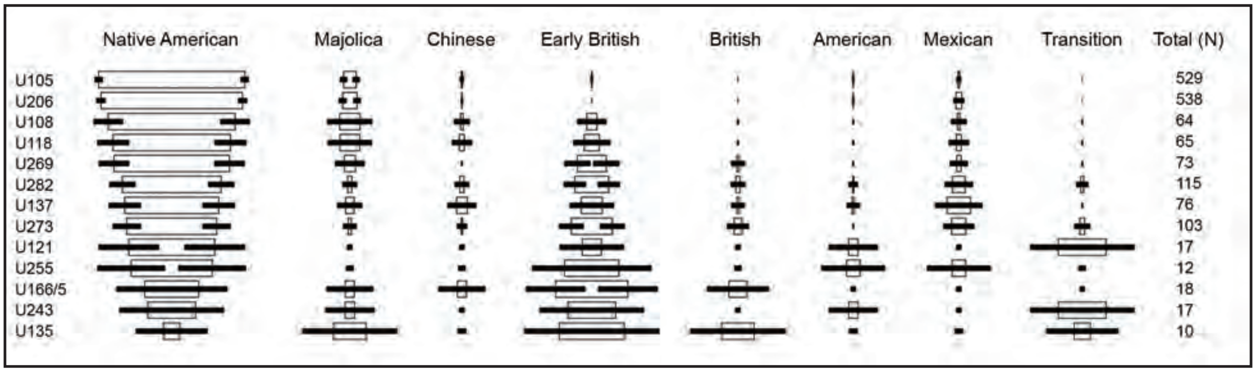

Figure 11.23. Seriation of excavation units based on the relative frequency of Native American pottery sherds (Column 1). The first four units are located in Area 2. The lower five units are located in Area 1. White bars illustrate percentages, black bars show confidence intervals for the error term.

These data suggest that the site is horizontally stratified. While Area 1 may overlap in time with Area 2, the analyzed contexts from Area 1 and the South Midden, as represented by EUs 273 and 282, appear to largely postdate Area 2 deposits. One plausible interpretation is that refuse deposition in Area 2 ceased or diminished after about 1823, when Chapman's Mill was built, but continued in Area 1. Thus, the features may be largely contemporaneous, but the sequence or length of deposition in association with them (or after them) may vary. Indeed, much of the fill deposition in Area 1 appears to postdate the Area 1 structure. The variation among Area 1 excavation units suggests multiple (at least two) periods of deposition, one deposition represented by EUs 255, 135, and 165/166, and a later deposition represented by EUs 121 and 243. EU 149, which is not included in this analysis, represents then a third depositional period in the western portion of the study area, dating solidly after 1860 (American period).

Although most Native American ceramics are associated with Area 2 (see Figure 11.14), they were not absent in the North Midden, the South Midden, or Area 1, and the various types pattern horizontally across the site in a manner similar to nonnative ceramics (Figure 11.24). Area 2 units are strongly associated with Mission San Gabriel Brown and California Desert Intermediate Brown Ware. Excavation units in Area 1, by contrast, contain a relatively high proportion of typical Southern California Brown Ware (i.e., not Mission San Gabriel Brown) and buff wares. Wheel-thrown sherds were most strongly associated with two adjacent excavation units in Area 1, EUs 165 and 166. If the differences noted across the study area are temporal, as suggested above, then typical Southern California Brown Ware, wheel-thrown ceramics, and buff wares may be relatively late introductions into the site and/or they may have persisted later than Mission San Gabriel Brown and California Desert Intermediate Brown wares.

Summary

Intriguing spatial patterning of artifacts is evident across the study area. Activity variation is evident in the distribution of broad artifact categories, particularly those related to food consumption and preparation, secondary deposition of glass and metal items, and the probable location of former structures based on the distribution of earthenware materials. In addition, the seriation of units based on ceramics suggests that the site is horizontally stratified, with Area 1 to the west dating later (or longer) than Area 2 to the east. This pattern holds for both Native American and nonnative ceramics.

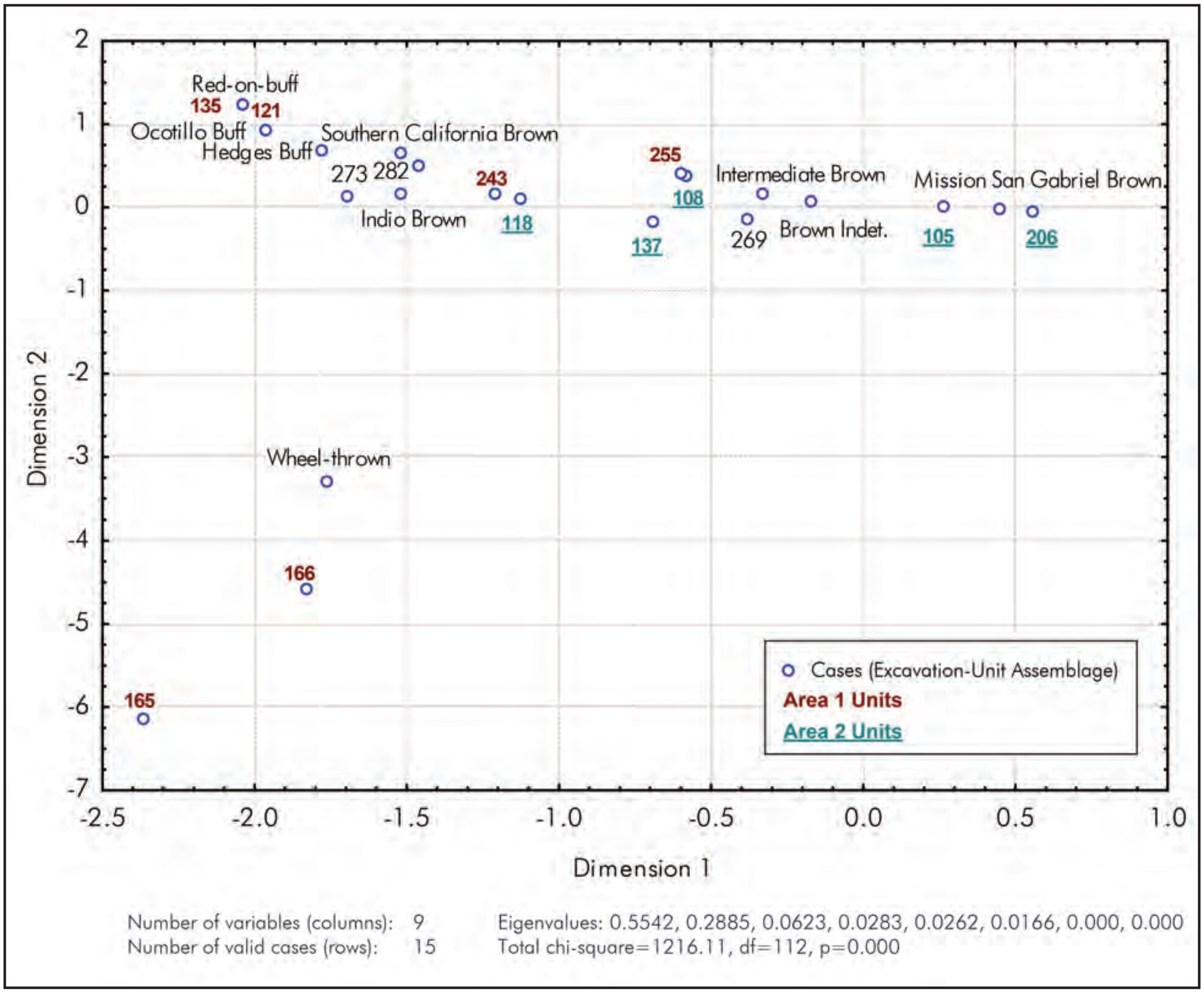

Figure 11.24. Correspondence analysis plot of Native American ceramics.

CHAPTER 12: SUMMARY AND CONCLUSIONS

John Dietler and James M. Potter

To achieve a full and nuanced understanding of the colonial past, a comprehensive approach relying on historical, anthropological, and archaeological analysis is crucial, for each adds dimensions and fills gaps left by the others (Deagan 1991; Leone and Potter 1988; Lightfoot 1995; Silliman 2004). Archaeology is of particular importance to this equation because it provides the means to study the materials left behind by people in pluralistic colonial communities who are poorly represented in written accounts. One of our main research goals in this study was to explore the daily lives and indigenous practices of Native Americans situated within the context of the agricultural economy of San Gabriel Mission. Our approach was necessarily multifaceted, and it consisted of researching in detail the historical context of the mission and its economic components (e.g., its cattle operation, gardens and vineyards, and mills), archaeologically recovering features of these components, and systematically recovering and analyzing a sample of Native American artifacts and ecofacts. In this way, our historical research and our excavations unveiled a unique view of the mission by juxtaposing indigenous practices and colonial worlds.

This chapter opens by summarizing the results of our work at San Gabriel Mission and specifically addressing questions posed in the research design (see Chapter 3). The emphasis is on the questions and hypotheses for which relevant data were recovered and thus may be addressed by the results of our investigations. The discussion then addresses the broader implications of the study, including San Gabriel Mission's place in the history of the region, and offers our views on where this work is situated within the larger scholarly world of mission archaeology.

Addressing the Research Design

Research questions for this study concerned site function; site chronology; Native American health, status, and ethnicity; engineering and architecture; environmental reconstruction; agriculture and industry; and the Secularization period. Data relevant to each of these subjects were recovered, although they were scant for the Secularization period (1834–1846). This section systematically addresses each topic and its specific questions.

Site Function

Previous research indicated that the portion of the San Gabriel Mission archaeological site in the study area contained the remains of structures with relatively clear, historically documented, Mission-period functions: Chapman's Mill and Millrace were used for processing grain, and the San Gabriel Mission garden wall enclosed a formal garden and orchard. It was anticipated, however, that additional features with less clear functions would be uncovered, and that post–Mission-period features would also be present.

During data recovery excavations in the study area, 45 features were encountered. Of these, 20 were structural and included components of Chapman's Mill and Millrace, the garden wall, and two small reservoirs associated with the mill and millrace. The remains of a large building—interpreted as a granary—were encountered and excavated in Area 1. The non-structural features were primarily middens, isolated refuse concentrations, posts and post holes, and ash features.

The function of most of these features was readily apparent from the construction, contents, and/or context of each. However, four structural features, two middens, and one refuse pit required data analysis or additional investigation to determine their functions. The results of these analyses varied.

Two of the structural features in question have been determined to be small reservoirs, one rectangular and one triangular (see Figures 6.4 and 6.8). The rectangular reservoir (Feature 21) was constructed prior to the construction of the triangular reservoir and Chapman's Mill and Millrace. Its original purpose was likely as a reservoir to store water for domestic, agricultural, and industrial uses. It was later incorporated into Chapman's Mill, at which point it was likely no longer used as a reservoir. A plastered interior and two *caños* (pipes) leading directly into the structure indicate that it was designed to hold water.

The complex consisting of Features 10, 12, 31, 39, and 1B was likely a triangular water reservoir. The plastered interior, associated spillway, and sloping floor were clear indications that the structure was designed to hold water. Construction sequence and stratigraphic relationships indicate that it was built and used prior to Chapman's Millrace. Our excavations demonstrated, however, that Chapman utilized the existing infrastructure to aid in the construction of his mill and millrace. He used the triangular reservoir as a foundation for the millrace and the rectangular reservoir as a foundation for the mill.

Feature 34, a portion of a wall foundation, was encountered north of Area 2 and the Union Pacific Railroad tracks. This feature was initially thought to be a small segment of wall, perhaps part of building that extended under the railroad tracks. However, the context of this segment was better revealed during subsequent construction monitoring beneath the tracks (to be reported in detail at a later date as part of a subsequent phase of work). A larger wall segment revealed during monitoring aligns perfectly with Feature 34, and was clearly a portion of the main enclosing wall of the mission garden. In the research design for the data recovery, we indicated the possibility that a section of wall exposed in earlier phases of archaeological fieldwork in Area 1 (now known as Features 3, 3A, and 44) represented the garden wall. This wall segment turned out to be the remnants of a large building, which is discussed next.

In Area 1, a complex of wall and floor segments (Features 3, 5, 9, 13, 22, 36, 44, and 45) suggest a large rectangular building, the function of which is unclear. There are some indications that this building was a granary because it approximates the dimensions of granaries listed in historical records (see Table 6.5) and the building is close to the mill and the fields where grain was grown. But botanical, feature, and artifact evidence of stored grains is lacking. The strongest argument for this building's function as a granary is that granaries were one of the most common building types on the mission grounds, and alternative interpretations are rather implausible. A similar argument has been applied to a building with similar dimensions and construction details at Santa Barbara Presidio, where a sparse artifact deposit and a strong documentary record support the interpretation of the building as a storage facility (Deetz 1964; Farrris 1997).

There are no artifact or feature data that support the interpretation that this building functioned as a dwelling, livery stable, chapel, jail, workshop, kitchen, hospital, mill, or other type of building. Moreover, Engelhardt (1927a:74–75, 93) describes eight granaries built on the San Gabriel Mission grounds between 1809 and 1821 (Table 6.5), indicating their abundance as a building type. It is possible that the building in Area 1 had multiple functions, for Engelhardt notes one granary built in 1804 had a weaving room, a carpentry shop, a pantry, a storeroom, and a priest's dwelling, and another, built in 1813, served as a temporary church following an earthquake. It is also possible that this structure was built as a granary but was never used as such, which would explain the lack of storage vessels, storage features, and botanical evidence of stored grains.

Feature 14 clearly served as a large and deep refuse pit, but the original function of the pit is unclear. The pit feature was dug during the American period, and it was presumably filled with refuse by people on the property or in the neighborhood. The pit was excavated through floor and between two external walls of the earlier Area 1 building. The lower strata of the pit fill contained little cultural refuse, so the initial reason for excavating the pit and therefore the original function of the feature is unknown. It is possible that it was initially a borrow pit associated with the construction of the Southern Pacific Railroad in 1874 and was used later as a refuse pit. Mechanical trenching revealed a large area of similarly excavated and disturbed sediments just east of this feature, without in-filled refuse, which we interpreted as a large borrow pit.

A large midden was identified across the central portion of the study area. For the sake of analysis, the midden area was divided by the railroad tracks and designated the North Midden and the South Midden. The precise areal extent of this deposit is unknown because it extends beyond the study area to the north and south. Based on the results of the current study as well as those of previous studies (see Chapter 2), it is clear that the midden extends more than 1,300 feet (400 m) east–west and 330 feet (100 m) north–south. This study's excavations documented the midden's contents, including high densities of artifacts and ecofacts. EUs (EUs) 118 and 273 in the South Midden contained relatively high proportions of Native American ceramics, cattle and sheep remains, and shell beads. Deposits in EU 269 in the North Midden also contained numerous *tejas* (roof tiles) and cattle and sheep remains (see Chapter 11). The North Midden also contained plant remains in EU 291 (see Appendix C) that may be considered Native American in origin, including charred pine nuts, corn cupule and kernel fragments, and uncharred tobacco seeds.

The site as a whole served a multitude of functions, some of which overlapped. The entire study area is within the mission garden area, and this is evident in the botanical remains recovered (see Chapter 7), but other activities are evident as well, including grinding and likely storing grain, controlling and storing water, disposing of refuse, and the butchering and processing of animals, primarily cattle, for food.

Artifact and ecofact concentrations indicate that an area immediately north and east of the millrace and triangular reservoir, within Area 2, represents primary refuse of Native American origin, particularly evidence of food preparation, consumption, and disposal. Both Native American ceramics and heavily processed faunal remains, as well as discrete deposits of ash and charcoal, were relatively abundant in EUs 105, 106, 184, 203, 206, 224, and 225 (see Figure 11.2 and 11.14). Also present in relatively high quantities in this area were shell beads (see Figure 11.17). The co-occurrence and concentration of these artifacts and ecofacts indicate the deposition of these items in the study area by Native Americans, and suggest that these units represent the primary deposition of these items (i.e., they were relatively intact primary deposits). One cannot definitively state, however, that residential use is evident based on the data recovery results alone, since no clearly domestic contexts (e.g., structures or living surfaces) were encountered during this phase of research.

Additional concentrations of artifacts are present across the site. In addition to the primary deposition of ceramics, fauna, and shell beads in the North and South Middens and in the area just north and east of the reservoir complex, secondary deposition of glass and metal artifacts occurred in Area 1, west of the large rectangular building, within Feature 14, and in the southern portion of Area 2, within the rectangular reservoir. Most of these items were deposited late in the history of the site in pits or trenches left open from previous (historical) excavations. No discrete activity areas were identified in the study area. This may be the result of the sheer quantity of artifacts and ecofacts deposited in the area during the Mission period and the level of post-depositional disturbance at the site from stream channeling, construction, rodents, and excavation.

In summary, although this portion of the San Gabriel Mission complex did not have a single, fixed purpose over time, the study area contained evidence of a variety of activities related to industry, habitation, transportation, and agriculture. The study area also contained evidence of post–Mission-period activities associated with the Southern Pacific Railroad. In addition to features, changing artifact densities across the site indicated the locations where these activities took place. Evidence for use of the area by Native Americans was present in the form of dense concentrations of food remains, shell beads, and Mission ware pottery.

Site Chronology

Prior to excavation, research at the San Gabriel Mission archaeological site (Ramirez et al. 2009; Dietler et al. 2010) had demonstrated that the site has substantial components from the Mission period (1769–1834) and the American period (1847–present). Aside from the historically documented construction date for Chapman's Mill (completed around 1825), research in the study area prior to the data recovery had revealed few discrete, datable deposits within these general time periods. It also remained unclear whether there were discernable, discrete components in the study area that dated to the Initial Contact period (1542–1769) or the Secularization period (1834–1847).

The current study provides a tremendous amount of chronological data. Nearly all of the recovered artifacts are temporally diagnostic, and can be assigned a specific date range. Most of these, however, were manufactured and used for time spans that are longer than the narrow periods defined above, limiting their utility in establishing a detailed site history. Historical records tell us that San Gabriel Mission functioned as an active mission community in this location from 1775 to 1834, a period of just 59 years. Majolica ceramics, one of the more common imported pottery types found at the mission, were used throughout the Mission period, eliminating their utility as chronological markers within the period. Significant exceptions to this generalization are artifacts that have date ranges of a half-century or less. Aside from the occasional coin or military uniform part, no artifact class is more useful in this regard than Native American-made olivella shell beads. Thanks to the detailed chronologies produced by King (1990) and others, certain olivella bead classes can be dated to narrow pre-Mission, Mission, and post-Mission periods.

Initial Contact Period

There is little clear evidence for site use in this area during the Initial Contact period, including the Gabrielino communities of Shevaanga or Toviscanga. No distinct deposits or features containing Native American artifacts and native food remains, and lacking imported metal and ceramic artifacts, have been identified. However, 12 Class E1a and E1b olivella beads, which are associated with the Initial Contact period (defined elsewhere as Late period 2a and 2b, 1500–1750 [Bennyhoff and Hughes 1981; Milliken and Schwitalla 2012) and two Class K1 olivella beads, which appear prior to contact (during what is defined as the Late period, 1150–1750 [Bennyhoff and Hughes 1981; Milliken and Schwitalla 2012]) and may have been curated items, were recovered. In contrast to the types discussed below, these were found scattered broadly across the site—in Area 1, Area 2, and the South Midden. Flaked stone artifacts were also scattered across the study area (see Figure 11.19). It may be that these artifacts represent the remnants of an ephemeral pre–Mission-period occupation, now intermixed with Mission-period and later materials due to the intensive use that the area experienced in subsequent periods. An alternate possibility is that these beads were kept in circulation and curated long after they were manufactured, entering the archaeological record decades later by being discarded in Mission-period deposits.

Mission Period

San Gabriel Mission was established in its second, and current location in 1775. San Gabriel Mission's formal *huerta* (garden and orchard), known as “Bishop’s Garden,” was established sometime before 1783. The second mission’s earliest buildings were made of wooden palisades and adobe, and roofed with earth (Engelhardt 1927a; Geiger 1968; see Table 6.5). Scholars have hypothesized that when older mission buildings were replaced, the new constructions were placed in the same location as the originals, repeating the initial pattern (Geiger 1968:40). If this hypothesis is correct, and if structural remains survived this continual rebuilding process, then it is likely that the mission’s earliest archaeological deposits at this location would be found near the current mission quadrangle and chapel. Nevertheless, artifacts dating to the early Mission period (1770–1810) have been recovered, including 17 Class H1a olivella beads, all but three of which were found in Area 2.

Artifacts from the late Mission period (1790–1816) include 15 Class H1b olivella beads; all but two of these were also found in Area 2. An 1816 Spanish real coin found in Feature 14 in Area 1 is thought to be incidental to this much later refuse pit feature, and not indicative of the feature’s age. The earliest architectural feature identified in the study may be the large building foundation in Area 1. If the structure was a granary, then it may date to 1812 or 1813, as it most closely resembles the dimensions of the granary described by Engelhardt (1927a) built in these years (see Table 6.5). At some point, the garden enclosure was made even more substantial through the construction of an adobe wall atop a stone foundation, as exemplified by Feature 34. The garden, orchard, and 340 acres of crops were enclosed by a wall and cactus hedge, in various segments.

Many of the site’s major features and several significant artifacts date to the terminal Mission period (1816–1834). These include 36 Class H2 olivella beads, all of which were found in Area 2 or the South Midden. A single phoenix button dating to the 1820s was also recovered from Area 2. The garden was enclosed by a prickly pear hedge in 1809, and by a wooden fence by 1830.

Our excavations demonstrated that the triangular and rectangular reservoirs in Area 2 were constructed and used prior to the construction of Chapman’s Mill and Millrace. The reservoirs may have been built during the tremendous burst of building activity that followed the completion of the great stone church in 1805. Under the energetic Father José María de Zalvidea, this building program added at least 26 structures to the mission between 1807 and 1825, including several constructions focused on the harnessing of water for industrial and agricultural uses. A water basin and two drainage sewers were constructed in 1817, and these may include the water features documented in this study (Table 6.5). The construction of these reservoirs, and their continual remodeling, marks the intensification of water-control efforts in this area.

According to historical documents, Chapman began construction of his mill at San Gabriel Mission in late 1821 or 1822, and it was completed in either 1823 or 1825 (see Bancroft 1886; Engelhardt 1927a; Hoover 1992). One possible scenario is that Zalvidea’s workers began the construction of a replacement mill for the flawed El Molino Viejo in 1820 and Chapman took over the project mid-construction in 1821 or 1822, completing his work in 1825. Chapman’s Mill may have been completed in some form by 1823, found to need some redesign once it was up and running, and then re-opened in 1825. The scenario accords well with our recovered archaeological evidence that indicates a mid-construction remodel on the eastern wall of the wheel pit. As originally constructed, the millrace was not aligned perfectly with the mill, but rather was canted slightly to the west. This may have created a splashing problem, as the water was forced to change direction as it increased in speed down the sluiceway. Perhaps to correct this problem and prevent overspill—which was of course the fatal flaw of the mission’s earlier gristmill—the wall (Feature 20) was modified. Both sections of this feature (Features 20A and 20B) exhibited evidence of adjustments to their construction. In the case of Feature 20B, an additional segment of wall was added to narrow the wheel pit (see Figure 6.15).

Chapman's Mill was one of the last major development projects at San Gabriel Mission; no building construction is recorded after 1825 (Geiger 1968). The decline in investment may be attributable to the Mexican government's desire to limit its financial obligations to the California missions in the wake of its costly, decade-long war against Spain.

Secularization Period

The Mexican government's efforts to divest itself of mission oversight were fully realized with secularization, which led to the mission being sold into private hands in 1834 (Engelhardt 1927a:174–176). Artifact deposition diminished in this period, reflecting a community in decline. Eight olivella Class H3 beads, which date to the post–Mission period (1834–1900) were recovered from Area 2. While pottery types dating to the Mission period were relatively abundant, types dating to the subsequent period were much fewer. Some Transitional British wares were recovered that date to the early American period (1840–1860), but these were relatively few in number and found primarily in Area 1.

Indeed, the seriation conducted on pottery from the study area indicates that deposition began earlier in Area 2 and continued later in Area 1, although there was substantial chronological overlap. Much of the fill deposition in Area 1 postdates the large rectangular building, and variation among Area 1 excavation units suggests at least two periods of deposition, one represented by EUs 255, 135, and 165/166, and a later period of deposition represented by EUs 121 and 243 (see Figure 11.22) that may extend into the Secularization period.

American Period

In 1847, the California Battalion was billeted at San Gabriel Mission, where Frémont sent them following the signing of the Treaty of Cahuenga. When he signed the treaty, Frémont claimed to have some 400 mounted riflemen, and this claim suggests an approximate number of troops stationed at the mission as of January 1847. Archaeological evidence of the presence of these troops was recovered in the study area in the form of an 1845 United States militia waist belt plate found in the northern portion of the Area 1 structure. Several Prosser beads and buttons, which postdate 1840, were recovered from the southern portion of Area 2 and in Feature 14, respectively.

The Southern Pacific Railroad was built in 1874, including a narrow trench that crossed the study area and bisected the millrace. Numerous pieces of railroad hardware, including steel spikes and strike plates that are difficult to date precisely, were recovered during the excavation. A single ironstone plate rim fragment from a Southern Pacific Railroad Harriman Blue patterned vessel, which postdates 1906, was recovered in Area 2 in a disturbed context. An 1884 photograph of the railroad cutting through the millrace (see Figure 2.9) shows a wooden shack standing just northeast of the study area, attesting to late nineteenth century use of the area. During Phase II testing, we recovered numerous late-nineteenth-century hand tools in this area. There is no archaeological evidence of any substantial post-1847 use of the study area until Feature 14 was dug and filled in the 1890s. Regardless of why Feature 14 was originally dug and who dug it, the pit was eventually filled with 1890s domestic refuse, presumably from nearby residents. The next substantive activity in the study area, aside from continued use and upkeep of the rail line, was Marshall and Webb's excavations of Chapman's Mill in 1934. Evidence for this work was recovered in the southern portion of Area 2 in the form of glass bottles and other trash, apparently discarded into their open trenches sometime after their excavations (see Figure 2.12). In 1941, a housing subdivision was built immediately south of the project area that caused further impacts to its archaeological features. The construction of Main Street removed all but the lowest foundations of Chapman's Mill and truncated the southern end of the Area 1 building foundation. Ongoing improvements to the railroad right-of-way evidently widened the trough in which the tracks sit, removing and displacing additional elements of the millrace over the years.

Native American Health, Status, and Ethnicity

Historical records such as the baptism, marriage, and burial records kept by mission priests (Hackel 2003; Huntington Library 2006), indicate that a diverse array of native ethnicities coexisted at San Gabriel Mission during its active years. Additionally, recent research has highlighted the process by which this coexistence led to the generation of new social identities in mission settings (e.g., Ginn 2009; Voss 2008). Mission facilities such as gristmills and formal gardens, although designed and managed by Hispanic people, were typically constructed and operated by Native Americans. The archaeological record of the study area, therefore, represents the intersection of indigenous practices and European engineering and design. The primary evidence of these practices survives in the form of artifacts and ecofacts, but these are not well contextualized other than their loose associations with Euro-American features. Shell and glass beads, Mission ware pottery, flaked and ground stone tools and debris, bones from butchered wild and domesticated animals, and the remains from cultivated and gathered plants all were used or consumed and deposited by Native Americans. No features were encountered during the data recovery that may be assigned exclusively to Native American use, such as houses, hearths, or storage pits. No human burials or identifiable funerary objects were recovered. This limits our ability to directly analyze the health, status, or ethnicity of Native Americans in the study area. We are able to speak in general terms, however, about some of the ways that Native American material culture and practices may have transformed in the Mission setting based on the occurrence and distribution of certain classes of artifact and ecofacts. Food remains can be analyzed to understand dietary health, while objects with known points of origin or cultural affiliations can be used to address questions of identity and ethnicity.

As discussed above, the South Midden (EUs 118, 273, and 282; see Figure 4.4 and 4.5) and the excavation units flanking the reservoir complex to the immediate north and east contain relatively high amounts of Mission brown ware, faunal remains, and shell beads. These remains are presumed to have been used, processed, consumed, and deposited by Native Americans at or near the location that they were recovered. In other words, they are considered primary deposition Native American refuse. These artifacts and ecofacts were not, however, directly associated with clearly identified Native American contexts, such as residential features. Nevertheless, in contrast to imported materials recovered from the diffuse sheet midden which could have been used by any subset of the mission community, these particular classes of artifacts almost certainly represents Native American use and manufacture.

Two-thirds of the Native American pottery assemblage was classified as a newly identified, locally-made type, Mission San Gabriel Brown. This type was hand-built using a variety of techniques with local silty clays containing varying amounts of naturally occurring sub-rounded non-plastics and possibly chaff and undoubtedly represents a type made and used by Native Americans. Native American brown ware sherds, and in particular Mission San Gabriel Brown, were most abundant in the excavation units just north and east of the reservoir complex in Area 2. Based on reconstructed vessel data, the Native American pottery assemblage consisted mostly of bowls and appears to have been related primarily to serving and cooking functions (see Table 10.10).

Faunal remains were extremely abundant in this concentrated portion of the site, and primarily consist of cattle, and to a lesser extent sheep (see Figure 8.4). The cattle bones were mostly meaty elements (ribs and long bones) that had been heavily processed and fragmented from butchering, preparation, and consumption as food. Also present in this area in relatively high numbers were deer elements (see Figure 8.5), further supporting the interpretation that these deposits represent a Native American context. Units excavated in the South Midden (EUs 118, 273, and 282) also contain high proportions of cattle and deer and thus may also have derived primarily from Native American processing, consumption, and discard (see Figures 8.4 and 8.5).

Shell beads, a hallmark of Native American trade and adornment, were also relatively common in excavation units just north and east of the reservoir complex in Area 2 and in the South Midden (see Figure 11.17). The strong association of heavily processed meat-rich cattle bone with Native American ceramics and shell beads indicates that cattle were likely processed and deposited by Native Americans. The cattle assemblage in the study area is dominated by rib fragments, suggesting that the primary goal of cattle butchering was for procurement of meat for food rather than extraction of tallow and hides through *matanza* events, as is evidenced at San Fernando Mission. Sheep and dogs, the two other common domesticated animals represented in the assemblage, are more evenly represented by other body parts, including the feet, vertebrae, scapulae, skull, and mandible bones. This suggests that Native Americans at the site had access to relatively high quality and abundant food sources and probably had a relatively healthful diet.

The cattle assemblage is also unique in the sample in the degree to which it was processed. Evidence of fragmentation and burning is far more prevalent in cattle bones than it is in bones of other large and medium-sized mammals such as sheep and dog. Most of the burning on cattle bones occurred on long bone fragments. These elements were highly fragmented and thus not identifiable to a particular long bone, and they appear to have been targeted for intensive processing for marrow extraction, a common Native American practice. Chop and cut marks appear primarily on limb and rib bones, and are generally the result of meat removal.

Botanical data from the site indicate that Native Americans used a wider array of plants than animals. Fifty plant taxa (identified to at least the level of family) were recovered as macrobotanical remains from the site. The macrobotanical assemblage from excavation units just north and east of the reservoir complex in Area 2 (as represented by Column Unit [CU] 145) contain cheno-am seeds, pine nuts, elderberry, tobacco seeds, corn, and charred cereal caryopses (wheat, oat, barley, or rye). A large variety of hardwood charcoals is also present in the assemblage. The assemblage indicates that a diverse array of wild and domesticated plant foods were consumed by Native Americans at the San Gabriel Mission archaeological site.

Contrary to expectations, the site-wide plant assemblage, including CU 145, primarily reflects Native American food consumption rather than food storage, grain processing, or the growing of plants in a garden, although these activities are certainly evident. Despite the intense production of wheat at San Gabriel Mission, corn appears to have made up a larger proportion of the diet of mission occupants. This is in contrast to at least two other missions, San Fernando Mission and Santa Cruz Mission, where wheat apparently dominated the diets of the occupants. Moreover, it appears that Native Americans at San Gabriel Mission were relatively free to collect or trade for plant foods (e.g., pine nuts) far from the mission grounds. The diverse array of plant foods consumed by Native Americans suggests a relatively healthy diet, assuming there was enough available to eat. Together, the faunal and botanical data indicate that Native American diet was dominated by domesticated species, particularly cattle and corn, but was supplemented by native foods, including pine nuts and deer.

The presence of shell beads in the assemblage suggest that some of the Native Americans at the mission participated in economic transactions outside of the mission's rationing system, as shell beads were known to have monetary value. Although the local manufacture of shell beads cannot be ruled out, in the absence of evidence for bead making at the mission, we presume that the shell beads were acquired through trade. Other imported Native American goods and raw materials were rare. In contrast, only 3% of identified Native American ceramics were imports from the deserts of California (California Intermediate Desert Brown or Lower Colorado Buff); the remainder were locally produced. The few imported Native American ceramics may be explained, in part, by the fact that pottery is bulky and fragile, and does not travel well.

The few projectile points we recovered were Cottonwood Triangular and Desert Side Notched points (see Table 9.16). Cottonwood Triangular points are distributed widely throughout most areas of the Southwest, Great Basin, California, and Mexico (Justice 2002:372). Thus, their presence at San Gabriel Mission does not speak to ethnic group origins per se. Desert Side Notched points, in contrast, are most common in the Mojave and Colorado desert regions to the east (Justice 2002:387). The projectile point data is therefore consistent with the ceramic data and indicates strong local Native American group representation in the mission community, as well as some evidence for the presence of or commerce with groups from the desert regions to the east. The relatively common occurrence of pine nuts in the archaeobotanical record of the study area further supports the San Gabriel community's connections with eastern peoples, such as the Serrano and Cahuilla.

Although relatively uncommon in the assemblage, the presence of traditional California lithic artifacts, including flaked and ground stone items (see Chapter 10), demonstrates that native stone technologies were not abandoned after the introduction of Spanish colonial tool forms and technologies at the mission. Although there was a regional transition from handheld stone tools to metal implements and mechanized grinding facilities—mills—it is clear that all of these technologies were used during the Mission period simultaneously. The persistence of native California stone tool forms such as simple flake cutting tools, arrowheads, and grinding stones may reflect limited access by Native Americans to metal implements, either due to their limited supply or greater expense, or due to intentional restrictions on their distribution by mission administrators. While there was certainly a shift over time at San Gabriel Mission from complete reliance on hand grinding to the mass processing of grain in water-powered mills, it is very likely that these technologies were used concurrently. Based on historical information that is bolstered by the archaeological evidence presented in previous chapters, we know that after 1816 much of the wheat, corn, and barley crop was ground into flour at the mission gristmills. These facilities may not have been accessible to individual community members for their personal use, however. Meal preparation in San Gabriel Mission's Native American households apparently included the processing of locally gathered plant and animal foods using traditional stone implements. The residue studies conducted for this project indicate that these items were used to process wild gathered cattails, grasshopper, yucca, and fish, in addition to domesticated corn and wheat. The choice to continue use of these technologies may not have been simply due to a lack of better options, however. As Silliman (2004:102) suggests, this persistence of traditional technologies may represent an affirmative preference for such tools among Native Americans, as well as a political, social, or cultural statement about identity, including gender.

In summary, Native Americans living near San Gabriel Mission were well supplied with domesticated animal food, particularly beef. Because San Gabriel Mission controlled an immense cattle empire that was valued for the hides and tallow rather than the meat it produced, it appears that few restrictions were placed on the distribution of beef to Native Americans. Because of the easy access to beef, Native American use of native animal foods to supplement their diet was minimal. Native American access to nonnative plant foods (e.g., corn and wheat) was more limited and was therefore supplemented with greater quantities of native plant foods, including pine nuts.

With respect to clearly Native American-produced artifacts and food items, the archaeological record indicates a material record that was predominantly locally generated. In some ways, the assemblage is less diverse than might be expected from the multicultural Native American population documented in historical records. This may be a reflection of the missionaries' strong ethos of hard work and self-reliance, where local manufacture of basic goods was encouraged, while dependence on imports was frowned upon. It may also reflect an affirmative persistence of traditional technologies on the part of the mission's Native American members, in spite of recently imported alternatives.

Engineering and Architecture

As a multicultural frontier community, San Gabriel Mission was built using a mixture of architectural styles. Europeans and Euro-Americans with a variety of backgrounds designed and directed the construction of buildings and other architectural features at the mission, while the labor force was primarily Native American (Engelhardt 1927a). Each of these cultures influenced the final design of the mission's built environment.

The current mission church evokes both Spanish and Moorish influences. The wall around the garden, as exemplified by Feature 34 in the study area, exhibits similarities to garden walls at other Spanish missions, such as San Buenaventura Mission (Williams 2007:57), San Antonio de Padua Mission (Bertrando 1997), and San Fernando Rey de España Mission (Hamilton and Warren 2006). The wall was constructed of adobe bricks atop a foundation of cobblestones, which was of core-and-veneer construction (see Figure 6.23). Larger cobblestones composed the exterior of the wall and smaller cobbles filled the space between the exterior walls. One of the distinctive features of these wall foundations at San Gabriel Mission is their uppermost layer shaped siltstone. These capstones seem to be the upper portion of the cobble footings that would have been in contact with adobe bricks. The adobes were then likely capped by tejas (Williams 2007:57). The excavated portion of the wall (Feature 34) was 4.9 feet (1.5 m) in width. The core-and-veneer design, which required rather thick walls, was a tradition from New Spain, signaling the influence of artisans from Mexico.

Features 3 and 5, both of which comprised foundation remnants of the large structure in Area 1, were similar in construction to Feature 34, but represent a more formal core-and-veneer design. Feature 3 was part of the eastern foundation of the structure and was constructed of rounded cobbles and packed earth lined with siltstone along the interior and exterior edges at the top (see Figure 6.18). Feature 5 was the foundation of the west wall of the structure and was also constructed of rounded cobbles and packed earth lined with siltstone capstones along the interior and exterior edges at the top. These foundations, and by extension the walls of the structure, were slightly over 1 meter (3.3 feet) thick. Unlike the garden wall, these structure walls would not have been directly capped by tejas, but would have instead supported a roof, possibly composed of reeds waterproofed with asphaltum.

The large structure in Area 1 (hypothesized to be a granary) was long and thin, presumably due to the limitations set by timber length. Wider buildings are rare in the Mission period, and exceptions to this, such as the San Gabriel Mission church, completed in 1805, and the Los Angeles Plaza church, completed in 1822, required substantial efforts to transport adequate timber from the San Gabriel Mountains (Owen 1960).

In addition to Spanish styles, American Joseph Chapman built several structures in the study area that were of Euro-American design. The mission's first mill, El Molino Viejo, was constructed using a Hispanic floor plan and architectural details, including a brick-and-tile construction, and an internal, horizontal millwheel (Figure 12.1). This second gristmill at San Gabriel Mission was explicitly designed to resemble the New England–style mill constructed under Chapman's direction at Santa Inés Mission (Webb 1952:82, 155). In September 1821, Chapman was ordered to San Gabriel Mission to construct a similar mill (Bancroft 1886:568). Distinctive New England design elements incorporated into the mill included an external, vertical wheel; bevel gearing that converted vertical to horizontal motion; and adjustable millstone separation, which allowed for processing various sizes of grains (e.g., wheat and corn; Figure 12.2). Importantly, this particular design kept water and grain separate, circumventing a flaw of El Molino Viejo.

As at Mission Santa Inés, Chapman used existing waterworks to build his San Gabriel Mission mill, including the *zanja* (ditch) system and two small reservoirs encountered in the study area. The improvements to the water system at San Gabriel Mission went well beyond the construction of the mill itself. With the installation of dams at Mission

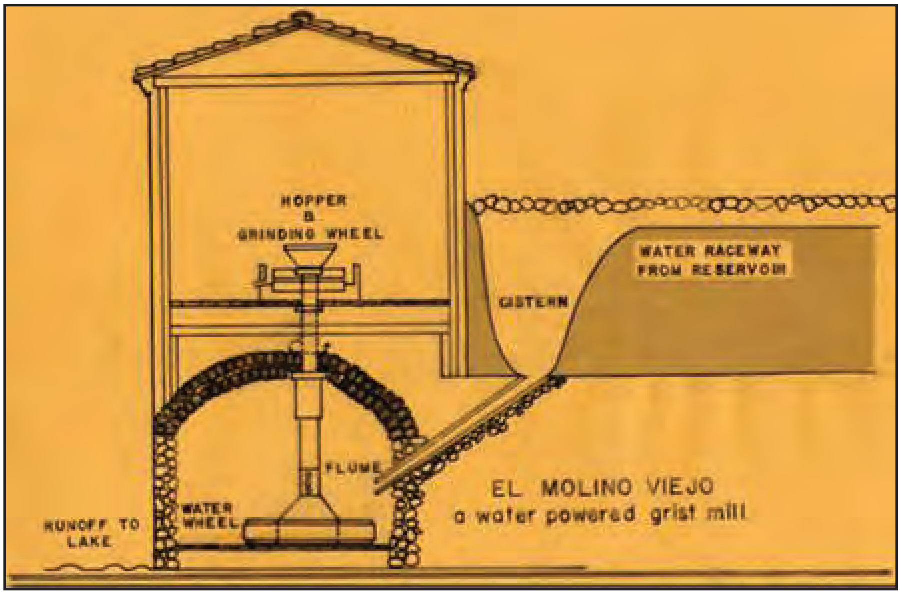

Figure 12.1. El Molino Viejo, built in the Spanish style. Image courtesy of the Old Mill Foundation.

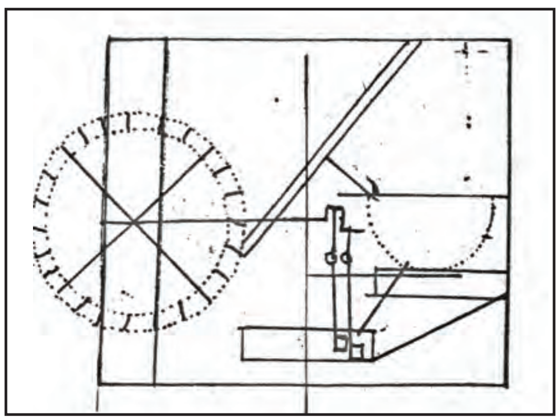

Figure 12.2. Joseph Chapman's design for a New England-style mill. Image courtesy of Santa Bárbara Mission Archive-Library.

Canyon and at La Presa, strong flows of water from the northwest and northeast were joined together into a single waterway just west of the mission quadrangles. From here, Chapman needed to direct the water sharply to the left across and then parallel to El Camino Real (today represented by a paved walkway that parallels the southern façade of the mission church), then sharply right through the garden wall, and finally straight into the mill's wheel pit. Forcing a large volume of water through an S-curve over a distance of just over 200 feet (60 m) required more than an earthen or tile-lined ditch, which would have been quickly overtopped. To solve this engineering challenge, Chapman installed a massive masonry flume, or millrace. Additional millrace segments, discovered after the study reported here, indicate that the millrace widened substantially to the north. This broad segment likely functioned as a millpond/reservoir, replacing the triangular reservoir/millpond that Chapman took out of service with the construction of his new mill.

In contrast to the Spanish-style walls evident in the study area, both the mill and millrace were constructed of various-sized cobbles held together with mortar tempered with tile fragments. The upper part of the west wall of the millrace (Feature 1A) was constructed of stacked ladrillos and mortar. The millrace channel was covered with a smooth plaster finish. Despite the strong American influence, the dimensions of the mill and its constituent elements reveal its Hispanic heritage. The millrace width at its southern terminus is precisely 1 *vara* (Spanish yard), while its western wall (Feature 1A) measures 2 *pies* (Spanish feet). These dimensions suggest that although Chapman used an American design for his mill, he used a Spanish measuring device to build it.

In addition to Spanish, Mexican, and Euro-American influences on the design and engineering of features and buildings in the study area, Native American influence can be seen as well. Native Americans were the primary source of labor, and Native American–made artifacts are direct evidence of a Native American presence in the study area (see above, Native American Health, Status, and Ethnicity). Native Americans have a long history of shaping and using milling stones to process food, and the millstones used in Chapman's Mill were likely a continuation of the native milling tradition (Figures 12.3 and 12.4). The millstones for Chapman's mill were reportedly made from gray granite from the mouth of Santa Anita Canyon and "laboriously pecked into shape by the Indians" (Reid 1895:52). The millstone fragment recovered during this study is made of sandstone rather than granite, but the techniques used to shape it do not differ substantially from those used for thousands of years by Native Californians to shape grinding stones.

In summary, the built environment at the San Gabriel Mission achaeological site reflects a multicultural landscape. The building in Area 1 and the wall around the mission garden are of utilitarian construction and represent basic Spanish design and the use of locally available materials. Chapman's Mill and Millrace were of Euro-American design, were much more substantially engineered and designed, and included the use of mortar and the incorporation of earlier built elements, such as the reservoirs, into the final product. The New England style of the mill contrasted with the earlier El Molino Viejo in its use of an external, vertical wheel, bevel gearing that converted vertical to horizontal motion, and an adjustable millstone, which allowed for the processing of both wheat and corn. The mill also incorporated Native American–made millstones.

Environmental Reconstruction

The placement of each of the missions on the California landscape was carefully considered by the mission padres, and each had a specific purpose. San Gabriel Mission was the fourth mission to be built and was intended to provide agricultural products to the region. Fathers Pedro Benito Cambón and Josef Angel Fernandez de la Somera established the first mission site on the banks of the Rio de los Temblores, near the confluence of what are now called Rio Hondo and the San Gabriel River (Engelhardt 1927a:4). Because that mission site (known as La Misión Vieja) flooded frequently, or perhaps due to insufficient agricultural yields, the mission was moved 5 miles northwest.

Prior to the establishment of San Gabriel Mission in this location, the study area was heavily vegetated and well-watered. The nearest water sources include the now-channelized Alhambra and Rubio Washes. These water sources provided seasonal water, fertile soil, and associated riparian plants and animals that would have been attractive to settlers in the past. During the Mission period, water was brought to the mission year-round from springs along the Raymond Fault's topographic break by a system of simple earthen zanjas.

When the mission was established in this location in 1775, the padres described a nearby oak grove from which timber could be harvested, as well as a great plain of moderate-quality soil that could be made fruitful through the use of an irrigation ditch (Hackel 2003:648). In 1852, Hugo Reid (1978:263–264) described the area's condition before the mission was developed as a forest of

Figure 12.3. Millstones at San Gabriel, ca. 1934. Image courtesy of Santa Bárbara Mission Archive-Library.

oaks, sycamores, cottonwood, and other trees, watered by a meandering stream, and with considerable underwood and rich black soil.

The pollen record recovered as a result of SWCA's excavations indicates potential differences in the local plant regime since the Mission period. Trees in the area, for example, appear to be more numerous today than they were at that time. Alder, birch, eucalyptus, chestnut, hickory, gum, and elm trees have been added recently or were only present in small numbers 200 years ago (see Appendix C). Puseman et al. (2012:65) suggest that either the area did not contain many trees when the mission was built, or the trees that were present were cut down to make way for the mission buildings and grounds. Another possibility is that the pollen record is not representative of the density or variety of trees growing in and around the study area at that time.

The charcoal record recovered by SWCA may better represent the wooded environment during the Mission period. This record is dominated by oak, including members of the white oak, live oak, and red oak groups (Appendix C: Figure 10), which archaeologically corroborates the historical description provided by Reid above. In addition, ash, birch, buckthorn, laurel, sycamore, cone-bearing, elm, maple, and willow or cottonwood trees are represented in the analyzed charcoal samples (see Table 7.2). This pattern accords more closely to the scene described by Reid than does the pollen record.

Figure 12.4. Native American milling equipment, Mission San Gabriel, ca. 1908. Courtesy of the University of Southern California, on behalf of USC Libraries.

There is photographic and archaeological evidence that the local area around the mission supported wetlands. Figure 12.5, for example, shows a large marshy area adjacent to the mission church. The presence of cattail (*Typha* sp.) and reed grass (*Phragmites* sp.) pollen in the archaeological assemblage recovered from the study area lends support for the presence of a marshy local environment during the Mission period (Appendix C). Both genuses are found in freshwater swamps, marshes, sloughs, and ponds. The cattail pollen was recovered from the fill within the triangular reservoir (Feature 10), which may have functioned as a human-made pond.

The faunal data recovered from the study area indicate an overwhelming dominance of domesticated animals (80 percent of identified species, see Chapter 8), primarily cattle and sheep, in the Mission-period assemblage. Historical records indicate that over 25,000 cattle and 15,000 sheep were present on San Gabriel Mission lands by 1828 (see Figure 8.3). In the 59 years that Engelhardt (1927a) reported records for the mission (1773–1834), over one million domesticated animals—cattle, sheep, pigs, and goats—lived on mission lands (see Table 8.4). This does not take into account the numerous horses, dogs, rats, and chickens that resided there as well. The negative impact of these animals on the landscape was enormous. Cattle and sheep, in particular, severely depleted native grasses and other plants growing in the grasslands, even small trees and bushes. This drove wild animals such as antelope and deer to migrate to other areas, in turn forcing Native Americans to rely even more heavily on domesticated foods (Hackel 2005; Dartt-Newton and Erlandson 2006:419; Silliman 2004:154).

Geomorphic investigations across the study area show that disturbed modern fill deposits overlie a series of relatively stable surfaces containing varying amounts of cultural materials (Stratum I). Stratum I can be divided into three soil horizons (Strata Ia, Ib, and Ic) with varying degrees of stratigraphic integrity and a diversity of cultural materials (see Chapter 5). Below Stratum I in the eastern portion of the study area, just west of Area 2, Stratum II is representative of alluvial flows that deposited inter-bedded sands and gravel layers. This stratum represents the remnant of a fluvial channel that runs from the northwestern portion of the site to the southeast where it intersects the millrace feature complex (Area 2). Five sub-strata with varying degrees of coarseness and sand content were identified within Stratum II. This obvious bedding demonstrates flow pulses followed by periods of slower sedimentation, indicating repeated channel activity. Near the millrace feature complex, the various substrata of Stratum II have relatively high densities of cultural materials,

Figure 12.5. 1889 photograph of wetlands near San Gabriel Mission, view facing southwest. Courtesy of the University of Southern California, on behalf of USC Libraries.

including earthenware construction materials, large-mammal bones, and Native American and nonnative ceramics. It is not clear whether these cultural materials were dumped into the channel or whether they washed down the channel to this location from other parts of the Mission site. Another possibility is that this material was purposely deposited to stabilize and control the incising or down-cutting of the channel. It is also not clear whether this channel is completely natural or whether it was created or simply enhanced by human activity. It is likely, however, that this channel is a precursor to the millrace and fed the reservoir feature that is part of the millrace complex (see Chapter 5).

It is possible, and we believe it is likely, that the channel formed in part due to accelerated erosion from the de-vegetation and alteration of the landscape associated with historical land clearing activities, including tree felling to satisfy fuel and construction needs, removing vegetation to plant crops, and intensive grazing, as discussed above. Flooding, exacerbated by the denuding of the landscape, may have further accelerated the downcutting of the channel (Gumprecht 2001). The mission padres may have taken advantage of this channeling by building two small reservoirs to control and capture water. Chapman then used the reservoirs as foundations for his mill and millrace, which formalized and redirected the channeling to power the mill. In this way, the historical environment and anthropogenic processes played directly into development of the mission, its waterworks, and its mill operations.

In summary, the local environment was well-watered and well-vegetated prior to the establishment of the mission. Archaeological and historical data indicate the presence of a marshy environment around the mission church and a wide variety of trees, especially oaks, growing in the vicinity of the study area during the Mission period. By 1820, the impacts of intensive cattle and sheep ranching activities appear to have impacted the local environment to the point where local wild fauna was rare (or not worth acquiring due to the abundance of beef and cattle hides) and erosion and down-cutting intensified, as evidenced by the development of a substantial channel through the study area. Two reservoirs were built to capture and control flow from this channel, which was ultimately redirected into Chapman's Mill through a massive stone and mortar millrace.

Agriculture and Industry

Out of the thickly forested riparian area, the mission padres directed Native Americans to clear land for vast orchards, gardens, and vineyards. Grazing land extended out from the church grounds in all directions. At its pinnacle of production, San Gabriel Mission boasted massive productive yields of livestock, grain, fruit, and other agricultural products. Among its industrial pursuits were the tanning of hides and the production of tallow and soap—key export products in the late eighteenth and early nineteenth centuries.

Historical records indicate that wheat and corn were by far the most intensively grown agricultural products at the mission (Engelhardt 1927a:273–275). Figure 7.2 depicts the production of wheat, barley, corn, beans, peas, lentils, garbanzos, and *habas* (favas) at San Gabriel Mission from 1773 to 1832. Wheat and corn heavily dominate in all years, but especially from 1806 to 1821. Corn appears to have been more important than wheat until about 1783. At that point wheat became the predominant crop until 1821, when both corn and wheat production dropped precipitously. However, plant remains recovered from SWCA's excavations in the study area do not directly support these historically derived values. None of the plants except wheat and corn are evident in the assemblage, and wheat is rare.

This pattern is in stark contrast not only to the historical record, but also to archaeological evidence collected through excavations at other mission sites. Recent excavations at San Fernando Mission targeting its Mission-period granary and midden produced an assemblage containing much more wheat (grains and/or rachis fragments) than corn (Abdo-Hintzman et al. 2010). Only two small and eroded corn cupules were found at San Fernando Mission, compared with 20 kernels and cupules at the San Gabriel Mission archaeological site.

The large difference seen between the cultivated plant assemblage at the San Gabriel Mission archaeological site and the San Fernando Mission assemblage archaeological site, as well as what we would expect at San Gabriel Mission based on the historical record, suggests either a sampling issue or a preservation issue. Since much of the recovered sample derives from contexts in association with the mill, it is likely that the dearth of wheat remains is due to poor preservation and a lack of burning of this particular plant and the highly disturbed nature of the deposits in and around the mill. As a consequence, the assemblage primarily appears to reflect Native American food consumption of corn and wild or native plants rather than wheat production and processing.

However, botanical data and the presence of a garden wall (Feature 34) indicate the use of the area as a garden. The seed evidence indicates that cherry, plum, broccoli, cauliflower, mint, chamomile, rose, and geranium were likely grown in the mission garden, and grape, fig, corn, mustard, tomatillo, pepper, elderberry, and tobacco were possibly grown there as well (see Table 7.6).

Cattle dominated all industry at San Gabriel Mission. Cattle production peaked in 1828 with 26,300 head recorded (Engelhardt 1927a:278–279). A total of 60 percent of the faunal remains assemblage was identified as cattle, and another 7 percent was identified as unidentified very large mammal, i.e., probably cattle (see Table 8.2). While the industry of the mission focused on tallow and hides as economic products, the assemblage recovered from the study area appeared to primarily represent Native American processing, consumption, and discard of cattle for food.

Sheep were also represented in the faunal remains assemblage, though fewer sheep bones than expected were recovered given the historical accounts of intensive sheep raising. This is probably because the deposits in the study area represent primarily Native American food remains; unlike cattle, adult sheep were utilized mostly for wool rather than food, and were consequently underrepresented in the assemblage.

In summary, there is a wide disparity between the historical accounts of agricultural and livestock production for the mission as a whole and the archaeologically recovered data from the study area. We suggest that this relates to the unique character of the study area deposits, in that they represent primarily Native American discard of domestic refuse rather than the materials derived from industrial production for export. While this may limit our ability to discuss larger economic systems, these results provide an exciting window into the daily lives of people who are largely underrepresented in the historical written record.

Secularization Period

The first 10 of the Alta California missions, including San Gabriel Mission, were secularized in 1834 after the Mexican government passed the Secularization Act. Following enactment of secularization, the padres surrendered control of the mission, thereby removing its properties from ecclesiastical control and secularizing its lands. With the threat of an American takeover over the next decade, the Mexican government issued large numbers of land grants aimed at privatizing mission lands. The state government sold the grounds of San Gabriel Mission to Hugo Reid and William Workman on June 8, 1846, to repay an outstanding debt (Engelhardt 1927a:216–229). Historical documents suggest that what followed was a period of revolution and lawlessness. With a disruption in trade came an increase in the number of American interlopers. Political resistance erupted on every front as Californios vied for control of their ranchos against American intruders and Mexican authority. As mission landholdings passed into private hands, Native American workers, who had become dependent on the missions, were left to fend for themselves. With no work at the mission, there was a far greater labor force in the region than could be employed. Most of San Gabriel’s neophytes left the community, migrating to the pueblo of Los Angeles, area ranchos, or further north.

Little evidence of this chaotic period was recovered from the study area. As indicated above, major construction at the mission had ceased by 1825, and substantial site deposition diminished by 1834. Some

Transitional British wares were recovered that date to the early American period (1840–1860), but these were relatively few in number and found primarily in Area 1. This pattern is not surprising, given that the period only lasted 13 years (1834–1847), and no construction events are documented to have occurred during this period. Although little evidence was recovered from the study area that can be confidently dated to this period, it is possible that the garden continued to produce fruits and vegetables, Chapman's Mill continued to operate for a few years, Native Americans remained in the general area and tended crops at least to a subsistence level, and light agricultural industry was carried on by those who stayed. Archaeological data from the study area, however, do not speak directly to these questions. However it should be noted that excavations at the Ortega Vigare Adobe, a small farmstead west of the garden and immediately southwest of the study area, revealed evidence of continuing use of the area after the 1850s (Marshall 1982).

San Gabriel Mission's Place in History

Over the summer of 1781, ten years after the establishment of San Gabriel Mission, 11 families, escorted by a company of soldiers, walked nine miles west and founded a pueblo called Reyna de Los Angeles (Treutlein 2004). Each year on or around Labor Day, hundreds of walkers reenact the journey from San Gabriel Mission to the City of Los Angeles, marking the founding of that city.

It is difficult to exaggerate the importance of San Gabriel Mission in the history of the Los Angeles region. It is the oldest continuously occupied European settlement in the area, one of the most successful missions in California, and the place where Los Angeles, as we know it today, began. But this particular mission is also a microcosm of larger phenomena. Thanks to its long history of occupation and the important events and interactions that it hosted, San Gabriel Mission's history is representative not only of the Los Angeles region, but also of the larger California mission system as a whole, as well as important aspects of the state's post–Mission period history.

San Gabriel Mission embodies important themes that span the eighteenth, nineteenth, and twentieth centuries, including economic and population booms and busts, the struggle to harness and control water resources, and changes in power between different ethnic groups and nationalities. At the local level, the history of the mission property is the history of the surrounding community of San Gabriel—the economic boom that followed the construction of the railroad, the citrus industry, immigration, and rampant subdivision construction. Here we briefly discuss San Gabriel Mission's place within the context of these larger historical processes, referencing our excavations and research when appropriate.

Booms, Busts, and Shifting Centers of Gravity

From the beginning of the Mission period until the 1849 Gold Rush, southern California was considered by much of the world to be a cultural, economic, and demographic backwater. It was the "edge of nowhere," where Spanish soldiers were sentenced to live while serving out a punishment. For more than three quarters of a century, few outsiders wanted to come to California; people came or remained in California because they had to (Starr 2007:37–38). Immigration into the state remained relatively modest until it was connected to the rest of the country via the transcontinental railroads in the 1880s. Appropriately, Mission-period California has been analyzed as a "peripheral area" within the context of the world economy at this time—characterized by a weak government, lacking a unifying identity, and inhabited a population that produced low-valued but vital products for core states (Wallerstein 1974:351; see also Hoover 1988 and Farnsworth 1987).

Initial colonization of Alta California was centered on two time-tested Spanish frontier institutions, the mission and the presidio (Bolton 1960). The settlement types were not initially very successful in California, however. Early mission efforts suffered low crop production, minimal construction, and few converts (see e.g., Engelhardt 1927a:267–277). Reasons for this include the colony's geographic isolation and a work force that was inexperienced in agriculture. This slow-growth trend prior to 1800 is borne out archaeologically in our study area; no direct evidence of pre-1800 material culture was recovered in our investigations, and it was not until after 1806, when Father Zalvidea served at San Gabriel Mission and initiated his building program, that we begin to see archaeological evidence of construction.

Even by the end of the Mission period, California's nonnative civilian population remained small. Only 27 land concessions had been made under the Spanish government, and private ranchos still numbered only 51 prior to 1834 (Hornbeck 1983:58). It was not until after 1834 and the secularization of the missions that private landholdings became a major economic force in California. Even the pueblos, which were largely economically unsuccessful during the Mission period and played a small role in provisioning Alta California, did not attract significant civilian immigration until after 1834 (Costello 1992a:52).

Nevertheless, it was during the Mission period, and especially at San Gabriel Mission, that the process of industrialization and mass production, particularly of cattle and wheat, got its start in southern California, a process that laid the groundwork for the economic growth and population booms of the ensuing decades.

Historical records indicate the immensity of the cattle industry associated with the mission, which is substantiated by our archaeological results from the study area. The period from 1806 to 1821 was one of great economic prosperity of the missions, especially San Gabriel Mission. By 1806 the missions were consistently producing beyond the needs of the resident populations, and surpluses were being used to purchase manufactured goods in much larger quantities than they were prior to this. Supply ships arrived regularly, at least one a year, but they were insufficient to move the massive amounts of exports being produced, most notably the products of San Gabriel Mission's cattle industry (Bancroft 1886:185; Costello 1992a:64). Exports were further restricted in 1810, when the rebellion in New Spain caused ships to rarely sail from San Blas. Even after 1810 the missions remained the primary economic engine, as regional populations became increasingly dependent on the missions for food, goods, and labor (Lightfoot 2005:59). This success, coupled with an easing of governmental policies of isolation, led to increasing commerce with foreign traders, particularly the English and the Americans. Ships from Great Britain and New England frequented the California coast during these decades, exchanging finished goods like tablewares and clothing for raw materials like hides and tallow.

The early nineteenth century was a boom time for San Gabriel Mission, when large building projects were begun, including a series of granaries, mills, reservoirs, and other structures, and culminating in the construction of Chapman's Mill and Millrace. The mission was the undisputed economic and social center of southern California, and in this sense, the success of the mission was synonymous with the success of the region. Thus, San Gabriel Mission, though situated in a peripheral area in a world systems sense, may be considered, at a regional scale, the core of this periphery at this time. This position changed with the secularization of the missions and the establishment of secular pueblos and ranchos, when the missions ceased being the centers of regional economies and a more diffused production and distribution system developed, primarily around international trade rather than local and regional provisioning.

The decline of the mission as a sustainable core economic institution in Alta California appears to have begun prior to secularization, however. The steady decline in mission populations due to disease, the emphasis on cattle raising to the exclusion of manufacturing industries, the raising of other animals for export, and increased taxes on crops, cattle, exports, and slaughtered animals all contributed to the economic decline of the missions between 1821 and 1834 (Bancroft 1886; Castillo 1989; Cook 1976). At San Gabriel and other missions, this decline is most starkly seen in the precipitous drop of crop yields after 1821 (see Figures 7.1 and 7.3). This trend is also evident archaeologically in the overabundance and dominance of cattle over other domesticated animals in the recovered assemblage from the study area (see Figure 8.4), including sheep, which were rarely used as food and whose wool was not exported (Bancroft 1886). As Costello (1992a:96) has written, “The financial success of the missions contributed to their demise. As the lucrative hide and tallow trade increased so did the acquisitiveness and discontent of the civilian population, contributing to the eventual secularization of the mission.”

The construction of Chapman’s Mill was a pivotal moment in San Gabriel Mission’s history. It represents the last substantial investment in mission infrastructure, and the end of a grand era of expansion and building. It was one of the most sophisticated machines in western North America in its time, being a mechanized grinding apparatus powered by a sophisticated system of dams and waterways, and representing the opening volley of the Industrial Revolution in the west. Designed and constructed by Los Angeles’ first American resident, it also represents the beginning of what would, two decades later, culminate in regime change and a stampede of American immigrants.

Between 1834 and 1837, the economy of California changed from one based on mission production and consumption to one controlled by private industry, as the missions were put under the control of secular commissioners and the mission estates were divided into private ranchos. Private ranchos rapidly took over production of hides and tallow, supplying trade networks run almost exclusively by Anglo-Americans. While some Native Americans remained at the mission, most left the region or became employed locally at ranchos, doing much of the same work they had at the missions but for fewer benefits (Starr 2007:50). This bust time for the Mission is also borne out archaeologically in our study area, for very little material dating from this period, including structures and artifacts, was recovered. Decline in the hide industry in the late 1840s was followed by the discovery of gold in 1848 and the Spanish-American political domination of California was replaced by that of the Anglo-Americans.

While San Gabriel Mission never again became the core of the regional economy, it did, in a very literal sense, sow the seeds of the next industrial wave to hit southern California—the citrus industry. The mission had several extensive gardens in which oranges, citrons, and limes could be found in abundance (Robinson 1846:45). For example, “The mission had, according to the inventory of November 1834, 2,333 fruit trees in nine orchards” (Webb 1952:87). We recovered evidence of cherries, plums, and figs in the study area, but no citrus. Citrus orchards outside the missions did not become established until after secularization. The mission padres seem to have prized citrus highly. In 1877, Jose del Carmen Lugo (1950) of the San Bernardino *asistencia* (sub-mission) recalled that owners of fields could not obtain seeds of oranges and lemons from the missions, because the padres “refused to allow these fruits to be raised elsewhere than at their missions.” So precious were the citrus fruits to the padres of San Gabriel Mission that they reportedly set traps in Bishop’s Garden to catch Native Americans who came at night to steal oranges (Dale 1918:209–210).

However, in 1834, Jean Louis Vignes, a Frenchman, procured 35 large seedling sweet orange trees from San Gabriel Mission that he transplanted to his residence on Aliso Street in Los Angeles. This number was gradually increased until Vignes possessed a sizable grove, which was the second orange orchard to be planted in California (Spalding 1885:7). In the same year, a small planting was also made in Los Angeles by Manuel Requena (Lelong 1902:17). By this time the planting of a few citrus trees in gardens and courts for home use had become a common practice, but no groves had been planted to provide fruit for sale.

When the 1849 Gold Rush hit, there was a huge demand for oranges because it was well established that fresh citrus was useful for combating scurvy. As a result, the citrus industry grew exponentially, particularly in the Los Angeles Basin. The establishment of the transcontinental railroad in the 1870s allowed growers to supply the navel oranges to the whole nation, especially the big eastern markets—New Orleans, Chicago, New York. As historians have noted, the citrus boom spurred California’s “second Gold Rush”—except the new gold was orange (Webber et al. 1967). Railroad transportation to eastern markets played a significant role in stimulating expansion of the California citrus industry.

The building of the railroad and the resultant increase in orange production marked the end of the bust period associated with secularization and the beginning of another boom era for the San Gabriel Valley. Southern Pacific Railroad began a decade of prosperity in 1873, connecting Los Angeles with neighboring towns to the north, east, and south, and becoming southern California's largest employer by 1880. The railroad line through San Gabriel, along with a small depot, was completed in 1874. The Southern Pacific Railroad's monopoly within the San Gabriel Valley ended in 1885, however, and an all-out rate war among several companies resulted in an explosion of traffic into southern California. The competition for passengers and the intense promotion of the sale of property along existing rail lines led to an unprecedented growth spurt in southern California known as the "boom of the eighties." The San Gabriel Valley developed rapidly with increased immigration, and seven new combination stations were built along the Southern Pacific Railroad line in the valley in 1887 alone (Mullaly and Petty 2002:20–22).

The completion of the Sunset Route to New Orleans in 1889 was a major coup for the Southern Pacific Railroad. This shorter, southerly route was ideal for the shipment of citrus fruits and other agricultural products, which were frequently damaged on longer, colder routes. The new route allowed southern California's farmers to get their products to eastern markets rapidly over lines exclusively owned by the Southern Pacific Railroad for the first time.

As more settlers continued to head west, the demand for real estate increased dramatically. Real estate prices soared and land that had been farmed for decades was sold for residential development. The large ranchos that surrounded Los Angeles were each annexed, subdivided, and developed. Los Angeles's population more than quadrupled in a decade, from 11,183 in 1880 to 50,395 by 1890 (Meyer 1981:45; Robinson 1979; Wilkman and Wilkman 2006:33–34).

Partly due to the effect of the railroads, the secular town of San Gabriel expanded along with the rest of Los Angeles County in the 1880s (Dumke 1991:76–92). The old Hispanic settlement pattern centered on the mission plaza gave way to a linear Euro-American pattern focused on major transportation routes like the Southern Pacific Railroad and what is now known as Mission Road (Williams 2005:23).

After World War II, there was marked decline in citrus production in California, which primarily resulted from urban encroachment on orchard land in the Los Angeles Basin (Webber et al. 1967). This decline in citrus, however, was matched by an increase in housing development, the next boom for the San Gabriel Valley. The construction of a tract of homes immediately south of the study area in 1941 was a precursor to what would become a defining trend for southern California.

In summary, San Gabriel Mission and the community of San Gabriel are microcosms of the historic boom and bust cycle of southern California, from the founding of the mission in 1771 to the present. In particular, San Gabriel experienced an economic boom during Mission period, a bust during the Secularization period, and another boom during the American period with the coming of the railroad. Most significantly, it was a springboard for the establishment and development of Los Angeles and two of the most important early industries of the region, cattle and citrus. The citrus industry was subsequently enhanced by the construction of the Southern Pacific Railroad, a main line of which extends through the study area. San Gabriel Mission was an early locus of California's entry into the Industrial Revolution, which eventually transformed southern California from an isolated frontier zone and world system periphery into a world economic core.

Water

The history of Los Angeles and southern California is intricately tied to the implementation of water control, movement, and storage technologies. The harnessing of water is one of the essential challenges of successful Euro-American-style occupation of southern California, for normal years in this Mediterranean climate are quite dry in comparison to other parts of the country, while wet years are less common but witness dramatic increases in precipitation and destructive flooding. Part of the solution to this problem has been the construction of massive canals and reservoirs. The process of taming the Los Angeles River is an obvious example. As stated by Gumprecht (2001:3):

> Flood control projects made the Los Angeles River what it is today. Despite its meager flow—and in part because of it—the river was unpredictable and prone to flooding, often shifting its course with each new storm and altering its outlet to the sea by as much as ninety degrees… Massive flood control reservoirs were constructed on the lowlands to regulate peak stream flows. The river itself was straightened, deepened, and widened and its new channel was lined with concrete to provide floodwaters the quickest route to the sea. Although the facilities that were built to keep the river in place and prevent it from flooding made it the eyesore it is now, large parts of present-day Los Angeles could not have been developed if the vagrant nature of the river had not been controlled.

The apex of water control efforts in southern California was the construction of the Los Angeles Aqueduct. From 1908 through 1913, William Mulholland directed the building of the 223-mile canal system. Completed in November 1913, the aqueduct required more than 2,000 workers and the digging of 164 tunnels. This engineering feat has been compared to the building of the Panama Canal. Water from the Owens River reached a reservoir in the San Fernando Valley on November 5, 1913, finally securing a water supply capable of satisfying the thirst of what would become one of the nation's largest cities.

Although perfected in the age of Mulholland, water control techniques like this were pioneered at San Gabriel Mission. Originally located directly within the floodplain of the Río de Jesús de los Temblores, in the area today called Whittier Narrows, residents of the first mission took their water from the river and other small creeks and springs in the surrounding plains (Engelhardt 1927a:20). Repeated flooding was a problem, however, and the padres chose higher ground for their second location. Although the threat of flood was decreased, there was no longer a year-round water source within easy reach of the settlement. But the new location was situated downhill from the San Gabriel Valley's most important water source, the Raymond Escarpment, a geological feature created by the east-northeast-trending Raymond Fault (see Figure 2.1). This escarpment has created an upwelling of ground water.

With the establishment of the mission at its current location in 1775, the padres of San Gabriel Mission became the first in the area to systematically tap this water for off-site use. An earthen ditch initially directed water to the mission for domestic and agricultural purposes from an artesian spring approximately 2 miles (3.2 km) northwest of the mission at the intersecting mouths of Mission (or Los Robles) Canyon and Mill Canyon. Located in present-day San Marino's Lacy Park and feeding what is now known as Alhambra Wash, this was the most important source of water for San Gabriel Mission during the Mission period. Before this improvement, the water pooled in this location, forming a swampy area known variously as Mission Lake, Wilson Lake, and Kewen Lake (Dryden 2008:4).

Continued growth of the mission increased demand for additional water sources. To address this problem, the padres expanded the system of zanjas and added brush and dirt dams (Reid 1895:51) and tapped a second spring along the Raymond Fault, this one along what is now called Eaton Wash, 2.6 miles (4.1 km) northeast of the mission. This water source was soon dammed with the massive stone-and-mortar dam called La Presa.

The system became increasingly complex after the arrival of master masons and potters from the south in the 1790s, who constructed substantial structures with stone and fired tiles set in mortar. Under the direction of Father Zalvidea, in 1807 the mission began a series of substantial investments in and improvements to the system. Native American laborers lined the zanjas with tiles and constructed a dam at the lower end of Mission Lake. The outflow was used to power a sawmill, a wool-washing works, and a tannery, all located close to the mission (Dryden 2008:4).

Chapman improved upon these existing waterworks to build his mill at San Gabriel Mission, including the zanja system and possibly including elements of the gristmill that was begun by others in 1820 (Engelhardt 1927a:144). The improvements to the water system at this time went well beyond the construction of the mill itself. With the installation of dams at Mission Canyon and at La Presa, strong flows of water from the northwest and northeast were joined together into a single waterway just west of the mission quadrangle. From here, Chapman needed to direct the water sharply to the west across and then parallel to El Camino Real, then sharply south through the garden wall, and finally straight into the mill's wheel pit. Forcing a large volume of water through an S-curve over a distance of just over 200 feet (60 m) required more than an earthen or tile-lined ditch, which would have been quickly overtopped. To solve this engineering challenge, Chapman installed a massive masonry flume, or millrace.

Our excavations revealed the presence of two small, previously unknown reservoirs located where the millrace intersected with the mill. This is further evidence of the padres' attempts at water control as well as Chapman's successful incorporation of previous infrastructure into his works. As mentioned above, the padres appear to have taken advantage of natural channeling by building two small reservoirs to control and capture water at this point. Chapman then used the reservoirs as foundations for his mill and millrace, which formalized and redirected the channeling to power the mill.

One of the more ingenious aspects of water control engineering by the padres and by Chapman is their forethought and attempt to get multiple uses from water. For example, Chapman's Mill was situated not at the bottom of a hill, but in an area low enough to collect water, yet high enough to outlet water for a second use. Thus, they got four uses out of the same water from the zanjas: 1) domestic use; 2) industrial use for hide tanning, etc.; 3) turning the mill wheel and thereby powering the mill; and 4) watering the garden.

In summary, the establishment of San Gabriel Mission marks the beginning of increasing control over water in the Los Angeles Basin. The water control techniques developed and used successfully by the padres and by Chapman in the Mission period set the stage for similar, albeit grander, engineering efforts to move and control water later in time.

Hegemony and Identity

The establishment of missions, forts, and pueblos in Alta California occurred quite late in the Spanish colonial era, and was primarily undertaken in response to the hegemonic expansion of Russia along the Northwest coast. In 1767, news of Russia's presence in North America solidified Spain's decision to colonize Alta California. Their challenge was to neutralize a heavily populated region located far from settlements in New Spain. They chose a unique and relatively inexpensive solution, where a handful of missionaries and soldiers would build self-sufficient agrarian communities populated by converted indigenous people. This strategy was tailor-made for densely populated coastal areas (Weber 1992). By 1797, with the completion of Mission San Jose, Spain's hegemony in coastal Alta California—from San Diego to San Francisco—was firmly established. The mission complexes each generally supported from 500 to 1,200 neophytes (Lightfoot 2005:55). San Gabriel Mission's population was at the highest end of this scale (see Figure 7.4), surpassing 1,500 from 1812 to 1826 (Engelhardt 1927a).

Spain's control over the region lasted until 1821, but the missions persisted under the control of Mexico until 1834. While the Mexican War of Independence was a major shift in continental terms, its impacts were not strongly felt 2,000 miles to the north, on the edge on the Hispanic world. Indeed, it took nearly a year for the news of Mexican independence and the collapse of Spain's hegemony in California to reach Alta California (Starr 2007:45). Moreover, the mission padres were still mostly Spanish-born royalists, and they apparently did what they could to ignore, if not openly resist, the newly established republic (Starr 2007:46). This included the continuation of major construction efforts on mission grounds, such as Chapman's Mill, built between 1821 and 1825. Following the regime change, the primary difference for the missions was a loosening of trade restrictions and the opening of California ports to foreign trade. Likely as a result of these relaxed commerce regulations, this was a time of considerable renegotiation of identities at San Gabriel Mission. American Joseph Chapman exemplified this identity renegotiation. He arrived in California as an English-speaking Protestant, but soon learned Spanish, converted to Catholicism, and began working within a Mexican political system with Native American workers on a Spanish mission project. Chapman's presence at the mission in the 1820s foreshadowed another shift in hegemony that culminated in 1847, when the Americans took control of California.

There is some evidence of activities in the study area prior to the construction of Chapman's Mill in 1821, including the construction of two reservoirs (see above, Site Chronology). But other than Chapman's work, there are no abrupt material culture changes that occurred at the beginning of Mexico's rule over the region. Sometime after 1821, metal, glass, and European and Asian ceramics increased in frequency in the study area (see Chapter 11). But other changes in response to these shifts in hegemony over the region are not obvious. Indeed, the consistency over time of the Native American assemblage within the Mission period—ceramics, lithics, and beads in particular (see above, Native American Health, Status, and Ethnicity)—is noteworthy.

The foundation of the missionary enterprise in Alta California was a directed enculturation program in which the padres indoctrinated the neophytes into the Catholic faith, taught them European crafts and trades, and forced them to alter their traditional work habits, subsistence patterns, dress, and diet (Lightfoot 2005:59), along with religious beliefs and cultural mores. To facilitate this, the Spanish invoked a massive relocation program known as *reducción*, which allowed the priests to keep close surveillance on neophytes, control interactions with non-baptized Native Americans, and disassociate them from their homelands (Lightfoot 2005:63). The result was the creation of highly aggregated settlements of people from diverse polities, who spoke mutually unintelligible languages, and may sometimes have regarded one another as traditional enemies (Lightfoot 2005:111). An American visitor to San Gabriel Mission remarked that "they have upwards of 1,000 persons employed, men women, and children, Ind[ian]s of different nations" (Dale 1918:200). This aggregation broke down traditional power structures and political and social alliances, hampering efforts at organized resistance (Hackel 2003; Sandos 2004, 2007).

One might expect then, contrary to observed patterning in the study area, some evidence of this cultural heterogeneity to be evidenced in the archaeological record. The question remains to what extent the apparent uniformity of the Native American assemblage is due to forced enculturation by the padres and the passive assimilation of neophytes from different historical and cultural backgrounds, or the active creation of a unified Native American identity in the face of hegemonic forces and in contradistinction to the dominant culture.

The answer, we suggest, is both. When considering the daily practices of Native Americans in the context of the mission, archaeologists have distinguished between public and private spaces (Lightfoot 2005:96; Skowronek 1998:687). In public, neophytes presented themselves according to the standards set by the padres; in private they were often able to conduct traditional practices out of sight of the padres and perform "covert social practices that maintained their connection to the past and renewed their linkages with other tradition-minded neophytes" (Lightfoot 2005:96). Excavations on neophyte quarters at other missions have demonstrated this pattern (e.g., Allen 1998; Deetz 1963; Skowronek 1998).

Our study area represents more public contexts than private, per se, potentially explaining why some of the "covert" items recovered in these other investigations, such as gaming pieces and ritual artifacts, were not recovered from our study area. Importantly though, roughly two thirds of ceramics in the San Gabriel Mission assemblage are locally made brown ware or "Mission ware," low-fired earthenware produced by indigenous and colonial peoples of California between 1769 and 1834 (see Chapter 9). In comparison, 50 percent of the ceramics associated with Native American populations at Mission San Buenaventura and Mission San Antonio were produced in the missions, and only 4 percent of the ceramics at La Purisima were local wares, the remainder consisting primarily of English wares (55 percent) and Chinese wares (22 percent) (Costello 1992b:67–68.).

The comparative abundance of Native American–made brown wares in our study area suggests several possibilities: 1) our sample is from an area of the mission that is not representative of the site as a whole or represents different contexts than those reported for other missions; 2) the study area deposits represent a time period in which trade restrictions forced people to rely more on local wares than trade wares, e.g., the 1810s; and 3) in this public context at San Gabriel Mission, Native American–made brown ware production, use, and discard was a highly visible form of identity construction in the context of hegemonic oppression. While it is difficult to demonstrate the last hypothesis, the first two seem unlikely. The sample from San Gabriel is large, derives from numerous contexts within the study area, and includes materials from the entire mission period, including the post-1821 period when trade restrictions were loosened.

We propose that the high density of brown ware pottery in the study area is the result of breakage from cooking, serving, and consuming communal meals, which are social contexts that helped integrate groups with diverse backgrounds and created and reinforced a unified Native American group identity. Supporting this hypothesis, the most common vessel form in the assemblage was the bowl—the bowl-to-jar ratio for the assemblage is 1.5, indicating that there are 50 percent more bowls in the assemblage than jars. As a comparison, a contemporary brown ware assemblage from household deposits at the Los Angeles Plaza Church site has a bowl-to-jar ratio of approximately 0.2, indicating that jars outnumbered bowls more than four to one. This ratio supports the interpretation that Native American-made pottery forms there had an emphasis on storage, primarily of food and water (Kealhofer 1991:428). Brown ware bowls at San Gabriel Mission were generally used for serving, eating, or cooking, and some examples showed traces of soot on the exterior, indicating use for cooking over open fires. Many of these were large in size (see Table 10.10), suggesting the cooking and serving of communal meals.

We also suggest that the act of pottery making itself created communities of practice among the Native Americans at San Gabriel Mission. The term "community of practice" refers to a group of people engaged in a joint enterprise who have developed shared practices, resources, and perspectives (Coburn and Stein 2006). It is within these joint-enterprise contexts and through "increasing participation in communities of practice" that learning and knowledge transmission occurs (Lave and Wenger 1991:49). Communities, as opposed to individuals, then, are the units of learning (Lave and Wenger 1991). Participation in communities of practice influences an individual's learning trajectory, social identity, and forms of membership (Sassaman and Rudolphi 2001:408).

Current archaeological applications of theories communities of practice have primarily focused on pottery production (Cordell and Habicht-Mauche 2012; Crown 1999, 2001, 2002; Duff and Nauman 2010; Habicht-Mauche et al. 2006; Reed

2008; Sassaman and Rudolphi 2001). As discussed by Griset in Chapter 10, missions initially had to teach pottery making to the neophytes. They did this by transferring Native American potters from missions to the south (including Baja California) to the new missions to the north, or by importing potters among the settlers and soldiers who immigrated to California from Sonora, Mexico. Griset notes that between 1792 and 1795 artisans from Mexico were brought to the missions to teach pottery making. After this, though, the knowledge of pottery making would have been passed on locally, most likely through participation in communities of practice. Here participants learned to produce Mission San Gabriel Brown, a unique type made using a combination of techniques on the same pot, something that might be termed "wheel fashioning"—hand modeling to begin the pot, then putting it on a slow wheel to shape and finish it, which produces surface features that are the result of different forming processes. Participation in this community of practice and the production of a consistent, unique, local pottery type, we suggest, cross-cut ethnic boundaries and helped create a distinct, unifying Native American identity at the Mission.

Additionally, Native Americans at the Mission used chipped stone tools for the working of hides; manos, metates, mortars, pestles, and steatite bowls for food preparation; and shell beads for decoration and exchange. Farnsworth (1987:618) has suggested that after 1810, less emphasis was placed on the indoctrination of neophytes, and thus Native Americans at the missions were able to perform indigenous practices more openly, including the use and manufacture of material cultures that represented continuity with their pre-Hispanic lifeways. It can be argued that use and discard of these objects in our study area demonstrate strong connections with the past and that the persistence and transformations of these traditions within the mission setting played an important role in both reifying existing community identity and building community identity where it may not have previously existed.

In summary, other than an increase in trade wares after 1821, large-scale political shifts in the Mission period do not appear to have dramatically affected material cultural patterning in the study area. In particular, the Native American assemblage appears to have been resistant to political changes in hegemony over the region, and it is more homogenous than would be expected given the apparent cultural diversity of the neophyte population. We suggest here that this is due to both forced enculturation by the padres and the active creation of a unified Native American identity through the communal use and production of pottery.

Conclusion

We conclude with two brief but important points. The first is that the artifact assemblage recovered from San Gabriel Mission is one of the most robust ever collected from a California mission using modern archaeological techniques. Encompassing nearly 300,000 artifacts, 80,000 faunal specimens, and 41 tons of building material, the materials recovered during our investigations at San Gabriel Mission constitute one of the largest Mission-period assemblages in the world. The unparalleled size of the Mission brown ware pottery assemblage alone makes this a world-class collection. The collection analyzed here is important not only for its size, however, but also for its association with one of the most prosperous and influential California communities in the Mission period. These materials allow us to understand the processes that took place within this setting, and their impacts throughout the region. These data are also an important point of comparison with contemporary communities that experienced less productivity, leading to different outcomes.

Secondly, the importance of San Gabriel Mission resonates strongly with multiple communities, as much now as it did during the Mission period. In many ways, California missions are the subject of "place making," wherein groups with varied histories and agendas assign meaning to a place through the practice of social traditions and through the formation of personal and collective social identities (Bowser and Zedeño 2009:1). These places in turn possess a marked capacity for triggering acts of self-reflection and identification (Basso 1996:107). In this way, the mission is still a very important place to many groups, including Native Americans, Latinos, and Catholics, as well as students of history and local residents. Members of these groups recognize that their modern identities are rooted in this place. For some, San Gabriel Mission is where their ancestors lived and died in heartbreaking conditions, for some it is a place where the dream of modern Southern California first took root, and for the descendants and newcomers who call San Gabriel home today, it is simply their parish community.

The importance of this history to the present-day community is acknowledged and celebrated every year as descendants of the Pobladores and Native Americans walk the nine miles from San Gabriel Mission to Los Angeles to reenact the 1781 founding of that city and participate in the Annual Fiesta. The year 2015 marked the 244th Annual Fiesta at San Gabriel Mission, and 20,000 people of all different backgrounds participated in religious, historical, and cultural festivities. The 2015 canonization of Padre Junípero Serra also brought the strong sentiments about this chapter of California history to the fore. Several Native American groups protested the move, given the mission system's devastating impacts to native cultures. Shifting the focus to their active resistance to missionization, local Gabrielino bands have erected a statue and staged a play highlighting the role of Toypurina, one of the leaders of a 1785 rebellion at San Gabriel Mission. The passion behind these ongoing conversations make it clear that here, the past is still very much alive.

EPILOGUE

John Dietler

This book is not intended to be the last word on the archaeology of San Gabriel Mission—far from it. Rather, it should be viewed as the beginning of what we hope to be a long and multifaceted examination of the mission's history using material remains as key evidence. In many ways, we have only scratched the surface of what can be learned from the more than 350,000 items that we recovered during this data recovery project. Like any scientific inquiry, our work has answered some questions while raising many more. It is our earnest hope that students and scholars will pick up where we left off, using our data and their own analyses of these items to produce master's theses, dissertations, and articles that build upon and challenge our initial findings.

More than once in Chapter 12, we pointed out the challenge we faced in answering some of our most important questions about the mission community—those that focus on the specific experiences of Native Americans at the mission. This was due to the fact that the data recovery study was largely focused on the mission's agricultural and industrial complex, and it did not identify archaeological contexts that could be definitively associated with exclusively Native American uses, such as houses, hearths, ceremonial features, and human burials. Subsequent to the initial data recovery phase, however, during the monitoring phase of the San Gabriel Trench project, we discovered, excavated, and analyzed examples of each of these feature types in partnership with Gabrielino representatives. We have already begun the process of preparing additional reports on the results of those studies, which promise to add much-needed detail to the broad framework that we have presented here.

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