Indigenous Archaeology at Tolay Lake:

Responsive Research and the Empowered Tribal Management of a Sacred Landscape

by

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Committee in charge:

Professor Kent G. Lightfoot, Chair

Professor Margaret Conkey

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Abstract

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The Tolay Archaeology Project (TAP), of which this dissertation is a part, is a multi-year, Community-Based, Participatory Research Project that seeks to support the work of the Federated Indians of Graton Rancheria (FIGR) within the Tolay Valley. The Tolay Valley is the location of a sacred lake to FIGR where doctors healed sick people with charmstones for thousands of years. Tolay Lake was the repository for these charmstones and is a sacred place to the contemporary tribe. Coast Miwok and other indigenous peoples traveled to Tolay to participate in ceremonies up to 1870 when the lake was drained by William Bihler. In the years following the draining of this lake, Coast Miwok and neighboring tribal people maintained stories and memories about Tolay, even though the charmstones and the sicknesses within them deterred many California Indian people from visiting the lake. Today, FIGR and the Sonoma County Regional Parks Department (SCRPD) are collaboratively planning the development of this area as Tolay Lake Regional Park, and are conducting studies of biological and cultural resources to learn more about how to appropriately manage and interpret these resources. This dissertation addresses the need for more information about Tolay's environmental and cultural history by conducting low-impact archaeology to answer questions about environmental change, indigenous land management, and the ways in which Coast Miwok people navigated settler colonialism in the nineteenth century to reaffirm connections to the valley.

The relationships between Native Americans and archaeologists have been fraught with over a century of contention. Avocational and professional archaeologists have repeatedly removed Native American ancestors from the ground and written Native American histories from Western perspectives without meaningfully consulting tribes. Community-based approaches to archaeology are strategies that some archaeologists are now employing to find the commonalities between their values and the values of Native American communities to forge ethical pathways forward in cultural resource preservation and research. The approach that I developed for this dissertation project in collaboration with FIGR is rooted in responsive justice and community- and desire-based research practices. This approach involved establishing and adhering to core research values and working with tribal committees to ensure that the research continues to be relevant and worthwhile to the tribe. Unlike much of the early research from the past century that did damage to cultural resources and did not meaningfully consult tribes, this dissertation research was designed, conducted, and written with constant feedback and collaboration from FIGR's citizen committees. I have found that research co-produced with Native American communities can lead to richer understandings of the past and can positively impact the lives of many different peoples today.

In this dissertation, I summarize the history of indigenous archaeologies, including community-based or community engaged research. I present my own process for community-engaged research with FIGR in which my research was continually reevaluated and reworked. I then review the regional traditions and theoretical considerations in California archaeology and situate the TAP within this larger body of research within the state. I offer a brief overview of previous research in the Tolay Valley to contextualize the approach taken in the TAP and present results from extensive non-invasive and low impact strategies (such as terrestrial LiDAR, geophysical survey, surface pedestrian survey, and intensive surface collection) as well as limited excavation and augering. I expand my discussion of the paleoethnobotanical and faunal results, which show how a grassland/shrubland environment was maintained at Tolay for thousands of years. I also expand on evidence from the Historic Period within the Tolay Valley, and show how Coast Miwok people maintained their connections to the Tolay Valley and refused settler colonial ways of engaging with land within the valley. These data and narratives were utilized to generate histories for tribal youth hikes and public interpretation at Tolay, supported the review of the master plan documents for Tolay Lake Regional Park, and will inform ecological restoration efforts at Tolay in the future.

For my Grandpa and my Great Great Uncle

For my tribe, the Federated Indians of Graton Rancheria, because it takes a strong community to raise an academic…

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Before any further acknowledgements, I would also like to acknowledge two tribal citizens who were members of my tribe's Sacred Sites Protection Committee (SSPC) and Tolay Advisory Group (TAG) Committee and who passed away during my time in graduate school. Frank Ross, one of the three founders of my tribe's SSPC, was a tough critic and passionate protector of Coast Miwok sacred sites. I think about the first question he posed to me when I introduced myself to him as a tribal member and an archaeologist. "Now, why would you ever want to do that?" he said. The blunt simplicity of this question and sincere existential interrogation of my positionality constantly challenges me to think about why I do and think what I do and whether it serves my community. Lisa Ouse, one of the founding members of my tribe's TAG committee, gave countless hours in her final years to TAG, attending meetings, reviewing documents, and hiking and being on the land in the Tolay Valley. Her inquisitiveness, positivity, curiosity, and devotion to the goals of our work at Tolay are inspiring.

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Chapter 1

Introduction

"…leaving the barge in the creek of Sonoma, and proceeded in a north-easterly direction by a chain of hills. Although the grass had been burnt by the Indians of the neighborhood, it could easily be perceived that it was convenient grazing land for cattle, sheep, horses, &c., distributing them suitably; for besides the hills having good pasturage, there are also sufficient springs, showing to be permanent, not omitting the remark that they are free from dense woods, which favor the straying of cattle…elk, (a species very abundant at all the localities we visited, from Olompali upwards, as also are the antelope and deer.)"

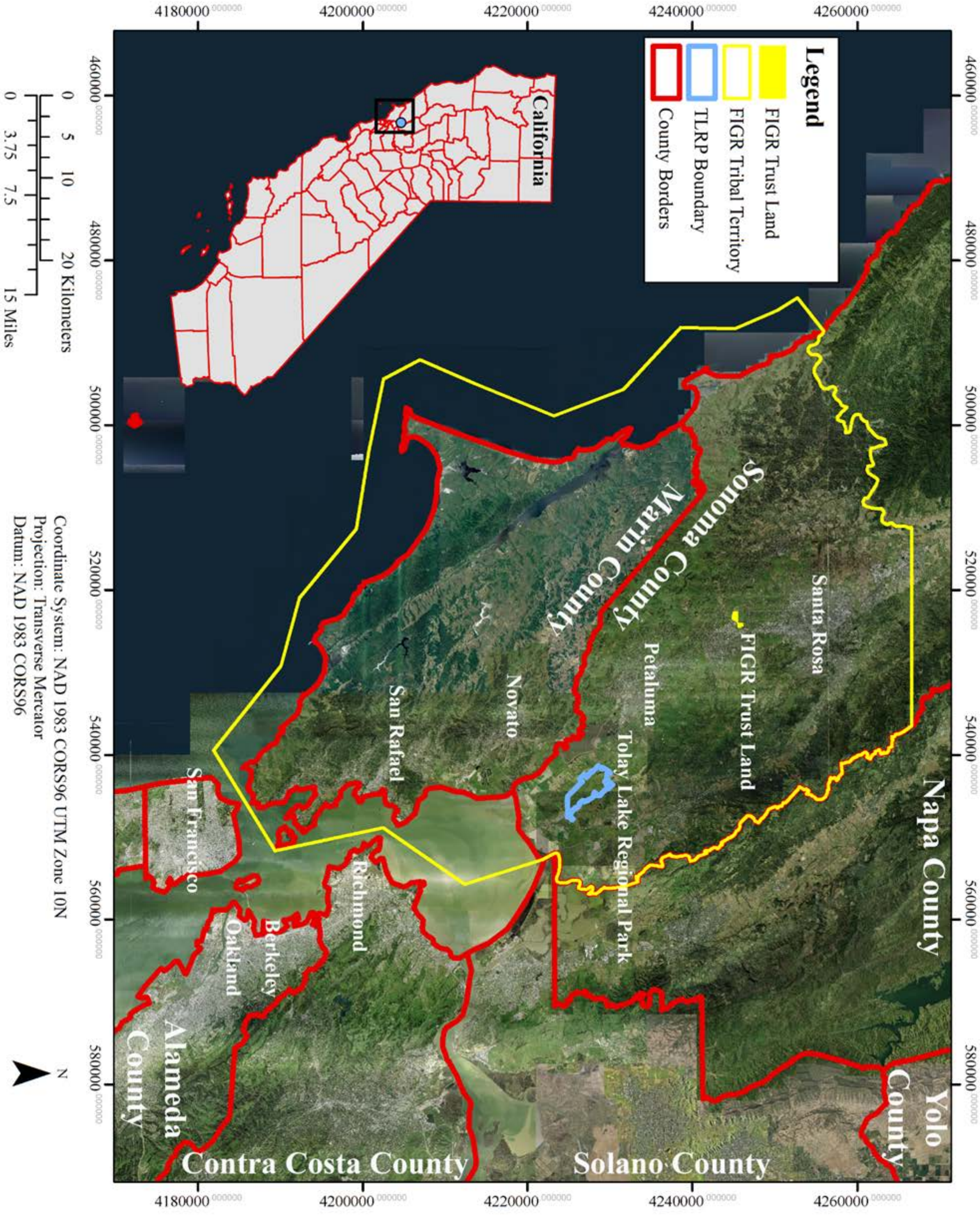
— from Jose Altimira's (1860:61) expedition through the Petaluma, Tolay, and Sonoma Valleys to establish Mission San Francisco de Solano in 1823.

When Spanish explorers arrived in California, they described vast open landscapes (M. K. Anderson 2005b; Cuthrell 2013b; Lightfoot and Parrish 2009). Though a few accounts, such as the one offered by Jose Altimira (1823, 1860) in 1823, attest to the fact that Native American people burned the surrounding landscape, many accounts describing pristine, park-like scenes ignored or did not fully make the connection that this early Californian landscape was kept open by cycles of controlled burns set by California Indians (M. K. Anderson 2005b; Lowell J. Bean and Blackburn 1976; Lightfoot and Parrish 2009). These controlled burns in tandem with other landscape management practices were integral to the regimes of food collection and storage that sustained California Indian societies and the health and productivity of the environments in which California Indians lived. These regimes of land management were so successful that the land within the modern state of California supported some of the largest indigenous population densities in all of North America outside of Mexico without the use of agriculture (Lightfoot and Parrish 2009:ix, 4-5).

Spanish, Mexican, and American colonization of California disrupted this way of life for California Indians and the regimes of management that supported much of California's natural resources. Missionaries and settlers forcibly removed California Indians from their ancestral lands, and cattle decimated stands of native grasses (Hackel 2005; R. H. Jackson and Castillo 1995; Madley 2016). But this impact to culture and land did not change the mandate of many tribes to care for the land, and many tribes are currently engaging in restoration efforts with whatever resources they have.

My dissertation project, which I named the Tolay Archaeology Project (TAP), was developed and implemented in response to a need for more information about environmental change in my tribe's territory in efforts to restore the natural resources and regimes of management that were disrupted by colonization. In this project, I investigate the environmental history of the Tolay Valley in Southern Sonoma County, California (see figure 1.1), through archaeological, botanical and faunal materials to provide a base line for local, historical information about the ecology of the valley. That is, this research asks: what plants and animals were present on the landscape before colonization? What does this suggest about the kind of environment that existed on the land in the past? How was the land managed and maintained? And how did the environment and regimes of indigenous management change before and after colonization?

Figure 1.1. Map illustrating the boundaries of Tolay Lake Regional Park, which defines the project area, and the tribal territory of the Federated Indians of Graton Rancheria.



Currently, there is some debate about how much of an impact California Indians had on the environment before colonization (e.g., Vale 1998, 2002). These same scholars question the importance of indigenous management practices in sustainably managing natural resources today. One of these scholars, Thomas Vale (1998, 2002), argues that the kinds of landscape management that California Indians practiced, such as low-intensity burning, were small in scale and did not impact the broader ecology outside of immediate village areas. Another critic of indigenous management, Jack Broughton (1997, 2003), uses his analysis of faunal remains at the Emeryville shellmound to argue that California Indians mismanaged fisheries and other resources at times in the past, and therefore, should not have undue influence in creating policies about resource management today. These critiques offer weighty challenges to tribal sovereignty and could undermine tribal abilities to practice indigenous land management in their own territories if the agencies that they work with use these sources as the "best available science." However, the diligent collaborative work of California Indian tribes and scholars such as Kat Anderson, Thomas Blackburn, Rob Cuthrell, Kent Lightfoot, myself, and others have been providing evidence to counter these critiques about land management and demonstrate the broad reach and beneficial outcomes of indigenous management practices, particularly the role of fire (e.g., M. K. Anderson 2005b; Blackburn and Anderson 1993; Cuthrell 2013b; Lightfoot, Cuthrell, et al. 2013; Lightfoot, Nelson, et al. 2013). Since park services and land managing agencies are tasked with using the best available science to inform their policies and practices (e.g., National Park Service 2006:22, 37, 120), it is necessary to collaborate with tribes in generating these studies so that the science reflects multiple epistemologies and values, including indigenous knowledge and practices, and not just Western epistemologies and values.

Many archaeological projects proposed today are not possible because tribes want to limit and reduce the impacts to these sites from study and development, only allowing studies that are necessary in accordance to local, state, and federal statues to proceed. The Tolay Archaeology Project was successful because it addressed questions that benefit my community and answered these questions with low-impact methodologies that reduced the negative impacts to our cultural resources when collecting archaeological data. This project represents in many ways an example of the future of academic archaeology in Central California, because the research was community-based and developed in close conversations with the broader citizenry of the Federated Indians of Graton Rancheria, not just consulting with one or another representative as is often the case in compliance or Cultural Resource Management archaeology. This project also engaged with multiple partnering agencies and institutions such as the Sonoma County Regional Parks Department, the Sonoma Land Trust, and the University of California at Berkeley that offered support for the project.

As a result of nearly three years of dialog with my community about archaeology, I was able to identify core research values for my project, which were verbally agreed upon by the consensus of tribal committee members. These core research values are: 1. Maintain the confidentiality of sensitive information in order to protect and preserve cultural resources. 2. Minimize the impacts to cultural resources in order to protect and preserve them. 3. Ask research questions that are relevant and speak to the concerns of the community in the present. 4. The project must have sufficient direct benefits to the tribe in order to outweigh the risks and/or potential impacts involved in the research.

The core research values and interests defined by my community which guided my research design toward lower-impact methodologies did not limit, and instead generated richer understandings of the history of the Tolay Valley. If a project had been designed without concern for community values, it almost certainly would have involved more excavation to maximize the number of good quality contexts under investigation. But such a strategy would have left less time to explore the broader site above the ground surface. Instead, my community guided me toward a low-impact strategy that investigated a broader area above the ground surface of the site and encouraged me to reserve excavation of deep units for only a small area on the site. This change in strategy necessitated a slight reorientation of my research questions toward what geophysical and surface artifact data could address, but it also led to the discovery of debris from a historic building and clued me into an important aspect of the site. That is, there was physical evidence for re-worked glass and a California Indian occupation of this site that lasted sometime into the late 1800's long after Spanish missionization. This new information allowed me to interpret in more physical terms the persistence of Coast Miwok people in the Tolay Valley, and how they navigated the settler colonial influences on their lives throughout the Historic Period.

The framing of the Tolay Archaeology Project around the goals and concerns of my tribe at Tolay Lake Regional Park is part of my commitment to what Goering et al. (2008) describe as responsive justice. Responsive justice not only involves distributing or redistributing resources and recognizing histories of marginalization and trauma, but also involves taking responsibility for the outcomes of research and being accountable to community partners (Goering, et al. 2008). By focusing my research on topics that can comment on and work to change existing land management policies, I am attempting to produce archaeological narratives about the past that speak to the struggles of California Indians in the present. There is no way to know what all of the future impacts and outcomes of research will be. But research that addresses contemporary concerns can be translated into policy change and can yield tremendous benefits for my tribe and other communities engaging in research.

Chapter Overview

In chapter 2, I outline the problematic early history of archaeological and anthropological research on Native Americans and the development of more inclusive laws, ethics, and practices protecting the rights of descendant communities to their heritages within these disciplines. One key issue in protests during the 1960's and 1970's was desecration of burial sites and the treatment and disposition of ancestors who were viewed as objects of study by archaeologists. Native American activism around this issue led to the federal Native American Graves Protection and Repatriation Act (NAGPRA) of 1990. With NAGPRA and other key legislation in place and advocates within the archaeological and anthropological community rethinking their theoretical and methodological approaches to the study of other peoples' heritage, the field of Indigenous archaeologies emerged. While the core of Indigenous archaeologies re-center the research on the concerns and worldviews of Indigenous peoples, Indigenous archaeologies have many different agendas, theories and methodologies to address the specific needs of the Indigenous people, nation or descendant community with which the archaeologist is working.

This chapter outlines the theoretical and methodological frameworks on which the Tolay Archaeology Project draws to accomplish a community-based, Indigenous archaeology approach to the study of Coast Miwok and Southern Pomo heritage with the Federated Indians of Graton Rancheria. This approach draws on the concepts of community-based archaeologies (Atalay 2012), responsive justice (Goering, et al. 2008), desire-centered research (Tuck and Yang 2014a), and ethnographic refusal (McGranahan 2016b; Simpson 2007, 2014, 2016; Tuck and Yang 2014a, 2014b). The core research values that emerged from the community-based process within the Tolay Archaeology Project and guided the research were: 1. Maintain the confidentiality of sensitive information in order to protect and preserve cultural resources; 2. Minimize the impacts to cultural resources in order to protect and preserve them; 3. Ask research questions that speak to the concerns of the community in the present; 4. Ensure that the project will have sufficient direct benefits to the tribe which must outweigh the risks and/or potential negative impacts involved in the research.

In chapter 3, I outline the history of archaeological research in California. California has many diverse sub-regions, and archaeologists in each region have explored different research questions in these very different areas. Research in Northwestern California has focused on social organization and households. Research in Central California has focused on the development of shellmounds along the Bayshore in tandem with changing resources in the Bay Area since the last interglacial. Research in the Central Valley, Delta, and Sierra Nevada has focused on subsistence and resource intensification. Research along the Southern Coast, having some of the oldest sites in California, has focused on the peopling of the Americas and also on the development of sociopolitical complexity. Research in the Southern Deserts has focused on the interpretation and age of rock art. One issue of critical importance to this dissertation is landscape management practices that California Indians employed to shape and manage the environment around them, most notably with fire. Alfred Kroeber and early scholars viewed California Indians as passive collectors in a benign environment. However, revisionist scholars (e.g., M. K. Anderson 2005b; Lowell J. Bean and Blackburn 1976; Blackburn and Anderson 1993) who saw California Indians as active land managers using fire to shape the environment around them. Critics of the revisionists (e.g., Broughton 1997, 2003; Vale 1998, 2002) have called for the revisionists to support their claims about the impact of indigenous lands management practices on the pre-contact Californian environment with empirical evidence. Some eco-archaeological projects (e.g., Cuthrell 2013b; Lightfoot and Parrish 2009) including the Tolay Archaeology Project are currently producing the empirical evidence to support the argument that indigenous land management practices had a significant impact on the Californian environment and should be viewed in as an integral part of contemporary management in parks and open spaces.

In chapter 4, I outline the history of artifact collecting and archaeology in the Tolay Valley since the mid-nineteenth century to the present. The thousands of charmstones, implements used in doctoring practices, collected from the dry lakebed earned it the nickname “Charmstone Lake” and an early reputation in the archaeological literature as the most prolific charmstone doctoring site in California (Elsasser 1955; Elsasser and Rhode 1996; Moorehead 1910). Despite Tolay Lake’s fame, not much formal archaeological study was conducted at the sites in the surrounding Tolay Valley. A few archaeological investigations were conducted by George Phebus (1965, 1990a) and Albert Elsasser (1955). I also offer a detailed account of the community-based process that led to the approval of the Tolay Archaeology Project, a community-based, indigenous archaeology project that investigates indigenous landscape management and the environmental history of the Tolay Valley. The methods for this project were designed to reduce the impact to this site through archaeological study. The methods and results from surface pedestrian surveys, intensive surface collection, terrestrial LiDAR topographic mapping, augering, and excavation are presented in this chapter. The methods and results of the geophysical component of this project are presented separately in chapter 5, because this mode of non-invasive investigation was especially important to the generation and revision of the excavation portion of the research design for the project and the interpretation of features and site structure.

In chapter 5, I present the methods and results of geophysical prospection. The methods discussed in this chapter are gradient magnetometry and Ground Penetrating Radar (GPR). The first survey, conducted in 2013, focused on one site on the Tolay Creek Ranch (TCR) property. This site, designated TAP-39, was surveyed in its entirety with both gradient magnetometry and GPR. There was a great deal of metal debris on the site that obscured features in the gradient magnetometry data, but the GPR method was successful in imaging multiple features and components of the site. Of interest are two planar features interpreted to be clay house floors.

The second study, conducted in 2014, focused on surveying transects throughout the lakebed and surrounding sites for potential features such as clusters of rocks that could be associated with the "charmstone site." This study served as a followup to Origer's 2011 survey of lakebed area resources and attempted to evaluate the boundaries of archaeological resources within the lakebed. The area outside of the lakebed had a very low magnetic susceptibility whereas the lakebed itself had a very high magnetic susceptibility due to an unknown geological feature. This geological feature obscured almost all of the area within the lakebed and made it impossible to evaluate cultural resources associated with the lakebed using the gradient magnetometry method.

In chapter 6, I present the methods and results of analyses of the paleoethnobotanical and faunal materials from surface collection and excavation at TAP-39. The paleoethnobotanical materials were analyzed by Rob Cuthrell and myself with Rob Cuthrell's assistance in Christine Hastorf's McCown Paleoethnobotany Laboratory at UC Berkeley. I outline the general characteristics of the macrobotanical assemblage for all samples and contexts at TAP-39. Then I discuss charred wood, nutshell, ubiquity of all identified macrobotanical taxa, and proportions of the top ten identified macrobotanical taxa. Within the discussion of each taxon category, I discuss the differences between different Excavation Units (EUs) on site and then I discuss the variation in the results from different levels within the same unit. I also discuss invasive species present in the assemblage which may represent grains that were part of the diet of site occupants in the Historic Period and compare the materials from TAP-39 to Silliman's (2000, 2004) dataset from historic Native American laborer sites near the Petaluma Adobe.

After discussing the implications of the invasive species in the paleoethnobotanical materials from TAP-39 and Silliman's (2000, 2004) dataset from historic Native American laborer sites near the Petaluma Adobe, I discuss the methods and results of the faunal analysis. The faunal materials were analyzed by Mike Stoyka and Whitney McClellan at the Anthropological Studies Center at Sonoma State University. The general characteristics of the faunal assemblage are presented with proportions for bird, mammal, fish, amphibian, reptile, and indeterminate faunal class categories. After presenting the proportional abundance of the overall faunal assemblage, I describe the proportional abundance of specific, identified taxa for each faunal class. The last consideration in the faunal assemblage section is evidence for faunal materials from the Historic Period and a comparison of the faunal dataset with Silliman's (2000, 2004) dataset from historic Native American laborer sites near the Petaluma Adobe.

In chapter 7, I explore multiple lines of evidence from the Tolay Valley to interpret the actions and activities of Coast Miwok people who engaged with this area in the Historic Period, circa 1776 to the 1920's. The central question guiding the discussion in this section is concerned with how to understand the departure of Coast Miwok peoples from the Tolay Valley when William Bihler drained Tolay Lake in 1870 to expand his agricultural operations in the valley. How were Coast Miwok institutions changed and maintained by the difficult decisions that Coast Miwok people made in order to navigate the pressures imposed on them by settler colonialism? The framework that I employ to understand this situation is indigenous refusal of settler colonialism. This chapter considers how the understanding of this history changes when the focus of analysis shifts from labor, violence, racism, and genocide to territoriality or access to the territory of indigenous peoples as being the quintessential, irreducible element of settler colonialism (Wolfe 2006:387-388). Facing the physical and political loss of territory, Coast Miwok people refused to acknowledge settler claims to this territory and settler ways of engaging with indigenous sacred landscapes. After Tolay Lake was drained, Coast Miwok people refused to return to the Tolay Valley, because the charmstones that were exposed to the air posed an immediate threat to the health and safety of Coast Miwok people. These Coast Miwok people who labored on ranches in the Tolay Valley and surrounding areas and had hunted, gathered, and worshipped in the Valley did not return to till soil in the lakebed, because of their understanding of the dangers associated with being exposed to the charmstones therein. Their refusal to engage in settler practices enabled the maintenance of indigenous ways of knowing and interacting with land and sacred placesm which did not mandate that Tolay would be off limits forever or would never be restored. Refusal, in this instance, protected Coast Miwok people and relationships to Tolay so that future possibilities for interacting with this place could emerge when the time was right. Despite the loss of land to settlers, the contemporary tribe engages with governments and agencies within the boundaries of the tribe's traditional territory—which still includes the Tolay Valley—a fact that refuses to accept the loss of this area to colonial powers. Current restoration efforts with the Sonoma County Regional Park service represent the persistence of strong and unbroken Coast Miwok and Southern Pomo connections to the Tolay Valley. Refusal is hopeful and generative, protecting the futurity of Tolay as a Coast Miwok sacred site and landscape.

In chapter 8, I conclude by revisiting the theoretical frames and main findings of this dissertation. As an Indigenous archaeology project, this dissertation and the Tolay Archaeology Project as a whole were conducted in a community-based manner in close collaboration with FIGR tribal committees. The questions, methods, and interpretations were reviewed by these committees, and the dissertation presents information that has been used to support educating the public and tribal youth and can support future environmental restoration efforts within Tolay Lake Regional Park. The theoretical concept of refusal, which is not used widely in archaeology, became important methodologically and interpretively in this research. Refusal is generative and offers new possibilities for the production of unexpected knowledge rather than producing sought-out knowledge that could have negative impacts on communities. Working with indigenous communities to explore cultural heritage and history in this way enriches our understandings of these histories and produces more relevant benefits for our community research partners.

In sum, my dissertation project provides important contributions to theorizing indigenous archaeologies, the study of settler colonialism, and the study of historical ecology and land management in Central California. Although many scholars currently engage with collaborative and community-based methods for research (Atalay 2012; Bruchac, et al. 2010; Nicholas 2008; Silliman 2008), the Tolay Archaeology Project engages methodologically and interpretively with the concept of refusal from the work of Audra Simpson (2007, 2014, 2016) and others (McGranahan 2016b; Ortner 1995; Tuck and Yang 2014a, 2014b). Methodologically, refusal offers a framework for thinking about how and why knowledge can be produced and shared. The act of refusing is generative and leads to the production of knowledge that is rooted in the desires of community partners (Tuck and Yang 2014a, 2014b). Used to interpret the actions of Native American peoples navigating the constraints of settler colonialism, refusal also offers an alternative (although related) interpretive framework to resistance for understanding indigenous peoples' engagement with land and territoriality. Due to the impacts on indigenous peoples and lands from colonization, much of the Californian landscape has been converted to non-native grasslands as pasture for cattle ranching. The Tolay Archaeology Project contributes to the debate about landscape management and historical ecology in California by providing evidence that the Tolay Valley, and potentially other interior areas in Central California, were extensive native grasslands that would have required intensive prescribed burns in order to maintain for the thousands of years that these grasslands persisted.

Chapter 2

Decolonizing Archaeological Methodologies: The Making and Remaking of Research Practices with Tribal Communities

Archaeological research has traditionally been a top down scientific process of knowledge production with little involvement from the descendant communities whose cultural resources and heritage are under investigation. With the incorporation of feminist, postprocessual, postcolonial, and Indigenous theories in archaeology, the discipline has become more accessible and accountable to publics and communities outside of the specialists who conduct archaeological research. This chapter will first summarize the history of indigenous archaeologies and argue that community-based or community-engaged approaches to research are especially important for archaeologists working with the cultural resources and heritage of Indigenous peoples. I will then present my own process for community-engaged research with my tribe showing how I generated my research questions and methods in collaboration with the tribal community and how my research was continually reevaluated and reworked throughout the course of my archaeological study.

Introduction

Increasingly over the past three or more decades, archaeologists have acknowledged the need to make their research more accessible and relevant to the general public outside of their discipline in order to stimulate broader support for the preservation of archaeological resources and the funding of archaeological research (R. L. Kelly 2015; Richardson and Almansa-Sanchez 2015). Some important theoretical movements toward greater accessibility, relevancy and inclusivity of archaeological research include: 1. public archaeology, which engages non-archaeologists in conversations about heritage management to foster public awareness of and sense of stewardship for the archaeological record (Richardson and Almansa-Sanchez 2015; Shackel and Chambers 2004); 2. multivocal and reflexive research within post-processual and Marxist archaeology, which strives to democratize research and research teams by incorporating the thoughts and interpretations of entire field crews as well as those of any interested stakeholders into the narratives that are generated as a result of archaeological research (Hodder 1997; R. H. McGuire 1993); 3. feminist archaeology, which has brought attention to the status of women in the discipline of archaeology as well as interpretations of gender in archaeological narratives (Conkey and Spector 1984; Gero and Conkey 1991); and 4. Indigenous archaeologies, which advocate for the special role that Indigenous peoples and knowledges should play in research projects that impact Indigenous resources and represent Indigenous cultures, lifeways, and histories (Atalay 2012; Conkey 2005; McNiven 2016; Watkins 2000). This theoretical and methodological trajectory in the discipline towards greater inclusivity of diverse perspectives and collaboration with descendent communities in archaeology forms the basis for my own work with the Federated Indians of Graton Rancheria in Sonoma County, California.

Some scholars are skeptical about how these social efforts within archaeology inform our interpretations and understandings of the past (McGhee 2008, 2010), claiming that archaeologists are the experts and authoritative producers of knowledge about the past. Fekri Hassan (1997:1021) compares archaeologists interpreting primary data and generating narratives about the past to medical doctors whose responsibility it is to interpret blood tests for a patient. Hassan (1997:1021) insists that we as archaeologists "fulfil our duty to the public not by humouring them, but by providing them with our expert opinion." Similar arguments have been made by scholars attempting to portray Native American activists as unknowledgeable and to delegitimize Native American peoples' rights to repatriate ancestors and sacred objects through the Native American Graves Protection and Repatriation Act (NAGPRA) (Meighan 1992, 1993). These scholars claim physical ancestral resources for Western science and knowledge production and ardently defend their ability to engage in unchecked, academic scholarship that represents tribal histories without respect to a tribe's own knowledge and traditions. Though these acts are done in the pursuit of knowledge, they undermine the sovereignty of tribal nations and harm members of tribal communities. In efforts to conduct research in a more responsible and less impactful manner, many scholars over the past twenty or more years have developed collaborative, Indigenous archaeological and museum projects with Indigenous peoples in North America and other regions of the world.

Even though there is now a very large literature on Indigenous archaeology, many scholars have argued that the theoretical agenda of Indigenous archaeology is in need of more definition and articulation (Atalay 2008:29; McNiven 2016:29; Nicholas and Andrews 1997:116). McNiven (2016:34, 36) outlines an agenda for Indigenous archaeology that attempts to broaden the ontological and epistemological boundaries of mainstream archaeology in order to make the discipline more cross-culturally sensitive and to produce understandings and interpretations of the past that are more sympathetic to Indigenous worldviews. I agree with McNiven's charge to set an agenda for Indigenous archaeology and hope to show how collaborative and community-based research shapes our interpretations of the past in ways that broaden the ontological and epistemological boundaries of the discipline and lead to much richer and deeply relevant understandings of Indigenous pasts, presents and futures.

In this chapter, I will draw on a responsive justice framework from Public Health (Goering, et al. 2008) and the concept of ethnographic refusal from Anthropology and Native American Studies (Simpson 2007, 2014; Tuck and Yang 2014a, 2014b) to articulate the agenda of my Indigenous archaeology project with the Federated Indians of Graton Rancheria (FIGR) at Tolay Lake Regional Park (TLRP) in Sonoma County, California. I will begin by reviewing the history of Native American struggles for rights to cultural resources in the United States and the creation of Indigenous archaeology and other collaborative research frameworks that seek to go beyond government-mandated consultation in working with tribal cultural resources. Next, I will describe the ways in which I have engaged with my own tribal community throughout the various stages of my research. Then, I will describe core research values, which are: 1. Maintain the confidentiality of sensitive information in order to protect and preserve cultural resources; 2. Minimize the impacts to cultural resources in order to protect and preserve them; 3. Ask research questions that speak to the concerns of the community in the present; 4. Ensure that the project will have sufficient direct benefits to the tribe which must outweigh the risks and/or potential negative impacts involved in the research. Adhering to the core research values outlined above upholds a decolonizing research paradigm that empowers my tribal community with authority and sovereignty over the research and ensures that the research products and the research itself are relevant and worthwhile. I hope to show through this case how archaeological projects and knowledges that are co-produced with Indigenous communities can lead to benefits for both archaeologists and Indigenous peoples while minimizing the potential damage or harm to tribal cultural resources and the contemporary community posed by this kind of research. Such collaborations will bring about social change within the discipline of archaeology as well as richer and more culturally relevant understandings of the past that can benefit Indigenous peoples today.

Background

Cultural Resource Legislation and Consultation

More than four decades ago, Vine Deloria, Jr. (1969) outlined how many Native American people felt about the disciplines of anthropology and archaeology in *Custer Died for Your Sins*. That is, anthropologists and archaeologists were concerned with abstract, generalizable knowledge and characterized Native peoples without consulting with these communities (Deloria Jr. 1969). For example, anthropologists such as Alfred Kroeber and Frederic Putnam of the University of California, Berkeley, perceived the tribes of California within the areas of direct Spanish missionization to be totally acculturated and their traditional cultures to be extinct. These views provided the rationale for the Bureau of Indian Affairs to acknowledge and set aside land for those tribes outside of the areas of direct missionization and to deny these same resources to tribes within those areas (Panich 2013:111). In this way, scholarship was used to further the project of settler colonialism in California and deny many mission tribes the acknowledgement of their sovereign status. Research such as this that reinforces the project of indigenous erasure and narratives of indigenous decline and settler inheritance of the landscape perpetuates the project of settler colonialism (Wolfe 2006:390).

Vine Deloria's (1969) social critique of anthropology was written just after the civil rights movement at a time of great political and social unrest in American society. Native American activists formed the American Indian Movement (AIM) and led protests to advocate for indigenous peoples' rights (Watkins 2000:3). One key issue that was taken up in these protests in the 1970s was how archaeologists treated the remains of Native American ancestors. AIM groups disrupted archaeological work during excavations, protested at museums, and called for the repatriation of human remains and sacred objects (Watkins 2000:4). This growing public tension between Native American activists and archaeologists led to the passage of repatriation legislation in 1990: the Native American Graves Protection and Repatriation Act (NAGPRA) (Bray 1996; Downer 1997; Ferguson 1996).

Although there were other laws that protected cultural resources, these early laws were more concerned with protecting resources from urban development and looting and privileged professional archaeologists as the authorities on and caretakers of these resources (Tsosie 1997:69). It was not until the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 that Native Americans received any real social justice in terms of control of their cultural heritage. NAGPRA governs the handling of Native American remains, sacred objects, and objects of cultural patrimony in both field excavation and museum contexts (Tsosie 1997:70). While this affords federally recognized tribes political power and an outlet to hold archaeologists and museums accountable to tribal communities, NAGPRA still does not address objects on non-federal lands nor does it address working with non-federally recognized tribal groups (Tsosie 1997:72). Of the tribes in America, 567 are federally recognized (Bureau of Indian Affairs 2016). However, over 350 tribes are still not federally recognized. State legislation has attempted to address some of these gaps, such as Cal NAGPRA (AB 978) enacted in 2001, which called for the recognition of claims made by state recognized—but not necessarily federally recognized—Californian tribes (Seidemann 2010:203).

As Native Americans pushed for repatriation legislation, many archaeologists, including many members of the Society for American Archaeology (SAA), did not endorse or support their repatriation efforts (Meighan 1992, 1993). Zimmerman (1997:47) states that "vested interest in the important archaeological information contained in the remains, however, compelled many of them to speak forcibly against reburial." However, after the passage of NAGPRA in 1990, many archaeologists were forced to rethink the situation and their positions; this is what Zimmerman (1997:49-51) has called the remythologizing of archaeologists' relationships with Native Americans (Zimmerman 1997:49-51). By 1991, the Society for American Archaeology "adopted a code of ethics that included a statement on collaboration and reburial" that addresses the rights of Native American people to repatriate the remains of their ancestors (Atalay 2006:289). Similarly, the current SAA Repatriation Policy recognizes both "scientific and traditional interests in human remains…" However, there is still more work to be done to advocate for repatriation and Native American rights to ancestral remains, because the current policy still privileges the Western scientific value of these remains as is evident in the statement: "Whatever their ultimate disposition, all human remains should receive appropriate scientific study, should be responsibly and carefully conserved, and should be accessible only for legitimate scientific or educational purposes" (www.saa.org).

Since the 1990s, there have been progressive updates and amendments to NAGPRA and other cultural resource laws around the country that have given Native American tribes more power in managing and protecting cultural resources. In California, Senate Bill 18 and Assembly Bill 52 amended the California Environmental Quality Act (CEQA). Both of these amendments have allowed for tribes to consult with a wider range of agencies. An important facet of SB 18 was establishing a process for protecting sites through establishing cultural easements (Middleton 2013:1067). One of the problems with CEQA that was not addressed until the passage of AB 52 in 2014 is that impacts to cultural resources have not been considered as significant as environmental impacts because of Western epistemological biases in environmental law (Middleton 2013:1070). An important facet of AB 52 is that it "establishes a formal consultation process for California tribes as part of the CEQA and equates significant impacts on 'tribal cultural resources' with significant environmental impacts (Rivasplata and Bass 2014:1). While giving tribes much more power to protect cultural resources than ever before, these laws still have limitations. In the consultation process, the resolution of disagreements about impacts to cultural resources and the appropriate level of mitigation ultimately depend on citizen litigation rather than defined standards for preservation and protection. This allows agencies some leeway to follow the "letter" rather than the "spirit" of the law, and may still result in unnecessary damage and loss of cultural heritage in the wake of urban expansion and development.

Indigenous, Feminist, and Collaborative Archaeologies

Though government mandated consultation is vital to protecting cultural resources and creating dialog about cultural heritage, these kinds of projects are more restricted by the constraints of development and often have less potential to produce archaeological studies that fully meet the needs of communities. Atalay (2006:292-293) makes a critical distinction between government mandated consultation and collaboration. In a consultation framework, archaeologists are accountable to cultural resource laws and agencies that allow for a minimum of comments and involvement from descendant communities but does not require more. In a collaborative framework, archaeologists are directly accountable to descendant communities and are required to incorporate much more sincerely the concerns of descendant communities into the research. Putting the community's concerns first may mean that some of the primary research questions developed by the researcher may remain unanswered or unpublished because of concerns with confidentiality, but the research also has far more potential to learn about the community than may have otherwise been possible (Chipps 2004; Panich 2011; Simpson 2007, 2014).

The concerns of descendant communities are very diverse, and as many authors have stressed, there is also a great diversity of goals within and approaches to Indigenous archaeologies (Bruchac, et al. 2010; Dongoske, et al. 2000; McNiven and Russell 2005; Nicholas and Andrews 1997; C. Smith and Wobst 2005; Swidler, et al. 1997; Watkins 2000). While Indigenous archaeologies escape simple definition, they are not so broad that they include all archaeological studies of Indigenous people regardless of theoretical approach (e.g. McNiven and Russell 2005). Giving some definition to Indigenous archaeologies, Nicholas (2008:1660) states that:

> Indigenous archaeology seeks to (1) make archaeology more representative of, responsible to, and relevant for Indigenous communities; (2) redress real and perceived inequalities in the practice of archaeology; and (3) inform and broaden the understanding and interpretation of the archaeological record through the incorporation of Aboriginal worldviews, histories, and science… In its broadest sense, Indigenous archaeology may be defined as any one (or more) of the following: (1) the active participation or consultation of Indigenous peoples in archaeology…; (2) a political statement concerned with issues of Aboriginal self-government, sovereignty, land rights, identity, and heritage; (3) a postcolonial enterprise designed to decolonize the discipline; (4) a manifestation of Indigenous epistemologies; (5) the basis for alternative models of cultural heritage management or stewardship; (6) the product of choices and actions made by individual archaeologists; (7) a means of empowerment and cultural revitalization or political resistance; and (8) an extension, evaluation, critique, or application of current archaeological theory.

Though this lengthy definition leaves a lot of room for what Indigenous archaeologies can be and do, this paper will address the aspects of Indigenous archaeologies that seek active engagement with Indigenous peoples in efforts to decolonize the discipline of archaeology and make research more relevant and mutually beneficial for tribal research partners. Archaeology and collecting have long histories of damaging and extracting cultural resources, but a decolonized practice of archaeological research can also be used as a tool that benefits communities as well. As described by Linda Smith (L. T. Smith 1999:39), decolonizing research methodologies can be accomplished by centering and refocusing the research on the concerns and worldviews of Indigenous people and approaching research from our own perspectives and for our own purposes. Similarly, "…working inside a more complex and dynamic understanding of what one, or a community, comes to know in (a) lived life" is central to what Eve Tuck and Wayne Yang (2014a:231) describe as a desire-based framework for research. This shift toward the desires and concerns of Indigenous communities constitutes an epistemological shift in the way research is carried out (Tuck and Yang 2014a:243).

Some archaeologists have not made this epistemological shift in their research because they are reluctant to engage with reflexivity, the politics of identity, and theories from postprocessual, feminist, and indigenous frameworks (Meskell 2002:279). Without reflexivity and the broadening of the epistemological boundaries of the discipline, archaeologists can easily slip into narratives about the past that uphold colonialist, imperialist, androcentric, and ethnocentric values, leaving little space for others (non-white and/or non-male people) in these narratives. Critically and reflexively engaging with the positionality of researchers and how, what, and whose knowledge is produced is fundamental for challenging the dominant discourse of the discipline. This reflexivity and engagement with positionality is an important facet of both feminist and indigenous archaeologies, even though the conceptual base or bottom line for these movements within the discipline are different (Conkey 2005; Lane 2011). Excusing oversimplification in the brevity of this explanation, the bottom lines for indigenous and feminist archaeologies respectively are self-determination and sovereignty versus narratives about women and gender that resonate with women today (Atalay 2012; Bruchac, et al. 2010; Conkey 2005, 2007; Conkey and Spector 1984; Nicholas 2008; Spector 1993; Tringham 1991; Wilkie and Hayes 2006). And although not all feminisms address the experiences and multifaceted lives and values of Native women, non-indigenous feminist scholars can include Native voices in feminist discourse through engagement in reciprocal and practical dialogue with research partners (Mihesuah 2003:8).

While feminist and indigenous conceptual bases or bottom lines connect some aspect of heritage or "the past" to contemporary or "present" people, the relationship of the past to the present in each conceptual framework may be different. Non-indigenous archaeologists may view the past as inanimate and informational, whereas the heritage of indigenous peoples is "deeply culturally and socially embedded" (Wobst 2010:24). That is, stories, cultural resources, and ancestors from "the past" have the potential to interact with people, animals, rocks, trees, and the landscape in "the present" (Swidler, et al. 1997). Thus, archaeologists who work with indigenous communities are not making "usable pasts" or "present-ing" the past. Archaeologists are interacting with components of contemporary indigenous worlds (heritage and archaeological resources included) in appropriate ways, so that "cultural resource" components are not negatively impacted and do not negatively impact other components of the world including the lives of indigenous peoples. In order to protect against the potential impacts posed by research, archaeologists can engage in collaborative or Community-Based, Participatory Research (CBPR).

Sonya Atalay (2007:255; 2012) employs a model of CBPR derived from the work of Paolo Friere (1993, 1998a, 1998b) in order to collaboratively identify community needs for research, develop strategies, collect and interpret data, and continuously engage in dialog about the effectiveness of the project (Atalay 2007:255). Similar to Atalay's (2007, 2012) approach, I draw on a model for CBPR that incorporates responsive justice. Goering et al. (2008) describe responsive justice as not only the (re)distribution of benefits to marginalized groups but also the recognition of a group's histories of marginalization and trauma and an ongoing responsibility to community research partners. Histories of marginalization and trauma may lead groups to be excluded from studies, sometimes through self-exclusion (Goering, et al. 2008:46). In responsive justice, we cannot only ask people to participate; we must achieve a "reciprocal relationship of respectful engagement and attentive concern" where power is shared in deciding how research is conducted before, during and after the study (Goering, et al. 2008:46). An ongoing responsibility to the community and a recognition that justice is never finished are essential to responsive justice (Goering, et al. 2008:49). Employing these tenets with CBPR "leads to a reenvisioning of traditional research ethics into a more relationship-based research ethics" (Goering, et al. 2008:50) and produces research products that are more relevant to community research partners.

Refusing Research

Much of the literature on CBPR already discussed is optimistic about the role research can play in improving the lives of communities. However, Eve Tuck and Wayne Yang (2014b:813) remind us that "Research may not be the intervention that is needed." Tuck and Yang (2014b:813) challenge the justification that more knowledge production through research will innately improve our lives and further argue that some knowledge, stories, and experiences should never be removed from their places of origin and put into an academic archive. Researchers should actively "refuse" this sort of production and dissemination of knowledge. Audra Simpson (2007) states that "…these refusals speak volumes, because they tell us when to stop. Whether or not we wish to share that is a matter of ethnography that can both refuse and also take up refusal in generative ways" (Simpson 2007:78). Said in another way, refusal is a generative stance that can produce unexpected knowledge when the route to knowledge that was sought is refused by a community or a researcher (Tuck and Yang 2014b:812).

In archaeology, refusal is not a concept that has been explicitly articulated, but it has been implicitly used in many community-based projects. Refusing to engage in traditional archaeological research, and instead engaging with communities to define the goals and parameters of research produce tremendous results. Many of these projects with Indigenous communities around the world gravitate towards cultural heritage management, intellectual knowledge rights, and repatriation of material cultural heritage items such as community initiatives of the Intellectual Property Issues in Cultural Heritage (IPinCH) project based at Simon Fraser University in British Columbia (http://www.sfu.ca/ipinch/). Letting research be guided by desire and community needs produces projects that generate knowledge about the relationships between communities and their cultural heritage as well as knowledge about a community's past and future if appropriate.

Reconciling Multiple Ontologies in a More Inclusive Archaeology

McNiven (2016) identifies challenges to Indigenous archaeology such as the dualities created by Western science in the present that are imposed on our interpretations of the past. Some examples of these dualities are science vs. religion, subject vs. object, animate vs. inanimate, culture vs. nature, global vs. local. Gell has demonstrated that “agency can be ascribed to ‘things,’” which function as agents in social relations. However, many non-academic, field archaeologists completing compliance projects view artifacts and the remains of living beings including human ancestors as inanimate objects that cannot impact the health and wellbeing of contemporary people and the world around them. These views that are contrary to the epistemologies of indigenous peoples can have profound and serious consequences for cultural resources and indigenous communities.

To scientists, the value of these objects is informational, and this value is lost once the objects are separated from their original context or location. To some Indigenous peoples, these objects still retain their value, because they were made by ancestors who put their spirit into making them, and no matter where they are moved, they are still “in use” by descendants whether they physically engage with them or not. From the perspective of the archaeologist, an object without a context or original location is no longer a priority to protect and preserve, whereas to Indigenous peoples, these objects will never cease to be a priority. Inherent in the dualities used to describe these objects is a compartmentalization that pervades much of Western knowledge and denies the incorporation of more holistic knowledges of Indigenous peoples (Nadasdy 2003:123-126). These dualities and compartmentalizations of knowledge are antithetical to an archaeology that is inclusive of all peoples, ontologies and epistemologies. Therefore, a more inclusive archaeology is one that promotes collaboration and multivocality.

Though it may seem to be more democratic to represent many diverse perspectives in a multivocal montage within a document or on park signage, these perspectives will not be treated equally by the reader. In certain circumstances the simultaneous presentation of Western and Indigenous perspectives can actually diminish the authority of the Indigenous knowledges that are presented. Uncritically setting Western and non-Western perspectives side by side, especially in the home arena of Western knowledge presentation such as an academic journal article, reinforces the authority of the Western perspective over the non-Western as a “natural” conclusion. Non-Western perspectives enter this arena in the position of folk knowledges upholding another false dualism between Western and non-western ontologies and epistemologies.

Project Description

The Tolay Archaeology Project is a Community Based Participatory Research project that I developed and implemented in collaboration with the Federated Indians of Graton Rancheria (FIGR) for my dissertation at UC Berkeley from 2009 to the present. Even though the field work for this project was carried out in 2013 and 2014, the years leading up to the field work and the years after were occupied by close collaborative engagement with FIGR. I am an enrolled tribal citizen of FIGR, so contacting the tribe on my arrival at UC Berkeley about my plans to initiate a project was straightforward. I was directed to FIGR’s Sacred Sites Protection Committee (SSPC) which is the group of tribal citizens that directly reviews all requests for consultation about archaeology and cultural resource management issues. I began attending monthly meetings of the SSPC as well as my tribe’s civic and social/family events such as General Council meetings, Tribal Council meetings, and tribal picnics in order to meet tribal citizens from other families and talk to them about my potential work. I also participated in the Coast Miwok Language class for about two years from the fall of 2009 through the summer of 2011 and met more of the tribal citizenry there. Once the Tolay Advisory Group (TAG) committee was created in 2012, I actively participated in the monthly meetings of this committee as well.

My active participation in FIGR tribal events and talking to tribal citizens on an individual basis over the first two to three years of my graduate program helped me form my initial ideas about what kind of project I wanted to propose to the FIGR Tribal Council (the governing body of the tribe) and SSPC. My project evolved out of a somewhat new co-management agreement between FIGR and Sonoma County Regional Parks Department (SCRPD) to develop a master plan for Tolay Lake Regional Park (TLRP) (see figure 1.1 for location), including trails and facilities development, management of cultural and natural resources, and cultural and natural resource interpretation. I proposed to study charred botanicals from old wood and seeds in the archaeological sites in the Tolay Valley in order to help FIGR and SCRPD better understand the history of environmental change in this valley and inform our plans for restoring indigenous species of plants and animals in this park.

Even after this proposal was approved by SSPC and Tribal Council, I continued to consult and collaborate with SSPC and the TAG committee (after 2012) in order to receive guidance about the appropriate way to conduct my archaeological research. In August of 2013, I also sought out the guidance of over twenty tribal citizens, most of whom were elders, in the form of personal guidance interviews about specific archaeological methods and research questions that I would explore in my project before any excavation or invasive fieldwork began in the fall of 2013. I reported the results of this guidance to Tribal Council who approved my project to proceed. I continued to consult with SSPC and TAG throughout the field seasons and laboratory analyses conducted in 2013 and 2014. In the summer of 2015, the bureaucratic landscape of the tribe changed yet again with the creation of a Tribal Historic Preservation Office (THPO). I am also consulting with the THPO as well as the SSPC and TAG as I finish analysis and write up the findings of my research.

Discussion

Considering the history of marginalization and trauma that my community, like many others has undergone through settler colonialism and colonial research, I went to great lengths to engage in dialog about the values that research has for my community. Drawing on my experiences working with tribal citizens and committees of FIGR as well as conversations about my project in particular, I identified in collaboration with my community core research values for my project. These core research values are similar to the “measures of success” described by Sonya Atalay (2012:253-257) that are part of a formal research agreement and evaluation. However, the core research values that were considered during regular check-ins and evaluations in my project were discussed verbally and approved by consensus of committee members. These core research values are: 1. Maintain the confidentiality of sensitive information in order to protect and preserve cultural resources. 2. Minimize the impacts to cultural resources in order to protect and preserve them. 3. Ask research questions that speak to the concerns of the community in the present. 4. Ensure that the project will have sufficient direct benefits to the tribe, which must outweigh the risks and/or potential negative impacts involved in the research.

Maintain Confidentiality and Representation of the Tribe's Heritage

Recognizing the potential for research to produce narratives and representations of Native American people that do more harm than good or are only self-serving, the Federated Indians of Graton Rancheria reserve the right to review and comment on all products of the research. In an effort to reduce the potential for information to be released, I developed an ethical research agreement form (see Appendix A) that every person is required to sign before starting work on the Tolay Archaeology Project. This agreement makes clear that everyone involved in this project has a responsibility to consult with the tribe and other research partners before any product or piece of information about the project is shared with someone who is not involved in the research.

The most sensitive information in this project is the locations of archaeological resources. Disclosing the location of archaeological resources in publications can lead to the looting, desecration and damage of archaeological resources and cultural heritage. As a result, I do not disclose the exact location of any archaeological sites in presentations or publications. And while I did need to bring a student crew to the site to conduct field work, they all signed the confidentiality agreement and were given cultural sensitivity training. Students who were brought to the area for class visits and educational purposes were not taken to specific archaeological sites and were only shown the broader landscape.

All site visits, presentations, and publication materials are vetted by two committees before they are approved. This does not always mean line by line edits for every paper and presentation that I write. In practice, I have a corpus of information that I have presented to the committees that has been reviewed and deemed appropriate for public consumption. This confidentiality agreement and close review of the interpretations of my research shape the outcome of that research in profound ways. For example, research questions from the very inception of the project have centered around the theme of environment, ecology, and restoration. This interest in environmental issues reaffirms a community value in being caretakers of the land and an intimate reciprocal relationship with this land. If the land is sick or full of invasive species of plants that push out Indigenous species important for basketry, food and medicine, the community's ability to maintain cultural practices is severely impacted.

Low Impact and Adaptive Methodologies

In order to collect information about archaeological resources in the Tolay Valley with as little impact to the sites as possible, I employed a low impact strategy that included geophysical survey, surface artifact surveys, terrestrial LiDAR topographic mapping, and augering in order to learn about the structure of the archaeological site. These low impact methods allowed my research team to identify activity areas on the site where there was residential, food processing and refuse areas. These were critical factors in deciding where to strategically place small excavation units from which we could study botanical materials and learn about the environmental history of this valley. These field methods were adaptive and flexible, and changed periodically based on our findings mid-field season. If any materials were suspected to be sensitive (for example, burned beads which are often associated with burials), the field crew would abandon working in the area where these materials were found. Constant vigilance, reassessment, and communication with tribal committees kept everyone abreast of the limits of our research and when we needed to stop.

Investing much time and effort in geophysical survey techniques such as Ground Penetrating Radar (GPR) have proved to be very productive for research and site protection purposes. Using GPR to record images of features in the ground has allowed me to document impacts to the site from cattle grazing making the case for excluding this site from grazing. I have also been able to document intact architectural features such as house floors. In combination with surface artifacts, I have identified areas where people were living throughout time and been able to argue that Coast Miwok people maintained a social memory of sites in the Tolay Valley and returned to these sites even after being removed from the landscape through colonization. This is part of my effort to go beyond just prospecting for features to excavate as geophysics has been used by many archaeologists. As Larry Conyers (2012:183) argues, GPR data can be used to ask anthropological questions and relate these data back to interpretations about people and social behaviors that would not be possible to test through excavation alone or other means. The findings of the Tolay Archaeology Project contribute to the development and refinement of geophysical archaeology as research in its own right, not geophysics as solely the prelude to more invasive studies.

Relevancy of the Research and Research Products

In my conversations with tribal citizens and committees about a potential project, themes around the possibilities for environmental restoration work and Indigenous landscape management in the Tolay Valley repeatedly emerged. Therefore, I designed an archaeological project that investigates the environmental history of the Tolay Valley through macrobotanical and microbotanical materials present in the archaeological sites to provide local, historical information about the ecology of the valley. These botanical data will help create a case for including Indigenous land management practices in future restoration projects and ongoing maintenance within the park.

Whether these Indigenous management practices have essential roles in maintaining healthy environments, particularly the role of cultural burning, is an argument that has been debated recently in the ecological literature. The alternative argument that Indigenous landscape management did not impact the "natural" ecology (e.g. Vale 1998, 2002) supports many land management policies that exclude or are antithetical to the ways these lands were managed by Indigenous people for thousands of years. My findings support the argument that many plants and animals in California became dependent on Indigenous management regimes, and the absence of such management due to fire suppression policies beginning in the 19th century (along with the introduction of invasive species, agriculture, and ranching) contributes to the rarity of certain indigenous species today. Some of these rare species are used for basketry, food, medicine, or other purposes by Native Californian people and are now difficult to access, especially for elders. Co-management in TLRP offers FIGR the potential to access protected botanical resources so that it will become easier for our tribal citizens to continue practicing certain aspects of our traditional culture. But first, the case must be made for generating a better understanding of the range of past resources used by tribal people and then valuing the restoration of these indigenous species of plants and animals. A crucial issue is working with tribal citizens to employ Indigenous practices to manage them. The products of my research such as conference presentations, academic articles, and publications in non-academic venues make this case.

Direct Benefits to the Tribe

In addition to the academic products of my research, I have developed educational materials for youth and adults about Tolay and archaeological research during the course of my project. I worked with the youth coordinator of the Federated Indians of Graton Rancheria to write a history of Tolay for a youth hike at Tolay Lake Regional Park to teach tribal youth about the history of this sacred valley. I participated in other youth hikes and cultural activities to help teach tribal youth about other places in our tribe's territory. And I organized a GPS (Global Positioning System) workshop for Sacred Sites Protection Committee members in order to raise the technical literacy of our tribal monitors and cultural resource managers. Bringing knowledge back to my tribe and increasing the technical literacy of tribal members provides the tribe with more options and potentially more efficient ways of protecting and managing our cultural heritage.

During my research at Tolay, I have been able to update archaeological site records for the resources in the park. My continued assessments of these resources in the valley gives the tribe better information about how to protect these resources when our committees are consulting with Sonoma County Regional Parks about their master plan for developing trails, buildings, and infrastructure for this park. And I am also creating a tribal narrative that will inform the master plan that is based on my conversations with elders and my archival and archaeological research for my dissertation.

Conclusion

By focusing my research on topics that influence existing land management policies, I am attempting to produce archaeological narratives about the past that speak to the struggles of Coast Miwok and Southern Pomo people in the present. The framing of this archaeological project around issues of the present and future development at Tolay Lake Regional Park is part of my commitment to what Goering et al. (2008) describe as responsive justice. Responsive justice not only involves distributing or redistributing resources and recognizing histories of marginalization and trauma, but also involves taking responsibility for the outcomes of research and being accountable to community partners (Goering, et al. 2008). Goering et al. (2008:49) argue that justice is never done and long after the project is over, researchers should revisit the work they have done with communities and re-evaluate if the solutions and outcomes of the research continue to meet the needs of the community.

There is no way to know what all of the future impacts and outcomes of research will be. I believe that representing Native Californian people as being active land managers rather than passive collectors will have a positive impact on these communities. My research team also strives to change land management policies in our area with our service hours and grant monies, because without the follow-up of political advocacy or applied practice, telling histories about Indigenous landscape management in the past will have little relevancy to my community today.

But research that can be translated into policy change can yield tremendous benefits to communities and serve as precedents for future efforts elsewhere. And the outcomes of this research should be revisited and adapted often so that the relevance of such work is not diminished.

By co-constructing the research, this project recognizes and refuses certain kinds of histories and representations of Coast Miwok people. In doing so, there is a conscious refusal to engage with particular methods, theories, research questions. Conducting research, discussing interpretations, and publishing only certain kinds of data protects the rights of the tribe to self-determine what is beneficial for the public to have access to and know. The refusals in this project are also generative. Refusing to do unnecessary damage to sites has directed my research towards a more intensive focus on non-invasive methods that have enabled me to understand more about the structure of the site than would have been possible through traditional excavation units. The findings of this research will in turn contribute to refining geophysical archaeology in Central California and provide an alternative model for research that is less impactful and more informative than studies have been in the past.

Chapter 3

A History of Research in California Archaeology: Diversity, Complexity and the Reimagining of Indigenous Peoples as Land Managers

In Chapter 2, I set the tone of this dissertation as a Community-Based Participatory Research (CBPR) project that addresses issues relevant to tribal partners, in this case, the tribe in which I am enrolled. CBPR projects, especially those conducted by California Indian scholars with their own communities, account for very few of the total number of archaeological projects conducted throughout the state. In chapter 3, I will broaden the scope of my discussion of archaeological research to explore the range of topics that archaeology has addressed in California in order to situate this study in the context of regional traditions of scholarship and the history of research in this unique and diverse state.

The diversity and uniqueness of California is unparalleled within the North America (Lightfoot and Parrish 2009). The California Floristic Province is one of only five places in the world that has a Mediterranean climate characterized by cool, wet winters and dry hot summers, including the Mediterranean Basin, central Chile, the southern tip of Africa, and parts of Australia (Quinn and Keeley 2006:22-23). California also has more endemic plant richness than any other U.S. state (Harrison 2013:44). In terms of the diversity of indigenous peoples, between eighty and one hundred separate Native American languages were spoken within the modern political boundaries of the state in pre-contact times, which is approximately 20 percent of all the languages spoken in North America (Lightfoot and Parrish 2009:7).

California is also unique in that Native American peoples of this region engaged in hunting and gathering subsistence practices and also maintained some of the highest population densities in North American north of Mexico (Lightfoot and Parrish 2009:4-5). High population densities and complex societies have traditionally been thought to result from more intensive subsistence strategies such as agriculture, and thus, the California case has puzzled scholars and defied these traditional anthropological models (T. L. Jones and Raab 2004; Price and Bar-Yosef 2011:166). Instead of engaging in agriculture, most California Indian peoples found other ways of increasing the productivity and biodiversity of the land by actively managing it with a range of different techniques, controlled burning being one of the most influential in shaping the environment (Lowell John Bean and Lawton 1976; Lightfoot and Parrish 2009). Because of this uniqueness and diversity, more recent scholars (e.g., Arnold 1996; Lowell John Bean and Lawton 1976; Lightfoot and Parrish 2009) have argued that California is an excellent place to explore anthropological issues such as the rise of social complexity, migration and the peopling of the Americas, and strategies that make societies resilient to climate change.

In this chapter, I will offer a brief overview of previous archaeological research conducted in the various regions of California and contextualize the history and development of archaeology in the state. Then I will discuss what I see as being one of the more relevant archaeological topics to the lives of California Indians today, that is debates about the extent and impact of indigenous landscape management and controlled burning on California's landscape and ecology. New evidence from eco-archaeological research in California for indigenous management of these landscapes has much to contribute to the debate about land management and the critique of concepts such as “wilderness” area. Though many national parks were preserved because they exhibited characteristics of “wilderness,” this idea is a romanticized fabrication of the past landscape that is entangled with settler colonialism and the removal of Native American people from lands and histories in America (Cronon 1995:79). The re-envisioning of California Indians as active land managers and pre-contact landscapes as anthropogenic can produce narratives that offer strong critiques of the removal of Native American people from these physical and intellectual spaces. The evidence for land management can also support the reincorporation of indigenous perspectives and management techniques in contemporary land managing policies and on-the-ground management of parklands.

California and its Sub-regions

For more than one hundred years, scholars and enthusiasts of pre-contact Californian cultures have tried to make sense of the California region of North America. To even discuss the idea of a cohesive California archaeology and ethnography immediately situates the frame of reference within modern political boundaries. These boundaries were drawn by Spanish, Mexican, and American colonizers in the 18th and 19th centuries, and do not reflect the boundaries of the multitude of indigenous nations within the now modern American state of California. These boundaries provide a problematic framework for reconciling the immense amount of diversity between the many, diverse California Indian nations, and they crosscut the territories of many California Indian groups in the north (e.g. Klamath), east (e.g. Paiute), and south (e.g. Kumeyaay).

Many other scholars have created their own versions of what they argue constitutes “California” as unit or regional area of research. A synthesis of the way California has been conceptualized through the 1970s can be found in Heizer (1978b). Powers (1877), Holmes (1919), Kroeber (1904, 1936, 1972[1925]-a, 1972[1925]-b), Murdock and O’Leary (1975), Driver (1969), as well as Heizer (1978a) all used linguistic and cultural information to construct a “California culture area” for their studies rather than using the modern political boundaries of the state. However, using these modern political boundaries to define California as a unified region has some merits, especially for contemporary archaeological research. As Chartkoff and Chartkoff (1984:14) have noted, many of the funding sources for research projects comes from the state level and is concerned only with the lands within its modern borders. Since the modern political boundaries influence the way that the state and federal agencies interact with tribes and this area has been treated as a whole political unit for a century and a half, many tribes in this broad region have also embraced a pan-California Indian identity and shared set of experiences and histories (Chartkoff and Chartkoff 1984:15).

Since the writing of two seminal texts, Michael Moratto’s (2004[1984]) *California Archaeology* and Chartkoff and Chartkoff’s (1984) *Archaeology of California* in the 1980’s, research in California archaeology has referred to the modern political boundaries of the state as a single entire unit with sub-regions based on geography for convenience. The division of California into sub-regions is partially due to a better understanding of paleoenvironment and the diverse ecological and geomorphological factors that influenced the homelands and cultures of

California Indians throughout the state (Arnold and Walsh 2010:4-5). Though the borders between these sub-regions are largely geographical, they also incorporate cultural and linguistic factors from the work of ethnographers (Arnold and Walsh 2010:5). While many books and articles about the state as a whole have attempted to tell a unified chronological story of the state and treat the development of ethnographically observed regional diversity (Arnold and Walsh 2010; Arnold, et al. 2004; Fagan 2003), Jones and Klar's (2007) edited volume updating Moratto (2004[1984]) and Chartkoff and Chartkoff (1984) remains largely topical, rather than strictly chronological, in its treatment of California archaeology. While many themes are studied throughout the state, certain trends and themes in research questions have developed as specialties within various regions of the state. These trends are not by any means exclusive to these regions, but they are highlighted in the regions that are well-known for them. The goal of this section is to offer a short survey of the themes that archaeologists are currently exploring in the various regions of this vast and diverse state of California.

Northwest Coast

The Northwest Coast of California is unique among California lifeways because of the long tradition of fishing communities that live there. The use of acorn as a dietary staple is also cited by scholars as connecting this region with California rather than it only exhibiting attributes from the Pacific Northwest (Arnold and Walsh 2010). Tribes from this area build redwood plank houses and dugout canoes, make shell bead money from *Dentalium* (obtained from the Pacific Northwest Coast around Vancouver Island), and use bone harpoons to hunt marine mammals (Arnold and Walsh 2010). Because the tribal groups relied on seasonal salmon runs as a major source of subsistence, extensive fishing weirs were constructed to funnel the salmon into a small opening where they could be netted or speared (Arnold and Walsh 2010; Lightfoot and Parrish 2009). The weirs were massive projects that required labor from the entire community, and so the social organization of these groups reflected the ability of head men or chiefs to direct non-kin labor. The organization and synchronization with other groups was extremely important as well. The groups upriver would only collect salmon for a few days to a few weeks at a time in order to allow remaining fish from the run to swim downriver through the territories of other tribes (Arnold and Walsh 2010). Fish were also allowed to swim out to the Pacific Ocean and back so they could spawn and continue the cycle.

One of the first archaeologists working in the area was L. L. Loud, who was instructed in 1913 by A. L. Kroeber to survey the area around Eureka Bay (Heizer 1970). Loud catalogued many sites, but as is evident from the letters between himself and Kroeber, he had more work than he could handle and many sites were not surveyed (Heizer 1970). Hildebrandt and McGuire (2002) offer a review of the work that has been done in this area. Most work before 1984 focused on settlement patterns. More recently, Tushingham (2009) has been studying the issues of subsistence strategies and resource intensification, economy, social organization, and household analyses of redwood plank houses.

San Francisco Bay and Central Coast

The most striking features of the San Francisco Bay Area (SFBA) are the massive shellmounds that prehistoric inhabitants built. Thus, in this region, there has been a lot of research concerning the built environment and landscape management. One of the first of such projects taken up in the area was to document the numerous shellmounds that surrounded the Bay. Nels Nelson, as well as others such as Max Uhle, did extensive work in this area at the beginning of the 20th century and recorded and/or excavated many shellmounds—some still extant and some destroyed or capped under urban development projects (Heizer 1978b:12). Since the early 20th century, urban development and expansion has been the main source of disturbance to mound sites, however, looting and mining "midden" soils for gardening and the construction of tennis courts has also contributed to the impacts to these sites (Luby, et al. 2006). Luby et al. (2006) offer a reanalysis of the early work done on shellmounds in the SFBA, and Lightfoot and Luby (2012) also review data on anthropogenic mounded landscapes from across North America.

The mounds that we know of today in the SFBA developed in the context of ecological changes taking place around 11,000 to 10,000 years ago due to climate change and sea level rise. Before these changes a large river ran through the Sacramento delta and out the golden gate. Studies of old sediments from the bay show that sea level rise quickly inundated the Bay Area, and by about 6000 BP, the bay had just about reached its fullest extent (Lightfoot and Luby 2002:265). From 6000-3000 BP, there was a decline in sea level rise, and tidal marshes and mudflats developed with booms in the number of oyster beds around 2500 BP.

With this ecological context in mind, Lightfoot and Luby (2002) offer two case studies in the development of SFBA shellmounds which they discuss in terms of the classic chronological designations for this region: the Early Period from 5000-2500 BP, the Upper Middle Period from 2500-1700 BP, the Lower Middle Period from 1700-1100 BP, the Late Period, Phase 1 from 1100-1500 BP, the Late Period Phase 2 from 1500-1700 BP. They find that the Middle Period, between 2500-1100BP, was a "golden age" that experienced prolific construction and use of shellmounds as residential sites compared to other periods (Lightfoot and Luby 2002:280).

Lightfoot (1997:129, 141) argues that the late development of the estuarine system and the exploitation of the resources becoming available to hunter-gatherers during the Middle Period is the primary reason why these mounds developed along the Bayshore during the Middle Period and not earlier. The record of earlier sites is obscured though, by bay waters and mud as well as current stabilization of this environment (Lightfoot 1997:141). People built mounds to keep low-lying bayshore sites above water in the winter. In addition to being used as residential sites, these mounds were positioned advantageously close to water resources and developed visual, symbolic and ritual importance over time. They marked the land where ancestors were buried and became markers of traditional use areas and territory controlled by the descendants of communities living at particular mounds (Lightfoot 1997:141).

Central Valley, Delta, and Sierra Nevada

The focus of research in the Central Valley has been concerned with the study of subsistence strategies, optimal foraging, resource intensification, demographics, and obsidian hydration dating. Scholars such as Jack Broughton (1994b) have found evidence for resource depression and harvest pressure that necessitated an intensification of subsistence strategies around 4000 BP. Special purpose sites, such as bedrock milling (BRM) stations, have also been connected with subsistence, and Jackson (1991:301) in particular explores the role of women's food procurement and production activities as fundamental in structuring subsistence and settlement systems in this region. Obsidian artifacts are common on sites from this area as well, and hydration dating has been performed on obsidian projectile points to help tighten the chronology for the region that had relied on artifact seriation in the past (Arnold, et al. 2004:42; Rondeau 1999). This method of dating artifacts directly has been particularly important in the Central Valley and Sierras where sites are often disturbed by bioturbation and unlikely to produce intact contexts (Hull 2007:190).

Southern Coast

This region has some of the oldest sites in California (and the Americas) which has led some scholars to theorize and model early migrations into the Americas to or through this region. Jon Erlandson (2002; 2007) argues that the first settlements in California were established by people using a water route as well as a land bridge from Asia into America, and the water route could have led to peopling of the Americas before or during the time when people used the land bridge. Erlandson et al. (2007) present the idea of a kelp highway, which maritime peoples navigated by sea, as a strip along the Pacific rim from NE Asia to Alaska and British Columbia and south to Baja California. This kelp highway provided both a wealth of subsistence resources and a calmer waterway for maritime travelers who could essentially island hop down from Asia to California and beyond (Erlandson, et al. 2007). Arguments for this route are based on evidence for maritime culture and seafaring at old sites (more than 9,000 BP) on the Channel Islands—i.e. microblade technology in combination with shellfish and fish dominated faunal assemblages and the fact that an ocean-going boat of some kind was required to access the Channel Islands from the distant mainland (Erlandson 2002; Erlandson, et al. 2005; Erlandson, et al. 2007; Erlandson, et al. 1996; Raab, et al. 2009; Torbin C. Rick, et al. 2005).

This alternative route challenges the “Clovis first” argument that all Native American peoples came from groups of big game hunters crossing the Bering Strait via a land bridge and radiated out into its various regions. These early groups shared a “fluted” point lithic technology that appears in the center of the continent. Work by Rondeau et al. (2007) has supported the idea of the kelp highway by arguing similarly that there are two traditions that need to be considered along the California coast: microblades at San Clemente Island and fluted points of the interior and coast. The former would have made efficient use of material and probably descended from a Northern arctic tradition of seafaring and boat mending. The latter probably came from a big game hunting tradition on the continent (Rondeau, et al. 2007).

Other scholars, such as Jones and Klar (2005) have also suggested that the technology for seafaring crafts in Southern California (i.e. tomols) may have been brought to this area via contact with Polynesians seafarers. This argument is based on archaeological evidence of punctuated change in boat construction and fishhook style as well as linguistic similarities between Proto-Central Eastern Polynesian and Chumash for *tomol* or ‘plank canoe’ and Gabrielino for ‘sewn plank canoe’ and ‘boat’ (T. L. Jones and Klar 2005, 2006, 2009; T. L. Jones, et al. 2010; Klar and Jones 2005). This argument has been critiqued based on substantial differences in boat and fishhook styles between Polynesian and Southern Californian peoples and the chronology of colonization of East Polynesia being too late to have produced further exploration to Southern California before the creation of the *tomol* by Southern Californian groups (A. Anderson 2006; Arnold 2007). Other sites and early dates have also contributed to challenges to the “Clovis first” hypothesis (Dillehay 1989, 1997; Marshall 2001), including reexaminations and critiques of these theories for the “peopling of the Americas” by indigenous scholars (e.g., Steeves 2015).

Some other research in the Southern Coast region has focused on sociopolitical complexity (Arnold 2001a, 2001b; Arnold and Green 2002; Gamble 2005, 2008; Gamble, et al. 2002; Gamble, et al. 2001). The polities in this area are known for the trade networks that were established between the nearshore island and mainland communities. This trade network was based on a shell bead economy that was supported by rich deposits of chert for drills from the islands. The debate surrounding the development of this trade network and complex sociopolitical systems that were intertwined with this network focus on the timing of climatic changes that could have prompted these developments. Arnold and Tissot (1993:390) offer their own study of variability in growth rate of black abalone to support a paleoclimatic study of microfossils in marine sediment cores by Pisias (1978) and argue that sea temperatures off the Coast of California warmed during the period from 1150-1300 AD. This warming climate caused a decline in marine resources, and imposed environmental stress on Chumash peoples who relied on these resources. Arnold (2001a, 2001b) argues that this period correlates with the emergence of an abundance of *Olivella* shell detritus from bead production and micro-blade cores. These items represent the production of shell beads in the Northern Channel Islands, which became valuable commodities in exchange for terrestrial food products from the mainland (Arnold 2001b:289). As Arnold (2001b) and Arnold and Green (2002) argue, the elites were the only individuals in the community who could control the amount of labor to produce the plank canoes or *tomols* that were required for crossing the Santa Barbara Straight in order to trade with craftsmen or elites from the islands. Their wealth and control of non-kin labor is what enabled them to support craft specialization and the trade networks that developed out of times of environmental stress (Arnold 2001b).

Lynn Gamble et al. (2002; 2001) use multiple lines of evidence (ethnohistoric, ethnographic and archaeological data) to offer a detailed consideration of the spatial distribution of burials, the health of individuals, and the types and associations of beads and ornaments. Like Arnold (2001a, 2001b), Gamble (2005) and Gamble et al. (2001) argue that the distribution of shell beads was very important in establishing power and influence, but Gamble (2005) argues that the development of sociopolitical complexity was a gradual rather than a punctuated process that began prior to 1150-1300 AD. Another key difference is that Gamble et al. (2002) argue that the mainland is where the *tomols* were manufactured and elites on the mainland were controlling the trade, whereas Arnold and Green (2002) argue that the elites on the islands held power over mainland communities. Kennett and Kennett (2000) support the arguments offered by Gamble et al. (2002; 2001) that cultural complexity developed earlier and more gradually. Kennett and Kennett (2000) present high-resolution, oxygen isotopic marine climate data that show how resource stress in the form of cool dry terrestrial conditions (that is, drought) during 450-1300 AD resulted in reduced terrestrial foods and water availability and encouraged inhabitants of the Santa Barbara region to engage in more intensified fishing, increased sedentism, violence, and trade.

Mark Raab (2009) challenges these perspectives on the development of chiefdoms and argues that there was very little specialized production and trade of steatite, a material type which not appear prominently in studies in the Northern Channel Islands. Raab (2009) also argues that punctuated changes based on climate change and resource stress caused by the Medieval Climatic Anomaly (MCA) placed more importance on seafaring craft to import food to the islands. This would also place more importance on the elites who controlled the boats and thus stratify social relationships between people and promote specialization (Raab 2009:191-192). Raab (2009) also notes that the situation on the Southern Coast is not straightforward and the responses to climatic stress are not universal. Territoriality, violence, and declining health are often the result of resource stress, and yet evidence of these outcomes are not consistent throughout the Northern and Southern Channel Island polities and mainland Chumash (Raab 2009:194-195).

Mikael Fauvelle (2011) critiques the arguments about the *tomol* playing an important role in supplying the island communities with a regular supply of food, because these watercraft did not have much cargo space and they were highly susceptible to poor atmospheric and oceanic conditions. Fauvelle (2011) argues that the trade between the island and mainland communities was for prestige goods for feasting and not for everyday consumption.

Writing about California as a whole, Robert Bettinger (2015) has a broader perspective in which he questions the presence of higher socio-political organizations across the state. Bettinger (2015) argues that there is orderly anarchy or small political entities or polities which are relatively autonomous. Within these polities, power and prestige are arranged horizontally rather than vertically with charismatic leaders who use situational cooperation in the absence of formal authority.

Southern Deserts

The Southern Desert region of California is most known for studies dealing with either the paleoenvironment or rock art (Arnold and Walsh 2010; Schaefer and Laylander 2007; Sutton, et al. 2007). Some studies have focused on the symbolic nature of the rock art, interpreting the images of mountain goats in the Coso region of Southern California as hunting magic and indicators of good hunting spots for big horn sheep (Arnold and Walsh 2010; Grant, et al. 1968). This theory about the connection between rituals and hunting postulates that the practice of creating rock art dwindled as herds were depleted by overhunting. Eventually the production of rock art and hunting magic were abandoned when the population of sheep collapsed (Grant, et al. 1968). An alternative view interprets these symbols as spirit helpers made by shamans in rituals to gain power (Whitley 1996, 2000). Big horn sheep were associated with the weather, and may have helped these shamans bring about rain (Whitley 1996, 2000). Some major advances in dating rock art have also taken place as a result of the focus on rock art in this region. Some scholars are now employing cation-radio dating of rock varnish, and counting microscopic lamina accumulated since the rock art was originally pecked in order to determine an approximate chronology for the markings (Arnold and Walsh 2010:150).

Kroeberian Anthropology and the Foundations of California Archaeology

Despite various problems that we now recognize about anthropological practice at the turn of the twentieth century in California (colonialist research, outdated theories and methodologies, etc.), it remains the foundation on which all subsequent anthropological and archaeological research in California has been built. The Department of Anthropology at the University of California was established in 1901, and Alfred Kroeber established his ethnographic survey in 1903. These early years after the establishment of the Anthropology Department were in many ways a turning point in that they marked the beginning of scientific anthropology in California and a data collection program that supplied information for seminal works such as Alfred L. Kroeber's *Handbook of the Indians of California*. I now turn to a discussion of the history of this early anthropological research in California. Here, I will discuss the early history of study in California. Some of the issues in Kroeberian Anthropology have attracted great amounts of revisionist work by recent scholars, and these issues persist in the current archaeological literature of California. As will be discussed later, these recent scholars have supplied new theory, methodology, and data that allowed them to diverge from the earlier work and reshape the direction of research in the state.

Europeans first came into contact with California Indians around 1542-1543 and on four subsequent expeditions up the Pacific coast of America (Lightfoot and Simmons 1998). After these early voyages (the last of which took place around 1600), California Indians did not see many Europeans until the late 1700s when the Spanish set up missions to secure their land north of Mexico (Heizer 1978b:6). Heizer argues that the "Franciscan missionaries were not concerned with recording the 'heathenish customs' of their 'gentile' (that is, unbaptized) wards, whom they generally classed as ignorant and stupid savages…" and thus, little information was recorded about their (indigenous nor missionized) daily life and practices (Heizer 1978b:6). However, it is good to note that mission records did include information on converts—names, places of origin, marriages, births, deaths, and other information—that has proved useful to a number of scholars studying the ethnohistory, demography and archaeology of this time (e.g. Goerke 2007; J. R. Johnson 1988; Lightfoot 2005; Milliken 1991, 1995).

It was not until around 1850, when California was admitted into the Union, that accounts regarding Native American peoples started to appear regularly in newspapers and journals (Heizer 1978b). Gold was discovered in California, and many more people immigrated to the state. Along with them came those who were interested in learning about local Native Americans. Between 1850 and 1901, a few anthropologically-minded works worth mentioning were written on the subject of California Indians or included California tribes in larger surveys of the Native Americans in the United States. These works are: Henry R. Schoolcraft's (1851-1857, 1860) *Historical and Statistical Information Respecting the History, Condition and Prospects of the Indian Tribes of the United States*; Alexander S. Taylor's (1860-1863) "Indianology of California," published in *The California Farmer and Journal of Useful Arts*; Hubert H. Bancroft's (1874) chapter on California Indians in Volume I of *The Native Races of the Pacific States of North America*; and most importantly, Stephen Powers' (1877) *Tribes of California* (first published as 18 separate articles between 1872 and 1875, and then collected into a book in 1877). All these works contained elements that would later be elaborated: word lists and linguistic studies; maps of California Indian tribes; recognition of broad types of tribes; and extensive ethnographic work detailing lifeways of various tribes. Though some of these works were extensive, especially that by Powers (1877), none of them were by any means exhaustive, and all were overshadowed by the work of University of California anthropologists in the early twentieth century.

In 1901, Alfred L. Kroeber and Frederic Putnam with financial support from Phoebe Apperson Hearst, established the Department of Anthropology at the University of California. The creation of this department and the anthropological museum attached to it were due in large part to those people Phoebe Hearst was in connection with: i.e. Frederic Putnam and his protégés Alice Fletcher and Zelia Nuttall, as well as the then president of the university, Benjamin Wheeler (Jacknis 2000; Thoreson 1975). Phoebe Hearst was an enthusiast of Egyptology and Classical Antiquity and donated freely to establish an Anthropology Department at the UC campus in the hopes that a museum would be established with various items from Classical Antiquity (Thoreson 1975). Kroeber, on the other hand, who was trained as an anthropologist by Franz Boas, saw this funding as an opportunity to establish a massive field research program in California ethnography and archaeology. This divergence in goals between Hearst and Kroeber created some animosity at times, but Kroeber, Putnam and others who advised Hearst were still able to see their research interests through and establish the foundations of their scientifically-minded anthropology program (Thoreson 1975).

As with many other institutions at this time, the transition from private patronage to public funding through the institution allowed scholars freedom from having to comply with the wishes of a patron, albeit working from a significantly reduced budget (Thoreson 1975:257). It was more this transition than the prior private funding itself that contributed to the creation of academic anthropology in California (Thoreson 1975:257). From the beginning, Putnam was chairman and Kroeber taught classes funded by the university (Heizer 1978b:8; Thoreson 1975). Pliny Earle Goddard was also brought on as the assistant in anthropology (Heizer 1978b:8). By 1908, Hearst’s support had ended, and the remaining UC Anthropology Department stood as a testament to the early work of Kroeber, Putnam and others who had diligently pushed the department in the direction of field research and education.

From the time that Kroeber established his ethnographic survey in 1903 to its eventual conclusion in 1946, this research program documented current California Indian societies, attempted to understand relationships among these societies, and investigated how these groups had formed, lived and moved across the landscape. However, Kroeber’s program valued ethnology and ethnography above all else, and its ultimate goal was to create as complete an ethnographic record of pre-contact California Indian societies as possible (Heizer 1978b; Thoreson 1975). This meant that while there were a number of archaeological projects during the early years, they were all executed as supplementary studies to the data that were collected through ethnography (Heizer 1978b:12).

Some of the early archaeological work was done by the following: Max Uhle who excavated at the Emeryville shellmound; Nels C. Nelson who executed a walking survey of the San Francisco Bay and excavated at Ellis Landing shellmound; and Philip M. Jones who excavated at Stockton and on Nicolas and Santa Rosa islands (Heizer 1978b:12). Archaeological work was continued by some researchers such as Llewelyn L. Loud, W. Egbert Schenck, and Ronald Olson, but the focus of the Anthropology Department as a whole was still ethnography (Heizer 1978b).

Kroeber delayed extensive archaeological work because he believed, like many others at the time, that Native American cultures were disappearing through the process of acculturation of Native Americans into Euro-American society (Heizer 1978b). Kroeber's study of culture through ethnography was built on a "memory culture" methodology which made a number of somewhat misleading assumptions about culture continuity and change (Heizer 1975, 1978b; Lightfoot and Parrish 2009:77). One major assumption was that California Indian cultures were static and that researchers could reconstruct a picture of pre-contact California Indian life through interviews with individuals who had lived before intense contact with Euro-Americans. What Kroeber did not expect was that archaeological sites were just as vulnerable to destruction as "cultural memory." As a result, intense development, such as that in the San Francisco Bay area, has destroyed many archaeological sites that will never be documented or recovered.

Kroeber and early anthropologists also tried to group California tribelets by culture area based on a core-periphery model of culture (Chartkoff and Chartkoff 1984:13; Kroeber 1936, 1972[1925]-a, 1972[1925]-b). Anthropologists interviewed California Indian informants from various tribelets and recorded which elements existed in the tradition of that group and which did not. These elements were things such as types of basket weaving, political organization, kinds of food eaten, how food is processed, etc. (Kroeber 1935-1937). Hundreds of elements were compared statistically between tribes and the most statistically similar tribes were grouped together. Tribes that exhibited the elements typical of an area became the core or typical culture and those that were less similar but still statistically related were deemed to be peripheral groups of the same culture area (Chartkoff and Chartkoff 1984; Kroeber 1936).

This led to the creation of a characterization of a California Culture Area that understandably did not exactly match the modern political boundaries of the state. In the north end of the state, groups were viewed as exhibiting traits that were too similar to the Pacific Northwest to be typical Californians; a strip on the eastern side of the Sierra Nevada was home to groups who were more similar to Great Basin groups; and in the southeastern deserts, groups exhibited more traits of the Southwest culture area (Kroeber 1936). Those "true" Californians existed in the areas along the north, central, and southern coasts; the Sacramento Valley and San Joaquin Valley; the western side of the Sierra Nevada; and some western desert groups (Kroeber 1936).

So how exactly were California Indians defined? Kroeber (1904, 1935-1937, 1972[1925]-a, 1972[1925]-b) characterizes California groups as simple, "undeveloped" and primitive hunter-gatherers. They lacked agriculture because of a benign environment that provided all they needed through fishing, hunting and gathering acorns and other roots or berries (T. L. Jones and Raab 2004; Kroeber 1904:81-82). Californians lacked developed arts and pottery which was prized by early anthropologists as a higher and more developed form of vessel than basketry (Kroeber 1904:83). Their social organization was loose and chiefs had little control over their communities (Kroeber 1904:83-84). Overall, prehistoric Californians were described by anthropologists by what they lacked.

A few of Kroeber's (1904:81-82) opening statements in "Types of Indian Culture in California" are telling:

> "From the time of the first settlement of California, its Indians have been described as both more primitive and more peaceful than the majority of the natives of North America. On the whole this opinion is undoubtedly true. The practical arts of life, the social institutions, and the ceremonies of the California Indians are unusually simple and undeveloped. There was no war for its own sake, no confederacies of powerful tribes, no communal stone pueblos, no totems, or potlatches. The picturesqueness and dignity of other Indians are lacking. In general rudeness of culture the California Indians are scarcely above the Eskimo; and whereas the lack of development of the Eskimo on many sides of their nature is reasonably attributable in part to their difficult and limiting environment, the Indians of California inhabit a country naturally as favorable, it would seem, as might be. If the degree of civilization attained by people depends in any large measure on their habitat, as does not seem likely, it might be concluded from the case of the California Indians that natural advantages were an impediment rather than an incentive to progress."

What Kroeber failed to recognize was the uniqueness of California Indians and their strategic choices that allowed them to actively create a landscape of intensive biodiversity and to support some of the largest populations in prehistoric North America (Lightfoot and Parrish 2009). The exploration of this uniqueness exists at the center of revisionist work after the Kroeberian program of research. In the next section, we will explore how and why persistent questions arising in the initial period of research have continued to be addressed by recent scholars; what new directions have come from these issues; and what still needs attention.

California Archaeology into the 1980s

The two books that really brought California Archaeology up to date in 1984 were the works by Moratto (2004[1984]), *California Archaeology*, and Chartkoff and Chartkoff (1984), *The Archaeology of California*. No other syntheses or overviews of this magnitude had been attempted before this time. Moratto's (2004[1984]) book is more of an encyclopedic volume that provides an overview of the previous archaeological research in each of the geographic areas of California. Chartkoff and Chartkoff's (1984) book is tailored more for the general public and thus offers an interpretation of the previous research. Chartkoff and Chartkoff's (1984) book is structured by a unified chronology for California and includes both the prehistoric and historic periods.

The climate in which these overviews were written and, indeed, much needed was one that was fraught with modern economic development (Moratto 2004[1984]:xlii). California was changing in the late 1960s and 1970s, and the strategies of archaeologists had to change as well (Moratto 2004[1984]:xli). Salvage archaeology became Cultural Resource Management and was established as a permanent fixture in the discipline of archaeology. Because of the incredible amount of data that was being produced, both published and in the unpublished "gray literature," the two overviews of archaeological research in California published in 1984 were not only welcome; they were needed. While I am not going to attempt to summarize these works that already contain hundreds of compact pages synthesizing other work, I will review the change that occurred in California's archaeology into the 1980s. In the following section, I hope to connect innovative and revisionist lines of inquiry that came out in this period with more current studies and conceptualizations of California Indians.

Cultural Resource Management

Cultural Resource Management (CRM) in California began in the late-1960s in an atmosphere of few laws protecting archaeological resources and very little communication with Native American descendent communities (Moratto 1992:41). Resources were managed on National Park Service (NPS) land in the public sector—and sometimes off these lands—through the Reservoir Salvage Act of 1960 (the NPS's salvage program), but this offered protection for relatively few sites in comparison to the number being neglected and destroyed "by the score each week" in the private sector (Moratto 1992:41). The National Historic Preservation Act of 1966 in Section 106 that required federal agencies consider historic properties and archaeological sites in development projects (Moratto 1992:42). The subsequent laws at both the state and federal levels that were passed included: the National Environmental Policy Act of 1969; the California Environmental Quality Act of 1970; Executive Order No. 11593, Protection and Enhancement of the Cultural Environment, 1971; the Historic and Archaeological Data Preservation Act of 1974; and the Archaeological Resources Protection Act of 1979 (Moratto 1992:42-43). Because of the new laws and resulting projects, the public (universities and museums) and private sector were unprepared to respond to the volume of work. As a result, the quality of work suffered (Moratto 1992:43). The quick training and mobilization of personnel resulted in projects being misled and in some cases abused (Moratto 1992:43).

Once the cultural and environmental laws were in place, however, it allowed for growth. The first CRM firm in California was founded by Roger Desautels in 1968 and named "Archaeological Research, Incorporated" (ARI) (Moratto 1992:44). The number of firms peaked at 150-200 in the late 1970s and declined afterwards (due to economic decline) and presently exist at around 40-50 (Moratto 1992:44). Increasingly over the years, these CRM studies with the aid of increasing budgets have become more sophisticated and technologically savvy in their recovery projects (Moratto 1992:45). The support from academic institutions in training new professionals and overseeing contract programs of their own have greatly influenced the direction of CRM in California (Moratto 1992:45). One of the more prominent of these academic CRM programs is the one run by Sonoma State University (Moratto 1992:45). CRM is now better integrated into the process of land-use planning and the infrastructure (funding, more firms, oversight through the State Historic Preservation Office, consultations, etc.). Cultural resource laws have also increased the professionalism and quality of working conditions of CRM archaeologists (Moratto 1992:46). CRM has contributed over the years to revising models of prehistoric land use and settlement through intensive survey, refining rapid sampling procedures, and even our knowledge of obsidian hydration dating and obsidian exchange systems (Moratto 1992:46). One of the most significant contributions of CRM in California has been expanding the breadth of data for all regions, some of which had not been studied extensively before.

Revisionists

Jones and Raab (2004) summarize the perception of California before the revisionists of the 1970s and 1980s. California has been seen as an exceptionally plentiful, biodiverse land with a mild Mediterranean climate since the time of European contact, and this perception has remained up to the present day (T. L. Jones and Raab 2004). This view has also been the basis of many interpretations for why prehistoric Californian groups remained hunter-gatherers rather than developing complex settlements and/or farming (T. L. Jones and Raab 2004:1). This view was originally forwarded by A. L. Kroeber as he thought California Indians had no reason to develop agriculture in this 'land of plenty'. This benign environmental determinism persisted in California archaeology for decades (T. L. Jones and Raab 2004:5). Early archaeologists assumed that an abundance of a natural crop (i.e. acorns) was what ultimately led to the 'hindrance' in developing agrarian societies (T. L. Jones and Raab 2004:6). Ecofunctionalist views followed that see people as adaptable to the environment (harsh or benign) and fostered the view that hunter-gatherers were affluent societies and more 'attuned' to nature (T. L. Jones and Raab 2004:6). Even post-Kroeberian scholars such as Robert Heizer adopted this concept of the abundant acorn that hindered agrarian development and essentially continued in this respect in the same vein as Kroeber (Lowell John Bean and Lawton 1976:23).

However, these views were challenged by scholars that argued Kroeber and others had underestimated the sociopolitical complexity of California Indian peoples (Lightfoot and Parrish 2009:79). The work of Revisionist can be seen in recent studies of sociopolitical complexity in California (Arnold 2001a, 2001b; Arnold and Green 2002; Gamble 2008; Gamble, et al. 2002; Gamble, et al. 2001; Lambert and Walker 1991; Shipek 1989), resource intensification (Basgall 1987; Broughton 1994a; K. R. McGuire and Hildebrandt 1994), and landscape management (Blackburn and Anderson 1993; Lightfoot and Luby 2012; Lightfoot and Parrish 2009; Luby, et al. 2006). All of these studies view California Indian peoples as responsive to climatic events and innovative in the ways that they adapt to the changing world around them.

An important aspect of the work of revisionists was to show that California Indians were active agents in the environment and capable of not only navigating through it, but actively shaping it. Seminal works in this area include Lewis (1973, 1985), Bean and Lawton (1976), and Shipek (1977). Bean and Lawton (1976) give an overview of practices relating to agriculture, proto-agriculture, horticulture, etc. Bean and Lawton (1976:38) argue that some of these practices such as burning combined with seed broadcasting, and in some instances, irrigation are evidence for proto-agriculture.

Bean and Lawton (1976) argue that the first part of succession after burning, that of native grasses, would have been much more interesting to the indigenous people than the succession of plants afterwards (Lowell John Bean and Lawton 1976:41). Burning may have had a selective influence on the genotypic strains of native grasses in coastal valleys (Lowell John Bean and Lawton 1976:41). In Spanish accounts, the native grasses had special qualities such as seeds the size of maize, but more archaeological investigation needs to be done to confirm such accounts (Lowell John Bean and Lawton 1976:41). Spanish accounts also refer to the indigenous peoples harvesting their fields and even bundling the grain into sheaves (Lowell John Bean and Lawton 1976:42-43). There was no sowing of seeds of grasses, but when harvesting with seed-beaters, some seeds were knocked off and replanted in the process (Lowell John Bean and Lawton 1976:44). These seeds have gene dispersal frequencies comparable to wild plants (Lowell John Bean and Lawton 1976:44). The role of grasses may have been more important than originally conceived of by earlier scholars who emphasized the importance of acorns (Lowell John Bean and Lawton 1976:45). Bean and Lawton (1976:46) argue that the ingenuity of these peoples "allowed them to develop beyond the normal parameters of hunting and gathering, particularly in the sociological, philosophical, and religious realms."

Moreover, ecological intervention by hunter-gatherers in California was practiced to such a great extent that California Indians did not only control the environment, but created whole new ecosystems in which they lived (T. L. Jones and Raab 2004:7). The climate and environment was far from benign though and prehistoric peoples had to struggle at times with food shortage during adverse climatic events (T. L. Jones and Raab 2004:8). However, these peoples developed innovative strategies for dealing with times of environmental stress.

Beyond that Orwellian Year (1984) and Current Trends in California Archaeology

The recent publication of Jones and Klar's (2007) book, *California Prehistory: Colonization, Culture, and Complexity*, was the edited version of the papers given at the 2004 Society for California Archaeology (SCA) conference. The goal of the conference and the book was to update the California archaeological community on 20 years of research since the two landmark books treating this subject in 1984: Chartkoff and Chartkoff (1984) and Moratto (2004[1984]). A few other papers on subjects not covered in the conference session were also added to make this work more complete.

In the first chapter of *California Prehistory*, Moratto and Chartkoff (2007:1-2) lay out the two most significant factors in defining recent scholarship: economic growth and laws requiring archaeological and cultural resources be considered in development plans; and a better understanding of climatic shifts and their effects on sudden cultural changes. These changes made possible the topics covered in the book. The book covers ten geographic regions (Northwest, San Francisco Bay Area, Central Coast, Central Valley, Northeast, Sierra Nevada, Northern Bight, Southern Bight, Mojave Desert, and Colorado Desert) and eight topics (terrestrial and marine paleoenvironments, Paleo-Indian settlement and technologies, linguistic prehistory, trade, rock art, and DNA) (T. L. Jones and Klar 2007:xi).

The geographical regions and topics covered in Jones and Klar (2007) are consistent with other current overviews (Arnold and Walsh 2010; Arnold, et al. 2004; Fagan 2003). Many of these topics have been discussed in association with a sub-region. In this section, I will explore further the issue of landscape management, and in particular fire management, because this is an emerging topic of importance in California archaeology that plays a key role in my research in the Tolay Valley. Many contemporary California Indian tribes, such as the Federated Indians of Graton Rancheria, are currently working with park services and land managing agencies to restore the lands within their traditional territories and reincorporate Traditional Ecological Knowledge (TEK) and indigenous land management practices into policies for managing parks and open spaces. Evidence-based, academic arguments for the importance of indigenous land management in shaping and maintaining the health of California's ecology can support the justification for the reincorporation of these practices. Co-managing parks and open spaces will allow California Indian people greater access to healthy, abundant and productive natural resources that support the cultural wellbeing of California Indian communities.

Land and Fire Management: Pyrodiversity Collectors

Current work on landscape management and the use of fire in particular to increase the biodiversity of the land have been discussed by Anderson (2005a) and Lightfoot and Parrish (2009). California Indians, like other hunter-gatherers, practiced a number of management techniques (coppicing, pruning, harrowing, sowing, weeding, burning, digging, thinning, and selective harvesting) that made the landscape more habitable and increased its productivity of food sources and utilitarian materials (K. M. Anderson 2005a:1-2). Blackburn and Anderson (1993:19) also mentions the diversion of water for irrigation as a management technique that was used before contact with Europeans, although hunter-gatherer water management has been little studied in California. These techniques were part of a whole toolkit of "traditional ecological knowledge" of how the environment works and how to manage plants and animals that had been developed over centuries by California Indians, and it was not without negative impacts. Indigenous peoples were also responsible for the extinction of some animal species (K. M. Anderson 2005a:5). All these impacts contributed to how the environment was shaped before Europeans arrived.

One of the most distinct features of the landscape that Europeans noticed when they arrived was the open meadows, prairies, and plains. Early accounts of the central coast region of California hail the landscape as pristine and natural, (unconsciously) describing the lands as being like gardens, parks, or orchards (K. M. Anderson 2005a:158). Similarly, historic accounts from the 19th century in the Pacific Northwest by the United States Exploring Expedition observed fire and smoke-filled canyons caused by Native American people (LaLande and Pullen 1999:255). Around the same time, Peter Skene Ogden observed country overrun by Native American-set fires and John C. Fremont observed new grass where the old had been burnt off (Robbins 2006:223-224). These examples support the argument that instances of wide open landscapes were the direct result of hunter-gatherer fire regimes that served to actively manage the landscape. Anderson (2005a:159) argues that these fire regimes drastically shaped the environment long before settlers arrived by modifying the genetics of and dispersing plant communities and encouraging biodiversity and desired floral and faunal species to proliferate.

Fire, as a tool for landscape management has been used for more than the above stated purposes. Lewis (1973) compiled 70 reasons for anthropogenic burning. However, Williams (2003:3) distilled the reasons for burning down to eleven after reviewing over 300 sources on anthropogenic fire. These eleven reasons are: hunting, crop management, improving growth and yields, fireproofing areas, insect collection, pest management, warfare and signaling, economic extortion, clearing areas for travel, felling trees, and clearing riparian areas (Williams 2003:4-5). This information in the fire literature is mainly derived from oral traditions, historical accounts, and ethnographic records.

Despite the vast amount of literature on impacts that hunter-gatherers have had on environments, especially in regards to anthropogenic burning (K. M. Anderson 2005a; Bird, et al. 2008; Blackburn and Anderson 1993; Keeley 2002; LaLande and Pullen 1999; Lightfoot and Parrish 2009; Pyne 1991), there are still a number of authors who argue that hunter-gatherers were not agents of great change in the environment and that anthropogenic fire was not the cause of many fire adapted floral and faunal species (Butzer 1992; Denevan 1992; Doolittle 1992; Krech III

1999; Russell 1983; Sale 1990; Vale 1998, 2002; Whitney 1994). Vale (1998:231) argues that the latter group of authors is replacing the old myth of a pristine landscape with a new myth of the humanized landscape. Vale (1998:235) attributes these views about a humanized landscape to social ideologies that view Native Americans as having a connection to the land and legitimize legal and emotional claims by Native Americans to that land. He further criticizes most scholars researching hunter-gatherer landscape management, and fire in particular, for their reliance on ethnographic and ethnohistoric sources to support their interpretations. Vale (1998:232) argues that the terminology used in these pristine and humanized 'myths' is inexact, and that only through "empirical and scientific effort" might the landscape be judged to be in whole or in part, pristine or humanized.

Vale (1998:232) uses the case study of Yosemite National Park to argue that this pre-historic landscape is not purely humanized. Vale (1998, 2002) argues the following points. Even with seasonal movements by indigenous populations, the impact on the park as a whole would be minimal. The few occupied places in the park are very small by comparison to other outlying, 'untended' places. Vale (2002:14) further argues that the groups inhabiting these areas had low population densities that demanded "much less of the natural world (relative to modern people)." Pruning and digging would not have impacted the basic appearance of the landscape or its fundamental ecological character (Vale 1998:232). Burning did happen in Yosemite. But it is not clear as to whether this was done in addition to rather than as substitution for natural burnings and whether or not such burning would significantly modify the landscape (Vale 1998:232). Two-thirds of the park area burned rarely, if at all, in spite of fairly common lightening ignitions (Vale 1998:232). Tree ring samples indicate that "fire frequencies varied temporally, with burning closely tracking weather conditions" which indicates natural causes of fire (Vale 1998:233). Moreover, Vale (1998:234) argues that the pre-European landscape was a patch-work of humanized and pristine landscapes.

However, even Vale (1998:232) admits that national parks, which are seen as pristine, may not be the best model for comparison, because they are often high in elevation, have low biological productivity, among other factors, that are disproportionately represented in these parks. A better case study for testing the hypothesis of anthropogenic fire in California and the extent to which this and other management techniques affected the environment can be done on California's central coast. Anderson (2005a:155) states that "natural" fire rarely occurs along California's coast, so it is clear that the vast treeless prairies of the northern and central coast are the result of indigenous fire regimes. Many plant communities in fact became dependent on human burning as well (K. M. Anderson 2005a:156).

Studies in response to Vale (1998, 2002) and other skeptics have commenced to bring physical evidence to bear on the debate about indigenous fire management. A new eco-archaeological approach to the study of fire management in California was developed in collaborations with the Amah Mutsun Tribal Band of Ohlone/Coastanoan peoples, University of California at Berkeley, University of California at Santa Cruz, and the San Francisco Estuary Institute (Cuthrell 2013b; Lightfoot and Parrish 2009:120-121; Lopez 2013). This project developed in Año Nuevo State Park, Quiroste Valley, and Pinnacles National Park involves California Indian scholars, archaeologists and ecologists employing the analysis of pollen, charcoal, phytoliths, fire scars on tree rings, archaeological and paleobotanical remains, as well as incorporating Amah Mutsun traditional knowledge and oral tradition (Cowart and Byrne 2013; Cuthrell 2013a, 2013b; Cuthrell, et al. 2013; Evett and Cuthrell 2013; Fine, et al. 2013; Gifford-Gonzalez, et al. 2013; Hylkema and Cuthrell 2013; Lightfoot, Cuthrell, et al. 2013; Lightfoot and Lopez 2013; Lightfoot and Parrish 2009).

Related to the work along the Santa Cruz coast, the Tolay Archaeology Project was developed in collaboration with the Federated Indians of Graton Rancheria for similar purposes of employing an innovative strategy of eco-archaeological botanical sampling in order to reconstruct the historical ecology of the area and how this area was actively managed by California Indian people. The evidence-based results from the Tolay Valley expand the geographic area and time depth of the study of past environments and indigenous land management in Central California. This expanded scope of work from these studies has enriched our understanding of the role of indigenous landscape management in California and strengthened the argument that indigenous land management practices are essential to the health, sustainability and resiliency of California's diverse ecology. And arguments for the active management of and engagement with the environment gives agency back to the California Indian people who are recast in the literature and history as sophisticated, savvy, engaged people and land managers who have much to contribute to scientific knowledge and contemporary policy concerning California's diverse ecology.

Conclusion

Throughout the discussion of research in California's diverse sub regions, many of the topics (e.g. settlement patterns, subsistence strategies, obsidian hydration dating, and the development of sociopolitical complexity) have been studied for the purpose of theoretical and historical interest. Much of this literature makes no attempt to bring these topics forward into the present to affect change in the lives of California Indian people and the general public in contemporary California. California Indian people, histories, and traditions have been the target of this kind of interest-based research, or damage-centered research as Eve Tuck and Wayne Yang (2014a) call it, for centuries, and it is about time that research considers the needs of these communities. Desire-based research, as discussed in chapter 2 of this dissertation, that addresses the needs of communities as much as it benefits the scholars who make their careers based on it should be the starting point from which we develop future research questions and projects in California archaeology. These projects can mobilize knowledge and narratives about the past to create relationships between California Indian people and land managing agencies combining traditional knowledge and Western science in innovative and culturally appropriate ways to manage lands with in more sustainable ways for future generations. These projects create relationships and reciprocate the skills, time, energy, financial and institutional support that are needed to restore and manage traditional territories with California Indian people and knowledge leading the way.

The Tolay Archaeology Project contributes to the effort to do collaborative research for the benefit of communities and offers a model that is scalable and replicable. Many contemporary California Indian tribes, such as the Federated Indians of Graton Rancheria at Tolay, are currently working with park services and land managing agencies to restore the lands within their traditional territories and reincorporate Traditional Ecological Knowledge (TEK) and indigenous land management practices into policies for managing parks and open spaces. The model of the Tolay Archaeology Project and work along the Santa Cruz Coast provide strategies for producing evidence-based, academic arguments that support the importance of indigenous land management in shaping and maintaining the health of California’s ecology and the justification for its reincorporation in contemporary policies. In the future, the specific topic of landscape management and ecological reconstruction may not be the most pressing issue for every tribe or even the Federated Indians of Graton Rancheria, but the framework that these eco-archaeological projects provide are valuable guides for building relationships with tribes based on these tribes’ desires to engage in research.

Chapter 4

Previous and Current Archaeological Research in the Tolay Valley

In chapter 3, I provided a topical and historical discussion of archaeological research in the state of California to provide a broader context for the Tolay Archaeology Project (TAP) and to put the TAP in conversation with other trends and traditions of scholarship in California. In chapter 4, I will review the history of amateur collecting and professional archaeology directly in the Tolay Valley leading up to the TAP. Then I will discuss the methods and results of the TAP. This discussion will include systematic and non-systematic surface pedestrian survey, intensive surface collection, Light imaging, Detection And Ranging (LiDAR) topographic mapping, augering, and excavation. Geophysical survey methods and results will be presented separately in chapter 5, because these data are too extensive to include in their entirety in chapter 4.

Archaeology and Artifact Collecting, 1850s to 2011

Archaeological resources in the Tolay Valley were first documented by J. B. Lewis (1900), W. K. Moorehead (1910, 1917), and L. E. Ricksecker (1907). Many of these early enthusiasts who documented the cultural resources in the Tolay Valley, excepting Moorehead who was a professional archaeologist, were hobbyist artifact collectors, looters, or “amateur archaeologists.” These early collectors only left brief accounts and a few objects to public institutions or their families out of their vast personal collections. A few items were gifted or sold to institutions such as the Smithsonian Institution and the California Academy of Sciences, however, the provenance of the majority of the items from these collections is unknown. Even though the majority of these collections were lost, the descendants of one of these settlers, J. B. Lewis, retain photographs and inventories of Lewis’s collections (Barbara Webster, personal communication, September 23-25, 2016). One of these images depicting Lewis’s collection of mortar bowls at his ranch near the Tolay Valley is published in Morehead’s (1910:108) volume on artifacts of pre-contact North America. These photographs and inventories offer some insights into the amount of larger, intact material that is no longer present on the surface of the sites in this valley and throughout many other sites in Central California.

While many different classes of artifacts were collected, many of the early collectors noted the abundance of charmstones deposited in Tolay Lake, which was drained and has remained dry since the 1870s (Elsasser 1955:30; Meredith 1900:282). Some scholars nicknamed Tolay Lake “Charmstone Lake” because of the unusually high density of charmstones found in the lakebed area (Elsasser and Rhode 1996). Cheryl Cherney (1984:74-75), a UC Berkeley anthropology alumna, estimates that potentially upwards of 15,000 charmstones were collected from Tolay Lake between the mid-1800s and 1984 (that is, the year she completed her honors thesis). More than one thousand of these charmstones from Tolay are housed in public collections at the National Museum of Natural History, National Museum of the Native American, Phoebe A. Hearst Museum of Anthropology, and California Academy of Sciences. Several hundred more charmstones from Tolay are housed in the private collection of the Cardoza family who owned the property from the 1940s until 2005. Even if only the known number of charmstones housed in public institutions is counted, Tolay Lake has produced more charmstones than any other single site in the region.

Charmstones are significant cultural objects usually associated with burials or special doctoring sites as in the case of Tolay Lake. Charmstones are usually about 10 cm long and shaped into a variety of forms (e.g. plummet, spindle, fish-shaped, phallic, etc.) by grinding or rubbing. Most charmstones from the Toaly Valley are made from basalt, but some are also made from greywacke, schist, steatite, granite, and other materials. Uses of charmstones have been documented for many different California Indian peoples including Coast Miwok (Elsasser and Rhode 1996; I. Kelly 1991:462; Sharp 2000). Early collectors misconstrued the use of charmstones or "plummets" as net weights or even bolas for killing waterfowl, because many of these early collectors favored their own conjectures over speaking with California Indian people about the uses of these items (Elsasser 1955; Elsasser and Rhode 1996; Moorehead 1910; Peabody 1901; Pennypacker 1938; Rhode 1989; Sharp 2000). Ethnographic sources and tribal oral traditions attest to the use of charmstones for other purposes such as "charms" for luck in hunting and fishing and as implements for doctoring, healing, and poisoning (I. Kelly 1991; Sarris 1994:115; 2011). Tom Smith, a Coast Miwok doctor who was interviewed by Isabel Kelly (1978:420-421), carried two of these charmstones in his doctoring bag. Maria Copa, a Coast Miwok woman who was also interviewed by Kelly (1991:368), notes that to contain the sicknesses and poisons in charmstones and protect other people from this, charmstones and poison things were put in water. Greg Sarris (2011), the chairman of the Federated Indians of Graton Rancheria, also stated in an interview:

> "When you throw these stones into the water and when you do these ceremonies to get rid of the sickness and these host of sicknesses, the ceremonies that went on there [Tolay Lake] were so important because that was for the purpose to rebalance, to create ease where there was disease. So that place was so sacred and so powerful because that's where the earth got centered again. That's where people, as a part of the earth and everybody got well, they left their unbalance, they left their poison, they left their sickness, greed, whatever evil spirit, whatever was in them, they left it there and the earth got renewed, and the body, spirit got renewed…"

Aside from information on charmstones, most of the archaeological information about the tribal cultural resources in the Tolay Valley derives from two subsurface investigations undertaken by Albert Elsasser and Martin Baumhoff of UC Berkeley and by George Phebus who gifted his collections to the Smithsonian Institution (Elsasser 1955; G. E. Phebus 1965, 1990a). Albert Elsasser (1955:31-32) and Martin Baumhoff excavated three test pits (the size of which were not recorded in his publication) "at the highest part of the site which is probably closest to the center of the lake bottom." Elsasser (1955) was most interested in evaluating his hypothesis that the charmstones were used as slingstones for hunting birds rather than for fishing (disregarding the wealth of ethnographic information on charmstones being used for medicinal purposes). Elsasser (1955:31-32) reports that there was in fact mammal and bird bone found in his test pits, and no fish bone. However, he admits that since they did not screen any of the excavated dirt, this absence of fish bone may have been a sampling error (Elsasser 1955:32).

Phebus (1965, 1990a) identified sites in the Tolay Valley as Cardoza 1-9 and the lake bottom. The only site aside from the lake bottom that has been positively linked to the standardized California trinomial naming system is Cardoza 6. However, the identity of the others may become clear through a closer examination of Phebus's descriptions of them in his publications (G. E. Phebus 1965, 1990a) and unpublished field notes that are housed at the Smithsonian Institution. Phebus (1990a:125) excavated three 3 m by 1.5 m units in 30.5 cm (12 inch) arbitrary levels down to the base of the site's deposits at Cardoza 6 and screened the matrix through quarter inch screens. Phebus (1990a:131) notes at Cardoza 6 the presence of looter pits and places where the owners dug midden soil to put in their gardens. Phebus (1990a:131) also excavated four small units (dimensions not reported) and two adjacent units (dimensions not reported) in three different locations at Cardoza 2.

Phebus's account of the sites at Tolay are little more than lists of artifacts and features and a few obsidian hydration dates from Cardoza 2 and 4 (completed by UCLA's lab in 1974), but he does establish the basis for a chronology and cultural sequence for the valley. According to Phebus (1965, 1990a), Cardoza 8 has an Early Horizon component; Cardoza 4 has a Middle to Late Horizon component; Cardozas 1, 2, 3, 5, and 7 have Late Horizon components; and Cardoza 6 has Late Horizon and Historic Period components. The earliest site, Cardoza 4, may be as old as 4,500 years BP based on obsidian hydration dates, but this date needs to be verified with radiocarbon dates from shell or charred botanical materials. More information and interpretation could also be obtained from a reanalysis of these materials and their spatial distribution throughout the excavation units. These materials are housed at the Smithsonian Institution along with the remains of five ancestors[1] from Tolay also excavated by George Phebus (1965, 1990a, n.d.).

Since the excavations conducted by Elsasser (1955) and Phebus (1965, 1990a), numerous cultural resource surveys involving surface pedestrian survey have been completed (Chavez 1978, 1979; Cherney 1984; Doherty 1974; Elsasser 1955; Evans 2003; Gerike, et al. 1996; Holman 1977; Jordan 1990; S. M. Patterson, et al. 1980; Pulcheon, et al. 2008; Rhode 1989; Weigel 1980). The most recent survey, performed by LSA Associates, Inc., confirmed or corrected the locations of 18 previously recorded prehistoric and historic cultural resource sites. LSA Associates, Inc. also found an additional 12 more previously unrecorded sites (Pulcheon, et al. 2008:37-41).

Many of the archaeological sites within the Tolay Valley represent habitation sites (either occupied permanently or seasonally) and contain midden deposits and various materials such as marine shell, faunal bone, shell beads, worked bone tools, flaked stone debitage and tools, heat-affected rock, groundstone, and human remains. Some other sites contain only one or two material types such as lithic scatters where tools were manufactured or ceremonial sites where

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[1] The assumption that the cultural affiliation of these ancestors is Coast Miwok given that they were buried in village sites within the Tolay Valley is most likely correct. However, since people from many tribes throughout the region visited Tolay, the possibility exists that these people may have been non-local. If the latter is true, these people as invited guests would have been under the protection and care of local residents and their descendants. For the purposes of the Native American Graves Protection and Repatriation Act (NAGPRA), these remains within the traditional territory of Coast Miwok peoples should be culturally affiliated with the contemporary tribe, the Federated Indians of Graton Rancheria, who continue to care for ancestors within Marin and Southern Sonoma Counties, California.

cupules, Pecked Curvilinear Nucleated (PCN) features, and mortar/milling station features have been ground into rock outcroppings. These latter features are primarily carved into blue schist rock outcroppings or boulders. Pulcheon et al. (2008:37-63) and Jones (2009) report that many of these sites retain their integrity for archaeological investigation. However, some sites have been impacted by historic and modern agriculture, ranching, irrigation, and recreation activities (Pulcheon, et al. 2008:37).

Origer and Associates Survey of Lakebed Resources, 2011

In 2011, Origer and Associates conducted a survey, which I was able to monitor, within the lakebed area as part of the California Environmental Quality Act (CEQA) to assess the potential impacts to Tolay Lake and the "charmstone" site within Tolay Lake from proposed development and restoration work in the park. The goal of this survey was to better understand and define the boundaries of the charmstone site and others nearest the lakebed by excavating about thirty-nine 0.5 m by 0.5 m Shovel Test Pits (or STPs) and ten 1 m by 1 m "surface scrapes" on the edge of these sites in search of archaeological materials. To expedite the screening of the clay soils found at Tolay (which are very difficult to dry screen through normal ¼ inch and 1/8 inch screens), the archaeologists decided to put this soil through ½ inch and 1 inch screens which have a much wider spacing between wires in the screens than the normal ¼ inch and 1/8 inch and thus do not retain as much material. This decision was made because the goal of the survey was primarily focused on finding charmstones, which are typically about 10 cm long and 4 cm wide. Thus, excavators could more quickly and efficiently screen through the clay soils of the lakebed while still retaining objects the size of charmstones.

Three obsidian flakes were the only cultural materials that were found in any of the test pits excavated during this survey. The survey added little to our knowledge of these sites and did little to change the previously-defined site boundaries that were created through visually-oriented pedestrian survey. The consulting archaeologists noted that in order to better assess the presence of charmstones in the lakebed, the research design and methodology would have to change. That is, the STPs executed during this survey are optimized for assessing the extent of large midden sites with anthropogenic soils and other constituents that are clustered close together. STPs are not as ideal for evaluating sparse scatters of cultural materials like the charmstones in the lakebed. Noting this in the report, Janine Lloyd (2011) suggested that the only way to truly assess the extent of the charmstone site would be to disk or plow the lakebed (as was done throughout the 20th century) and document the distribution of near-surface charmstones that appear in the freshly disturbed soils.

Though disking the entire lakebed would not necessarily impact the integrity of the archaeological resources at this site because the lake has undergone disking in the past, this method is not culturally appropriate given the lake is a sacred place to the Federated Indians of Graton Rancheria. As will be discussed in the geophysical section, a non-invasive Ground Penetrating Radar survey was collaboratively co-designed in 2014 as part of the Tolay Archaeology Project to follow up the 2011 assessment of these tribal cultural resources. This non-invasive survey in combination with additional documentary research provided a quick and cost-effective way of re-assessing physical tribal cultural resources as well as geological features in the vicinity of the lakebed without being as invasive and damaging to sensitive materials and this sacred site.

The Tolay Archaeology Project, 2011 to 2017

The Tolay Archaeology Project is a multi-year initiative consisting of ongoing survey and monitoring of tribal cultural and botanical resources within and near the Tolay Valley. During the formal years of the project since its approval by FIGR Tribal Council in 2012, I conducted museum collections research, surface pedestrian survey, site mapping using GPS and total station, intensive surface collection from delineated units, terrestrial LiDAR 3D laser scanning of topography, geophysical survey, augering, and limited archaeological excavation to support efforts to learn about and manage cultural and natural resources within the Tolay Valley. I completed some of this work on my own, but the majority of the fieldwork would not have been possible without field crews consisting of fellow tribal citizens of the Federated Indians of Graton Rancheria, undergraduate students, graduate students, post-doctoral fellows and professors from the University of California at Berkeley, Sonoma State University, Cal State East Bay, and San Diego State University.

Though some of the Tolay Valley is still owned privately, the majority of the valley is now public land. These public lands, now called Tolay Lake Regional Park (TLRP), are composed of two properties that divide the valley into northern and southern halves. The northern half of Tolay Lake Regional Park is called the Tolay Lake Ranch (formerly the Cardoza Ranch) and was acquired by SCRPD in 2005 from the Cardoza family of Portuguese farmers who had owned and operated this 1,737-acre property since the 1940s. The southern property (approximately 1,665 acres) is called the Tolay Creek Ranch (formerly the Roche Ranch) and was acquired by the Sonoma Land Trust (SLT) in 2008 from the Roche family. SCRPD has assumed the operational responsibilities for the Tolay Lake Ranch property, but did not assume these same responsibilities for the Tolay Creek Ranch property until ownership of this property was transferred from the SLT to SCRPD in 2017 (Verheyen, et al. 2017:4-5).

During the formative stages of the project from 2010-2012, I attended meetings of FIGR’s Sacred Sites Protection Committee to learn from committee members and tribal monitors about working with tribal cultural resources. I participated in some tribal monitoring work during a few compliance projects in Marin and Sonoma County as well. The chairman and vice-chairman of this committee were particularly helpful and influential in giving me advice about potential dissertation topics that could integrate with larger tribal initiatives, one of which was learning more about the past environment in efforts to inform future botanical restoration at Tolay Lake Regional Park, the property that the SCPRD acquired only five years before that time. This idea resonated with me, and I started talking to other FIGR tribal citizens and tribal council members during tribal picnics, workshops, and other gatherings about the possibilities of doing work at Tolay. I also hosted an initial meeting with my academic advisors and representatives of FIGR, SCRPD, and SLT to discuss the potential for a study of tribal cultural resources and the environment at Tolay on November 10, 2011. This meeting was very positive about the potential for this research, so I decided to pursue writing my proposal to work at Tolay in the winter for official approval by FIGR’s tribal council.

During the winter, I also participated in a survey of archaeological materials in the Tolay Valley as I wrote and finalized my proposal to work at Tolay. This survey was conducted by Origer and Associates in November 2011 as part of site condition assessments and documentation of new discoveries from LSA's cultural resource report to the Sonoma County Regional Parks Department (SCRPD). This survey was carried out to satisfy the requirements of California Environmental Quality Act (CEQA) and to write an Environmental Impacts Report (EIR) about the impacts to cultural resources from lakebed restoration as part of SCRPD's master plan for the park (Loyd 2011). The cultural resource survey in 2011 as well as independent research with site records and informal visits to Tolay provided me with a sense for the types of resources located throughout the Tolay Valley, and helped me think through the fieldwork I proposed to complete.

I submitted my dissertation project proposal for review to FIGR Tribal Council, and on March 9, 2012, I attended the FIGR Tribal Council meeting to orally present the project and answer questions. Tribal Council approved the project proposal, and I began working with Sonoma County Regional Parks Department (SCRPD) to satisfy their permitting requirements to do research on their property. SCRPD was not very familiar with the nature of dissertation projects and required the project to have sufficient insurance to cover all of the participants in the project as I were a consulting firm working on a compliance project. I explored what UC Berkeley could offer in terms of insurance, but after navigating the university's multiple levels of bureaucracy over several months, I found that the university would not insure graduate student research projects. This insurance requirement led me to postpone plans for my first field season of the newly approved Tolay Archaeology Project.

Thus, I began to explore alternatives to working on the TLRP property (or the northern end of the Tolay Valley) for my dissertation project. While I searched for alternative sites, I was able to participate in a short two-day survey of the Tolay Creek Ranch (TCR) property (or the southern end of the Tolay Valley) in July 2012. During this survey, Origer and Associates completed a follow up study to update the original site records from the TCR property provided by LSA and Associates (E. T. Jones 2009). After viewing these sites and speaking with representatives from the Sonoma Land Trust about permitting on this property (which was less restrictive in terms of insurance), I decided to write up a revised scope of work for my dissertation proposal that shifted fieldwork to only one site on the TCR property, i.e. TAP-39, rather than multiple sites on the TLRP property. I discussed the details of this new scope of work throughout the 2012-2013 academic year with FIGR's SSPC committee, members of FIGR's Tribal Council, the SLT, and SCRPD.

I also surveyed and conducted site visits to most of the tribal cultural resources within the TLRP property boundaries from 2012 to 2013, being able to complete the work as a member of FIGR's SSPC under an interim agreement about usage of the park between SCRPD and FIGR. During this time, I noted the condition of sites and was able to identify some previously unrecorded sites. I was also able to visit the Smithsonian Institution's National Museum of the Native American and National Museum of Natural History from July 30 – August 9, 2012 and the Phoebe A. Hearst Museum of Anthropology multiple times in fall 2012, to view collections of materials and archival materials relating to tribal cultural resources in the Tolay Valley. These visits were also followed by carrying out a records search at the Northwest Information Center, which is part of the larger California Historic Information System (CHRIS), to gather reports and

GPS information about archaeological resources in and around the Tolay Valley that I had not already obtained through my work in tandem with compliance projects at TLRP and TCR.

In the fall of 2012, FIGR initiated tribal citizen involvement in its agreement with SCRPD (in addition to official tribal representative involvement) to comment on and co-develop the master plan for this park. The first meeting consisted of two all-day workshops in September. The comments from this workshop and the tribal citizens who attended formed the purpose, initial vision, and membership of the Tolay Advisory Group (TAG) within FIGR. I participated as one of the founding members of this group, which was later formalized as a tribal committee, and TAG became an essential source of community review for my project in tandem with SSPC. A final source of review for the design of my project came as a directive from FIGR's Tribal Council in May 2013 after my new scope of work was finalized. Tribal Council encouraged me to speak with elders about the particulars of my project to help advise me about the sensitivity and appropriateness of the research being proposed. I presented to Tribal Council on the results of these conversations with elders on May 24, 2013.

On May 29, 2013, I began the first field season of the Tolay Archaeology Project with all non-invasive methods of prospection. These methods included geophysical survey (i.e. Ground Penetrating Radar, magnetometry, and resistivity), surface collection, terrestrial Light Detection And Ranging (LiDAR) topographic mapping, and GPS/total station mapping of surface features and artifacts. I designed this field season (as well as the subsequent field season in 2014) as educational field schools, and the field crews were primarily composed of volunteer undergraduate students who had taken courses in archaeology or had previously worked in the California Archaeology Lab at UC Berkeley. These field crews were also composed of students from CSU East Bay, Sonoma State University, San Diego State University, and tribal citizens (myself and, on occasion, Tsim Schneider). The crews camped on the TCR property for the majority of the summer field work, though additional work in the fall involved driving from the East Bay to the site in Sonoma County every morning, and driving back to the East Bay in the evening.

In August 2013 when the extensive non-invasive prospection phase of the fieldwork was completed, I presented the results of this work to SSPC, TAG, and Tribal Council. At this meeting, Tribal Council instructed me to work directly with SSPC and TAG for the remainder of my project, and I discussed the final details for the excavation phase of the fieldwork with SSPC and TAG in September 2013. I proposed to excavate eight 1 meter by 1 meter standard units within the boundaries of midden soil at TAP-39 and three or four standard units outside of the boundaries of midden as controls. I specifically focused the 2013 proposal on a feature from the Ground Penetrating Radar that I could readily interpret (i.e. a saucer-like planar reflection representing a house floor). My intention was to use four or five of the standard units to gradually expose a large portion of the feature and study activities within the structure. And the remaining three or four standard units would have been used to investigate other areas within the midden boundaries. The hope in investigating an intact house floor was that excavating a known feature would pose less risk of impacting sensitive materials, because there were no indications of large objects, pits, or cuts into the soil above or below the floor that might indicate a burial. This strategy and scope of work was approved, and excavation began on September 26, 2013.

Fieldwork in fall 2013 on the TCR property was conducted primarily from Thursday to Sunday each week. Simultaneous with this fieldwork, UC Berkeley students analyzed materials on Mondays and Wednesdays from surface collections earlier in the summer under my and Professor Kent Lightfoot's supervision. I used Tuesdays as administrative days to evaluate student work, grade assignments, and prepare for the next six days of teaching and fieldwork. During this field season, crews completed additional surface collection, geophysical survey, and the excavation of two adjacent units (EU 1 and EU 3) to a depth of about 50 cm, ending at the house floor, and the excavation of EU 2 (an offsite 1 m by 0.5 m "half" unit) to a depth of about 40 cm. The 2013 field season concluded on November 16, 2013 after backfilling all of the open units to prepare for the winter. The SSPC and TAG had a chance to visit the site on the preceding weekend before units were backfilled, and I presented the results of the 2013 excavation.

After further analysis of the materials collected during the 2013 field season, I presented the results in winter 2014 to the Tolay Advisory Group as well as the Sacred Sites Protection Committee. Based on the lab analysis, some samples from EUs 1 and 3 above the house floor feature contained sensitive materials that were not readily identifiable in the field. The SSPC, TAG, and SLT were contacted about these materials as per the permit agreements. After discussing these results, I also presented a revised proposal for fieldwork in the summer of 2014 at the SSPC and TAG meetings in May 2014. No more excavation would take place in the vicinity of the house floor, though the committees agreed that the samples from this area could be retained temporarily and analyzed before they were returned to the site to be reburied or "curated in the ground" in the exact location from which they came. As a note, the treatment and final disposition of these samples emerged out of a community-based process within this research project and may not necessarily align with current tribal policy about the treatment of such items in compliance projects with local, state, and federal agencies.

The findings from the 2013 field season drastically altered the field strategy for 2014. The revised strategy included having a trained osteologist on site every week who could identify any possible human remains within the highly fragmented osteological/faunal assemblage so that our crew would be sure that we were not disturbing and removing these materials from the site. Other sensitive materials could include burned beads or pendants and other contextual factors that might indicate the presence of burials. As was the protocol in the previous field season, all work would be stopped in an area if sensitive materials were encountered. After the tribe and appropriate agencies were notified and had a chance to assess the situation, these materials would be returned, and the unit would be backfilled. During the summer of 2014, I checked in regularly with the chairman of SSPC over the phone and once in person at the June 9th SSPC meeting with the entire committee to receive guidance on the direction of the excavation work. I was also able to check in with TAG on June 21, 2014.

In addition to having an osteologist on site and checking in more frequently with tribal committees and representatives for guidance, the new strategy also included excavating small auger holes (10 cm or 4 inches in diameter) in the areas where any larger units were to be placed to provide a check for sensitive materials and reduce broader impacts to any sensitive areas of the site. Additional auger units across the site also provided information about the broader formation processes of the site while keeping the impact to individual areas low.

During the 2014 field season, sensitive materials were found relatively close to the ground surface in three out of sixteen auger units and in three of the standard units. Only one of these standard units (EU 4) was excavated to a depth of about 40 cm (less than half of the full depth of the unit). The other two units did not exceed a depth of 20 cm before the appearance of sensitive materials. These findings mid-field season necessitated a change in research design and a reevaluation of how to assess the environmental research questions within the study.

While crews can excavate in a more controlled fashion (better for paleoethnobotanical sampling) and can recognize stratigraphic changes much more easily in standard units (1 m by 1 m) than in "half" units (1 m by 0.5 m), "quarter" units (0.5 m by 0.5 m), shovel test pits (0.3 m by 0.3 m), or auger units (0.1 m by 0.1 m), 1 m by 1 m standard units also impact much more of the site than smaller unit sizes. Shovel test pits and auger units on the opposite end of the spectrum are quickly excavated, lower impact, and offer a general sense for stratigraphy and the abundance and diversity of artifacts. However, crews cannot excavate shovel test pits and auger units in the same controlled manner as larger units because of the narrow dimensions of these types of units. While excavating these narrow units, the excavation tools often brush soil off of the sidewalls of these units mixing soil from different depths, which can be problematic for paleoethnobotanical sampling. Quarter units are the smallest unit type that still allow for good quality sampling and recovery of paleoethnobotanical materials, because the excavator still has enough albeit a slim amount of space to hand excavate with a trowel and a better ability to limit the mixing of soils from the sidewalls.

Thus, the sizes of the four remaining 1 m by 1 m standard units from the 2014 field season were significantly reduced to four 0.5 m by 0.5 m quarter units in order to reduce the impacts to the site as much as possible while still maintaining the ability to address the environmental questions of the project. This reduced the total area to be excavated by 75%. The positions of these quarter units were also reconsidered and moved to the eastern and western margins of the site away from other units where sensitive materials had been found. Because of this shift in excavation strategy to answering solely environmental questions with narrow quarter units, the research questions within the project concerned with the broader spatial patterning and the investigation of features and activity areas were refocused on surface-level contexts (such as materials from a historic structure in the northwestern portion of the site) for the remainder of the study.

Although the strategy for completing the excavation work and answering the environmental questions within the Tolay Archaeology Project was co-designed and revised in close collaboration with FIGR, it does not necessarily condone the use of this same strategy as a model for future research at TAP-39 or other sites in FIGR territory, because all of these sites contain unique resources and materials that may be sensitive. Even though great care was taken to avoid sensitive materials during the TAP, prospecting with non-invasive methods before excavating, sensitive materials were still encountered. Excavation throughout the TAP found TAP-39 to be a very sensitive site, and it is my opinion after conducting this research that future activities (associated with research or not) at this site pose a high risk of impacting the sensitive materials at this site. Impactful activities could potentially include (but are not limited to) ground-disturbing activities and research, animals grazing, visitors hiking off trail, and crews from neighboring properties carrying out maintenance at the spring boxes embedded in the site to support their facilities beyond the TCR property lines.

One additional geophysical field season was completed in August 2015 to address the need for additional assessment of tribal cultural resources in the vicinity of the lakebed. Undergraduate students from the UC-Berkeley Undergraduate Research Apprenticeship Program (URAP), graduate students, a post-doctoral scholar, and I analyzed the materials from the Tolay Archaeology Project in the California Archaeology Lab at UC Berkeley from fall 2014 to spring 2017. Faunal materials were temporarily loaned to Sonoma State University for analysis after which they were returned and reunited with the other materials from the project.

While the data analysis took place between 2014 and 2017, I attended SSPC and TAG meetings regularly to participate in active discussions about the master plan for developing and managing Tolay Lake Regional Park. I also wrote a history of Tolay for use by tribal officials and another history for use during tribal youth hikes at Tolay. The master plan that was co-written by SCRPD and the Federated Indians of Graton Rancheria was recently posted online for public comment in December 2016. The completion of this masterplan marked a milestone in the planning process and the culmination of many years of cultural and natural resource assessment and discussions between SCRPD and FIGR about how the park would be developed and presented to the public.

Fieldwork in the Broader Tolay Valley

Surface Pedestrian Survey

All of the area surveyed in the Tolay Archaeology Project between 2012 and 2015 was recorded in the field with a TripMate 850 model GPS data logger which that carried at all times by myself. The TripMate 850 data logger is set by default to record a GPS point every 1 second, producing a georeferenced breadcrumb trail of where the holder of the GPS has been. Each GPS point is WAAS-corrected as it is collected by the TripMate 850 producing an error range of about 3-5 meters in excellent conditions. In poor conditions, the error could be greater, but the survey in general took place in open grasslands with some incursion into the wooded drainages. Thus, it is assumed that most of the data is accurate to about 5 meters. The data from the TripMate 850 downloads as a text-based .nma file that must be converted to an .nmea file, so that "Google Earth" software can recognize and open it. The raw data can be viewed in a basic text application such as "Notepad" or "Notepad++," and all that is required to convert the file from .nma to .nmea is to change the file extension. After the file is converted to an .nmea file, it can be opened in Google Earth and converted into a .kml file. The .kml file can then be imported into ArcGIS and converted into a shapefile. Although this may be a little more time intensive back at the lab, the inexpensive cost, small size, simplicity of menus of the TripMate 850 made this device ideal for untrained or newly trained field crew members who had little knowledge of more complicated and expensive Trimble units. The inexpensive cost of the TripMate 850 also makes it ideal if multiple units are needed for crews working simultaneously in different portions of the research area. If a note about a resource or a photo was collected, the time stamp of the GPS coordinate on the TripMate 850 was recorded in the field notes and used to reunite the coordinate with the note or photo about a resource. For very important resources found during the project, the resource was relocated using the less accurate GPS point generated by the TripMate 850, and another GPS coordinate was collected with a Trimble GeoXH6000 unit.

My initial survey of archaeological resources in the Tolay Valley began in 2012. The primary goal of this initial survey was to locate and familiarize myself with the cultural resources within Tolay Lake Regional Park through surface pedestrian survey. I used the most recent archaeological reports from the Northwest Information Center in order to locate the present location and extent of sites (E. T. Jones 2009; Pulcheon, et al. 2008), as well as older reports, articles, and accounts to give some historical depth to the archaeological observations of these sites since they were first documented in written accounts by Euro-American settlers in the 19th century (Elsasser 1955; Moorehead 1900, 1910; G. E. Phebus 1965, 1990a). There is also a rich oral tradition among Coast Miwok and Southern Pomo people with regard to Tolay Lake that reiterates the cultural and spiritual significance of this area to the ancestors of Coast Miwok people who lived there in the past as well as their descendants in the present, the Federated Indians of Graton Rancheria.

The surface pedestrian survey conducted in this early phase was judgmental and focused on relocating and reassessing the conditions of the known existing resources within Tolay Lake Regional Park, because the entire valley was too vast to survey in a broader, systematic fashion for this project within the constraints of time, resources and personnel available. Previous reports on surveys in the valley also expressed limited ability at times to conduct a full systematic coverage of the valley, and so there is a high potential for new archaeological sites to be discovered (E. T. Jones 2009; Pulcheon, et al. 2008). Most survey over the years has been concentrated on the most likely areas to contain archaeological resources such as areas near drainages and springs, areas protected from the wind, and areas where diverse indigenous plant life is abundant. That being said, three new archaeological resources were discovered between 2012 and 2015 while surveying other archaeological and botanical resources within the valley.

Newly Identified Archaeological Resources

One of these newly identified archaeological sites is a lithic scatter that was found on September 8, 2012. This site is situated in an old agricultural field to the north of TAP-37. Isolate artifacts have been found on the surface in or along the drainage ditch to the north of TAP-37, and on further inspection of the north side of this ditch, I discovered this lithic scatter site. The site consists of very light gray, ashy soil in which there are pieces of lithic debitage. This site is small and sparse on the surface, and the subsurface extent of it is unknown.

A second previously unrecorded site was observed in June 2014 during the field work at the nearby midden/village site, TAP-39, on the Tolay Creek Ranch property. This site was revisited on August 22, 2014 to describe, map and record GPS information for the site. The site consists of a small, 1 m x 1 m rock with five small shallow cupules and is situated in an ultramafic rock outcropping on the hillside above and to the west of TAP-39. Often these sorts of rocks are associated with larger village sites, and it makes sense that this rock is associated with TAP-39 because it is in such close proximity (within about 200 meters) of that site.

A third site was observed by Bob Neale of the Sonoma Land Trust on January 30, 2015 while on a consultation site visit to the Tolay Creek Ranch property to talk about trails with the Federated Indians of Graton Rancheria and Sonoma County Regional Parks Department. This particular rock is situated in an ultramafic rock outcropping on top of a knoll near the large midden site, TAP-39. The rock is partially hidden underneath the boughs of an oak tree on the top of the knoll, and it was probably missed by previous surveyors because it is not visible from a distance. The site consists of a roughly 1m x 1m rock with Pecked Curvilinear Nucleated (PCN) features, shallow cupules, and deep mortar holes. Often these sorts of rocks are associated with larger village sites, and it makes sense that this rock is associated with TAP-39 because it is in such close proximity (within about 200 meters) of that site. I was able to take a photograph and describe the rock on January 30, 2015 along with Bob Neale. However due to time constraints, I was not able to sketch or more precisely record the features of the rock.

Geophysical Prospection

As a follow up to Origer's survey of archaeological resources in the lakebed (Loyd 2011), I conducted geophysical prospection in the vicinity of the ancient lakebed and surrounding areas in August 2014 as part of ongoing discussion about environmental restoration of Tolay Lake and the assessment of potential impacts to cultural resources associated with Tolay Lake. During this survey, I also took the opportunity to assess other sites on this upper portion of the Tolay Lake Regional Park property with Ground Penetrating Radar (GPR) and gradient magnetometry. For more information about this survey, see chapter 6, Tolay Valley Geophysical Prospection.

Grid Systems and Mapping

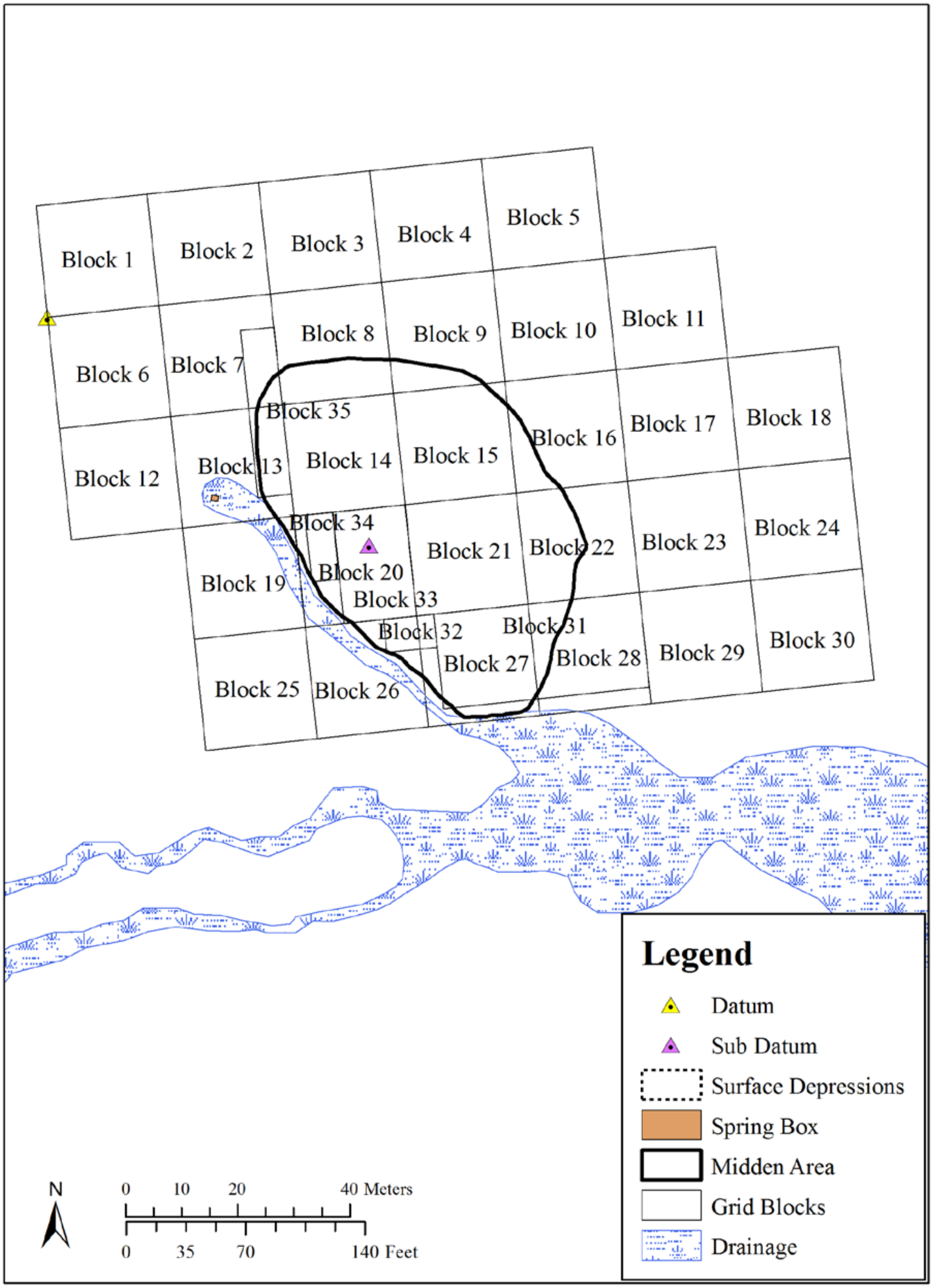
For the purposes of the TAP, space and the locations of objects were recorded in three dimensions using either Real-World Coordinates or arbitrary coordinates depending on the mode of investigation and mapping instrumentation used. All arbitrary coordinates were recorded relative to site datums for which Real World Coordinates were known or recorded with GPS (Global Positioning System) technology. Arbitrary coordinate systems used units of space arranged in a hierarchy from largest unit to smallest unit with the ability to sub-divide units should the need arise. The standard units of space in the TAP from largest to smallest are grid (infinite size), block (20 meters by 20 meters), sub-block (5 meters by 5 meters), Excavation Unit (generally 1 meter by 1 meter, but can be sub-divided into smaller half and quarter units), Shovel Test Pit (30 cm in diameter), and Auger Unit (10 cm in diameter). The dimensions for any non-standard units of space are noted where they appear in this text. No two sites had the same arbitrary grid system, and each site could have had multiple grids depending on the constraints or parameters of the survey. Each grid within the same site differed from one another in that they have a different orientation and alignment of the 0-degree line for their coordinate system. For example, a site might have one grid with its 0-degree line oriented in alignment with true north and another grid with the 0-degree line aligned with a drainage that is 45 degrees from true north. These arbitrary alignments facilitate the efficiency of the survey and maximize the space that can be covered within the smaller units within the grid. The grids for each site were numbered from 1 to as many as were needed.

Fieldwork at TAP-39

Only one grid was established for work at TAP-39, which was designated grid 1. Grid 1 was set up to accommodate geophysical prospection and used an arbitrary coordinate system rather than Real-World Coordinates. The datum location for grid 1 (6000 E, 3000 N, 1000 Z) was placed on the top of a hill from which the entire grid area was visible. The datum and sub-datum were marked with large 9-inch nails with an “X” etched across the top for setting up the total station with precision. Both the datum and sub-datum points were mapped with a Trimble GeoXH6000 GPS device connected to a Tornado antenna. The data for these points were collected for at least half of a day and averaged to ensure a high level of accuracy for these two locations. After differential correction of all the GPS data collected for this project with the Trimble GeoXH6000 instrument, 99.11% of the estimated accuracies ranged between 0 cm to 5 cm, 0.86% of the estimated accuracies ranged between 5 cm to 15 cm, 0.02% of the estimated accuracies ranged between 1 m to 2 m, and 0.01% of the estimated accuracies ranged between 2 m to 5 m. Since the locations of the resources discussed in this project are confidential, the arbitrary coordinate system will be used to refer to the relative locations of various items.

Initially, thirty 20 m by 20 m standard blocks were mapped with a Sokkia SET530r3 total station and marked in the ground with wooden stakes. An additional five non-standard blocks were created to navigate around the drainage to the southwest of TAP-39, which obstructed the movement of surveyors and geophysical equipment within blocks 13, 19, 20, 26, 27, and 28 (see figure 4.1). The standard blocks were further divided into 5 m by 5 m sub-blocks for planning purposes, but these sub-blocks were never marked on the ground. These sub-blocks were used solely for the purpose of determining the placement of the 1 m by 1 m intensive surface collection units.

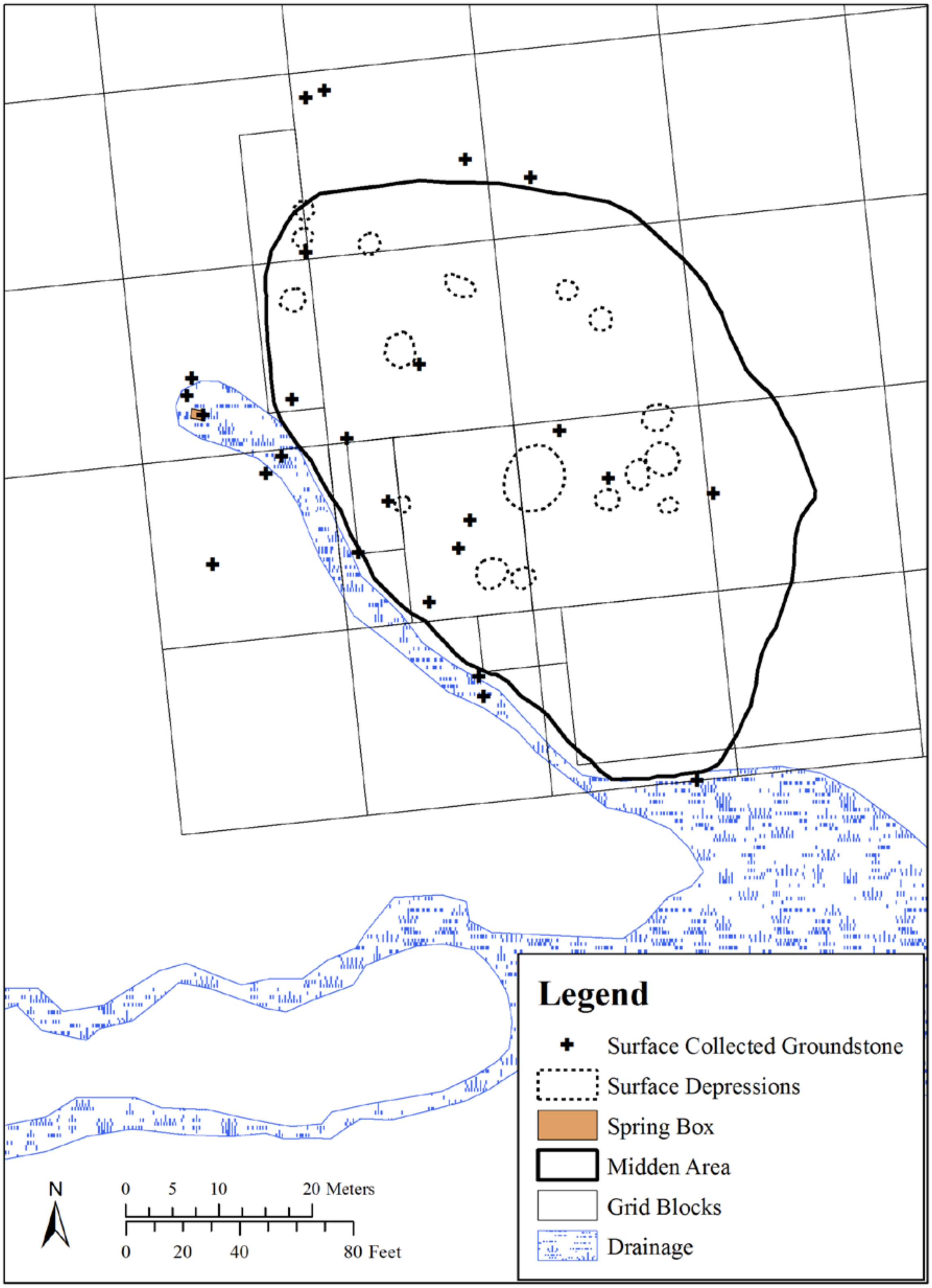
Figure 4.1. Map of the survey blocks within Grid 1 of TAP-39.



Systematic Surface Pedestrian Survey for Groundstone at TAP-39

On July 1, 2013, my field crew conducted a systematic surface pedestrian survey within Grid 1 of site TAP-39. This survey consisted of eleven transects spaced 10 meters apart covering all mapped blocks (Blocks 1-30) within Grid 1. The transects were laid out from west to east, beginning at 6000 E, 3020 N within Block 1 and ending at 6140 E, 2920 N within Block 30. The purpose of this systematic study was to identify any patterned concentrations of groundstone across the surface of TAP-39. Because we were simultaneously conducting geophysical survey at the time of this surface pedestrian survey, the vegetation had already been cut on the site producing excellent visibility. We were able to identify many partial mortars, some pestles and handstones, and an anvil rock. In addition to the mortar fragments that were found, there were also two whole mortars that were found turned over (concave side down) on the surface of the site. As can be seen in figure 4.2, most of the groundstone objects observed on the surface were located in the southwestern portion of the site along the drainage bounding the site. Very little groundstone material was found in the center of the midden portion of the site unless it was heavily fragmented and fire cracked.

Figure 4.2. Map illustrating the results of surface pedestrian survey for groundstone materials on top of the midden area of TAP-39.



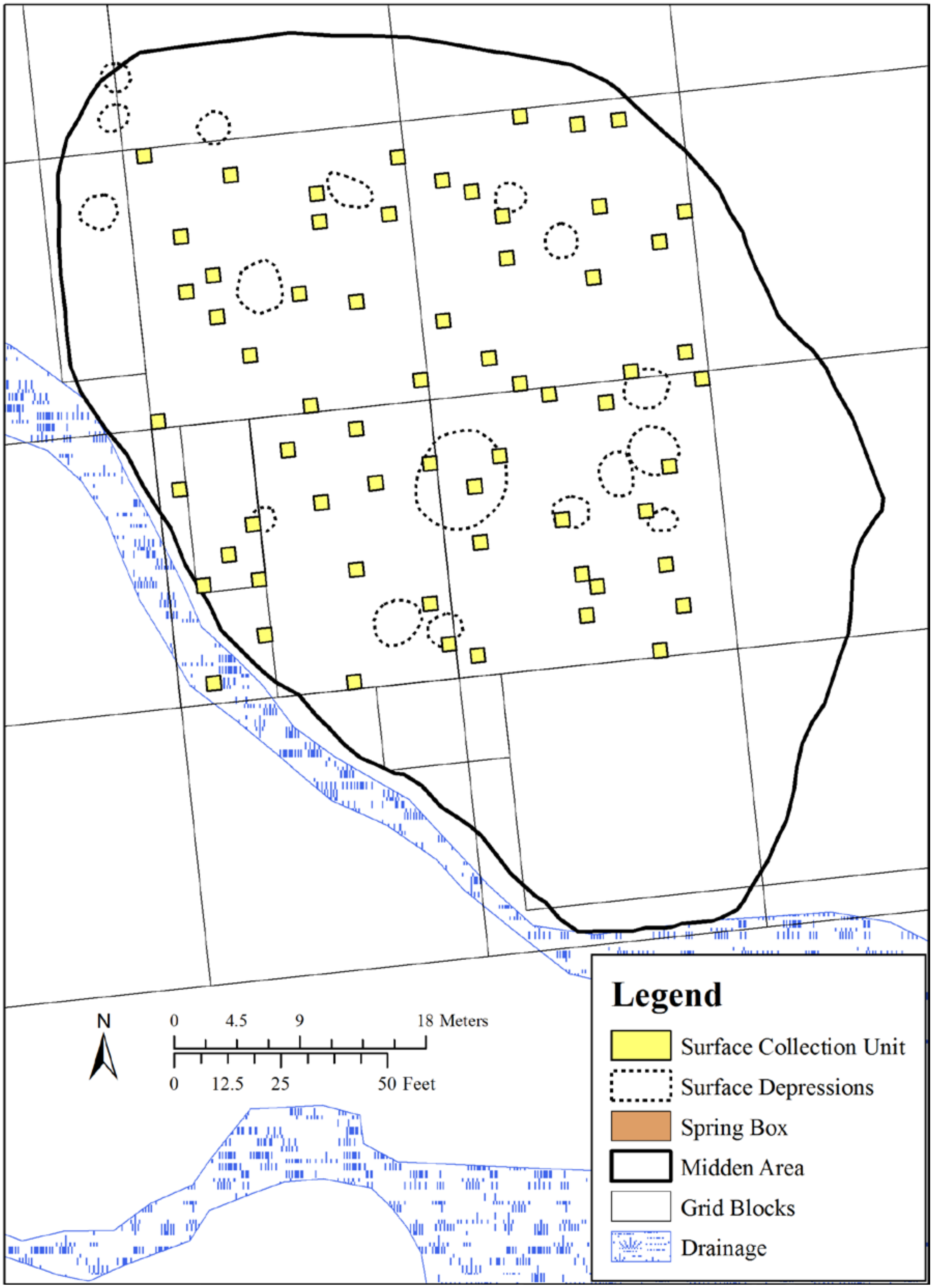
Intensive Surface Collection

The cultural materials in an archaeological site can be entirely obscured by dense vegetation or differentially obscured in some areas and exposed in other areas resulting in an unrepresentative sampling of the density of these materials across the site. Surface pedestrian survey is the most time efficient method for gathering information about the density and diversity of cultural materials on in a broad area, but it is also reliant on good (and surveyor-consistent) visibility at archaeological sites that have sparse vegetation and are relatively exposed. In order to study sites that do not have good visibility, shovel test pits or augering is often used as a means to assess the resource (Lightfoot 1989). While these methods provide good information about the subsurface materials in the site, they also disturb the subsurface deposits of the site, involve more time and effort to complete, and do not provide as much coverage across the surface of a site as surface surveys can.

At sites where there is a lot of vegetation, a method of intensive surface collection can be used to assess the distribution and diversity of cultural materials across the surface of an archaeological site (Gonzalez 2011, 2016; Lightfoot 2006, 2008; Schneider 2010). This method involves laying out a series of 1 meter by 1 meter square units and stripping the vegetation off of the ground surface of these squares before documenting materials in the field or collecting the materials for analysis back in the lab. Soil from the root mat of the vegetation is scraped off and screened, and then a 1-2 cm scrape of soil from the surface of the unit is screened. This could be considered the first shallow level of an excavation unit, but the soils near the surface in Coastal California are so active from rodent burrowing, and in many cases cattle ranching and agriculture, these materials in the first 1-2 cm do not have good vertical integrity (Gonzalez 2016:545). That being said, actively disturbed contexts can still yield good information about the constituents of a site and the spatial distribution of artifacts, because these materials are not usually transported far in the horizontal direction despite their movement upward and downward (Gonzalez 2016; Steinberg 1996). Approached in this controlled manner, every intensive surface collection unit has an equal chance of yielding materials that are visible to the crew as any other area on or off of the site. Sara Gonzalez (2016) calls this method of intensive surface collection the “Catch-and-Release” method, whereas other archaeologists consider these intensive surface collection units to be “surface scrapes” (e.g. Loyd 2011).

For the 2013 and 2014 field seasons at Tolay, crews employed a systematic random survey strategy in which each 20 m by 20 meter geophysical survey block was divided into 16 sub-blocks, each 5 m by 5 m in size. The sub-blocks were further divided into 25 1 m by 1 m surface collection units, which formed five rows of five units. The units were numbered sequentially (1 to 25) from right to left, top row to bottom row, beginning at the northwest-most unit and ending with the southeast-most unit. For each sub-block, a number from 1-25 was selected at random from a hat representing the placement of the intensive surface collection unit. Only 1 out of the 25 units was surveyed for every sub-block. Sampling the site in this manner provides a 4% coverage of the entire surface of the site (figure 4.3).

Figure 4.3. Map of the intensive surface collection units at TAP-39.



The materials collected in 2013 and 2014 during intensive surface collection at the TAP-39 were analyzed in the California Archaeology Lab. These materials were categorized into three general categories: Lithic Materials, Faunal Materials, and Historic Materials. Each artifact was given an individual artifact number and its attributes were recorded.

Attributes recorded during lithic analysis helped address questions about the types of materials used for stone tools (obsidian, chert, quartz, rhyolite, basalt, schist, other); the types of lithic flaked stone tools and debitage present (biface, uniface, other formal tool, retouched flake, complete flake, proximal flake, bipolar flake, flake shatter, angular shatter); the stages of lithic flaked stone tool production and maintenance represented on site (amount of cortex, platform and termination type, length and width in mm, weight in g); and the use of lithic flaked stone as tools (edge modification and retouch). Other lithic materials, such as milling stones, mortars, handstones, pestles, anvil stones, charmstones, beads, pendants, battered cobbles, hammerstones, net weights, unmodified cobbles, crystal, and thermal spalls, were much less frequently encountered than lithic flaked stone materials. The questions and methods of lab analysis in the TAP were adapted from the system used by the California Archaeology Lab at UC Berkeley and included the following as references: Andrefsky (2005) Beardsley (1954a, 1954b), Heizer (1953), Odell (2004), Patterson (1995), Sutton and Arkush (2009), and White et al. (2002).

Faunal materials were analyzed by Michael Stoyka and Whitney McClellan, both staff of the Anthropological Studies Center at Sonoma State University. This analysis involved identification of each bone to the lowest taxonomic level possible and documentation of modifications such as burning, weathering, butchery cut marks, reshaping the bone as a tool, and etching designs into the bone.

Historic materials included nails (wire and machine-cut), metal wire or barbed wire, miscellaneous scrap metal, grommets, bottle glass, flat or window glass, ceramics (earthenware, stoneware, whiteware, etc.). Historic materials were analyzed in the California Archaeology Lab at UC Berkeley using the following as references for historic archaeology lab methods and materials identification: Miller (2000), Silliman (2000), Sutton and Arkush (2009), Wells (1998), Voss (2002) and the Society for Historic Archaeology "Historic Glass Bottle Identification and Information" website (https://sha.org/bottle/), as well as the advice and assistance of many other graduate students and undergraduates researching historic archaeology in the California Archaeology Lab and the Historic Archaeology Lab at UC Berkeley.

For the purposes of exploring broad activity areas associated with different material types on site, this discussion will be limited to the three broad category types: lithic materials, faunal materials, and historic materials. The maps below show the data for blocks 14, 15, 20, and 21, which encompass nearly the entire flat top and center of the midden area. Each map has a square, grayscale image of this four-block area that represents the approximate number of items expected to be found throughout these four blocks. These images were generated in Surfer 8 using the arbitrary grid coordinates of the southwest corner for each surface collection unit as x and y values and the number of items found in each unit as the z value. These data were interpolated with the Kriging Gridding Method, and the colors from lighter to darker in the gray scale indicate fewer or more items respectively.

Figure 4.4. Map illustrating the density of obsidian lithics collected from intensive surface units.

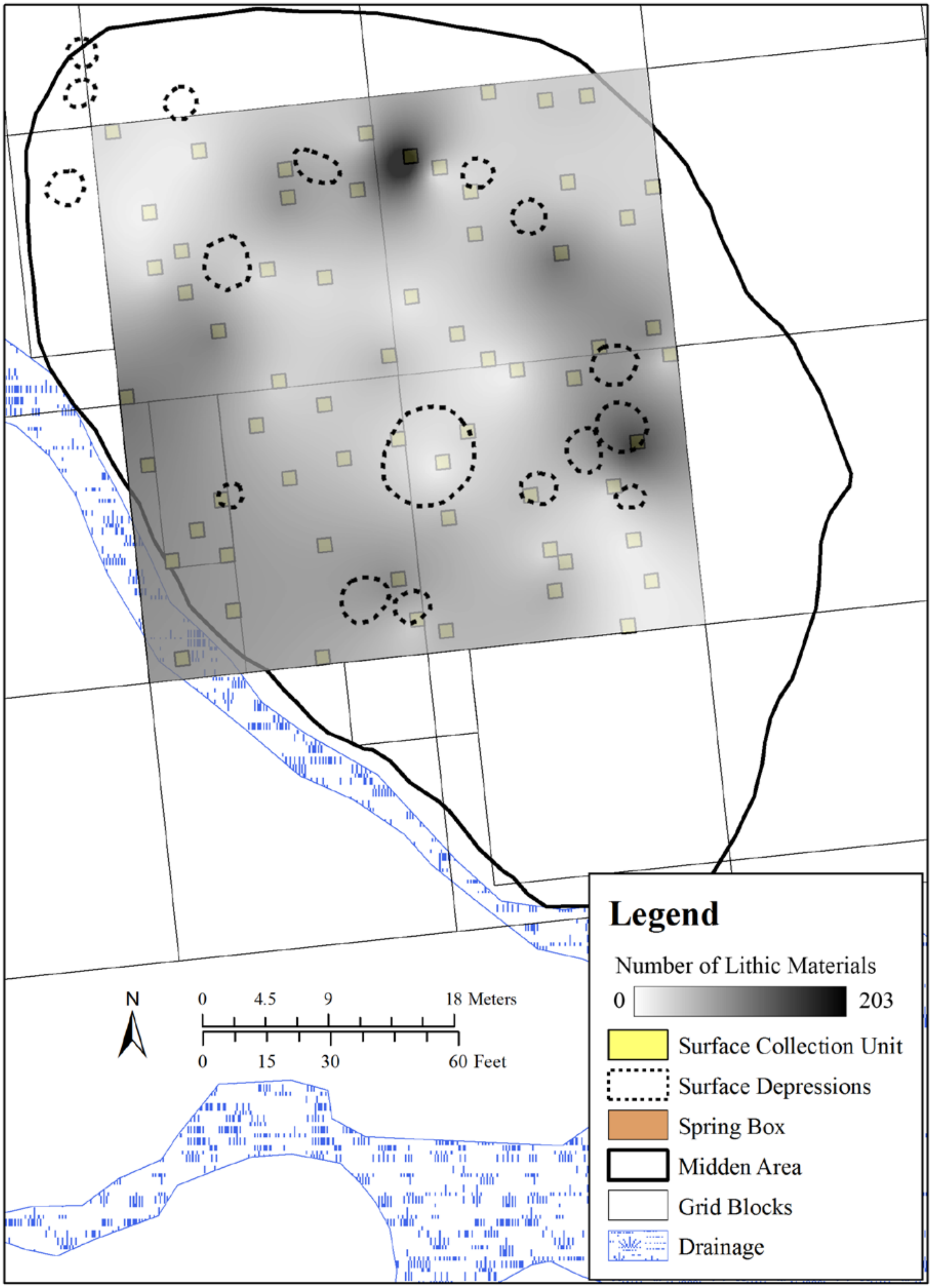


Figure 4.5. Map illustrating the density of faunal materials collected from intensive surface units.

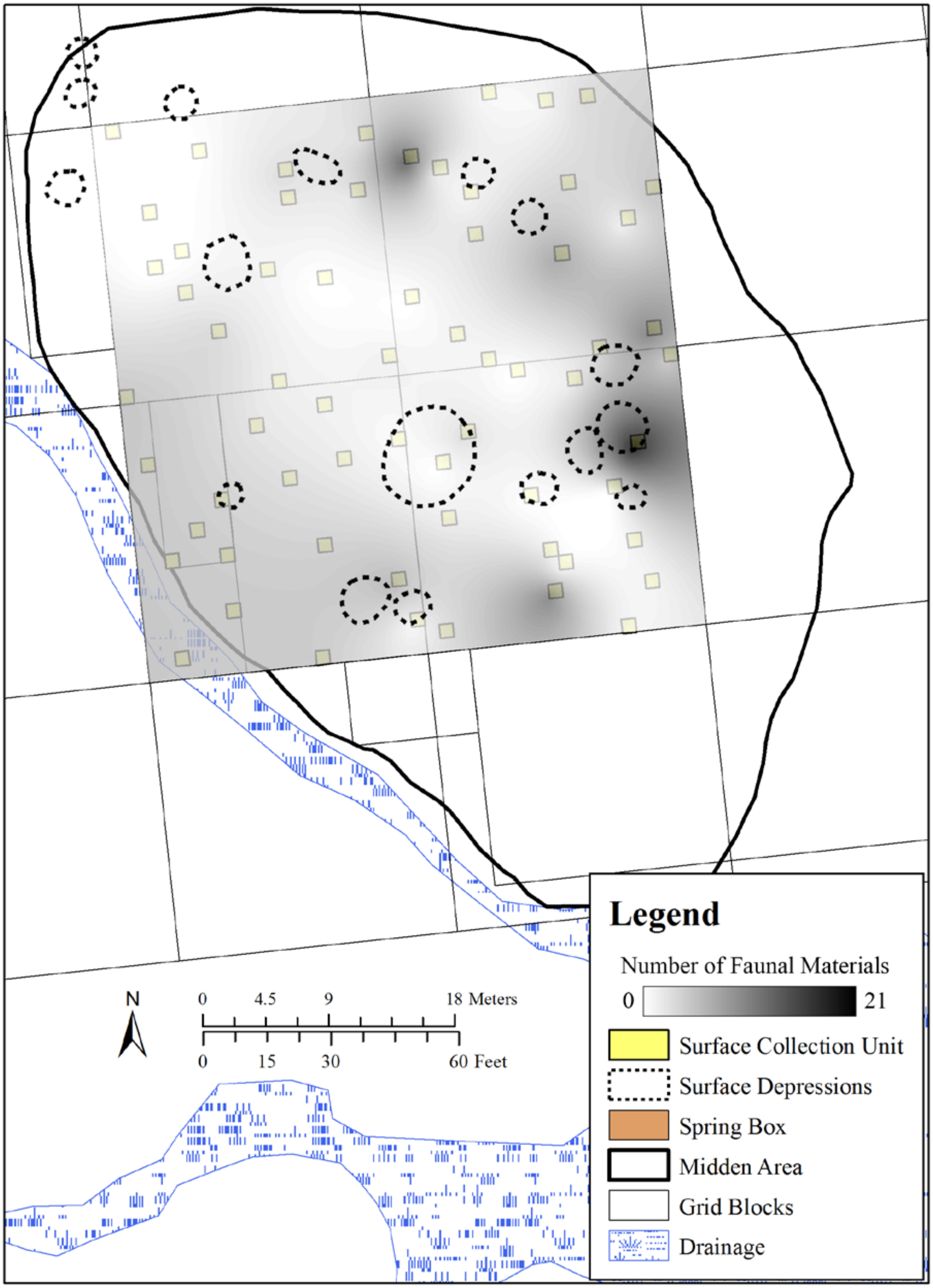
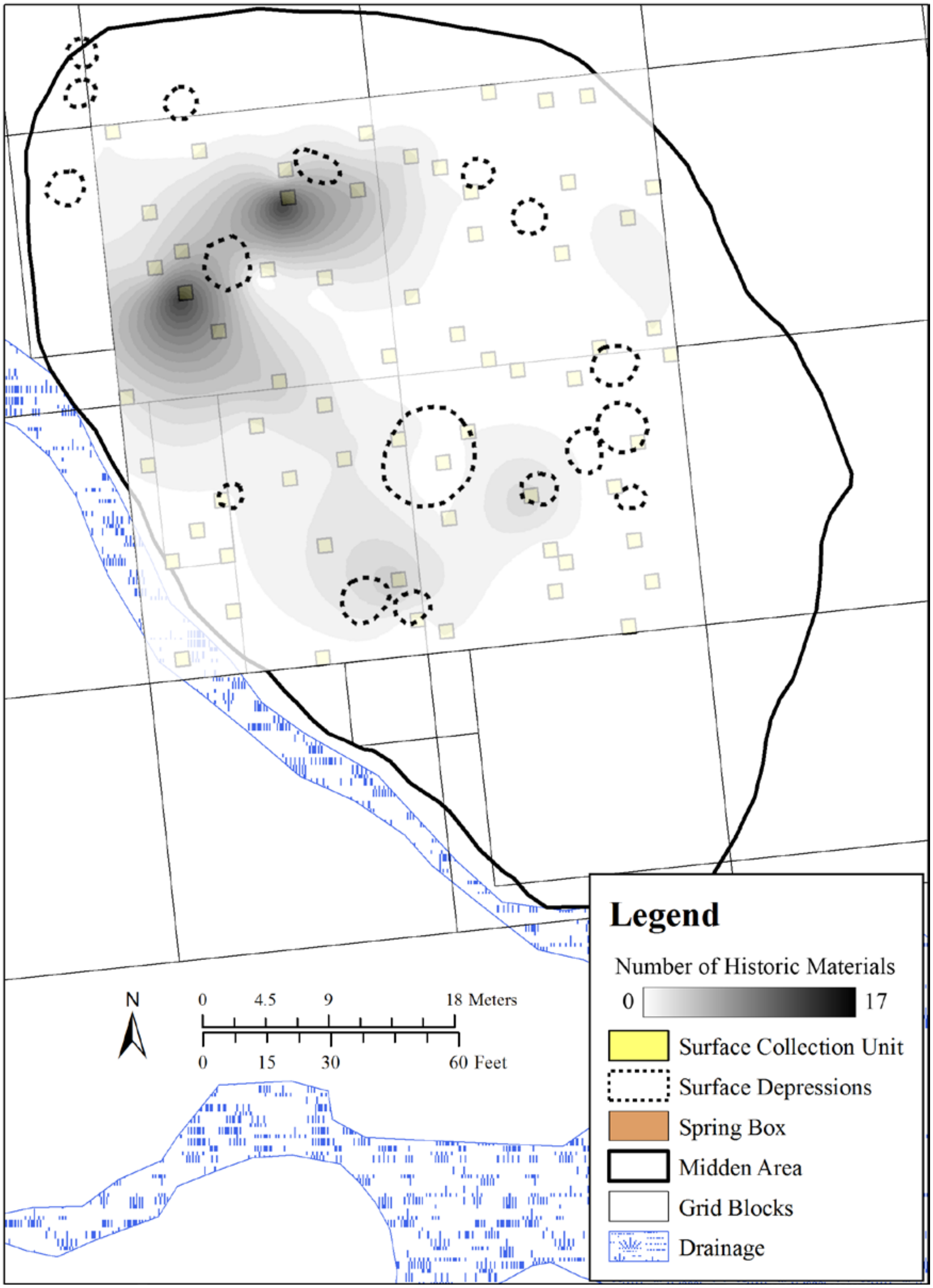


Figure 4.6. Map illustrating the density of historic materials collected from intensive surface units.



The spatial pattern that emerges from the surface-level data in these maps is relatively low densities (lighter color in figures 4.4, 4.5, and 4.6) of lithic, faunal, and historic refuse materials in the center of this four-block square. Most of the surface depressions (demarcated by dotted lines) also seem to have low densities of refuse materials. The low densities of refuse materials in these areas exhibit a stark contrast to the areas immediately adjacent to them, which exhibit very high densities (darker color in figures 4.4, 4.5, and 4.6) of refuse. The alternating low densities within the surface depressions and the nodes of high densities just outside of the surface depressions form more or less a circle or ring inscribed within the four-block square survey area on top of the midden.

The patterns from the geophysical data (see chapter 6, Tolay Valley Geophysical Prospection), also seem to corroborate the patterns identified in the surface collection data. Higher amplitude areas indicating GPR features (possibly structure floors or old outdoor ground surfaces) align with the surface depressions and the areas with lower refuse density, whereas the lower amplitude areas indicating no GPR features align with the areas with higher refuse densities outside of the depressions. These multiple lines of evidence may suggest that the depressions represent interior, domestic space and house pits that would have been kept clear of debris during use. Whereas the areas of densest refuse materials outside of these depressions may represent exterior space where refuse was deposited.

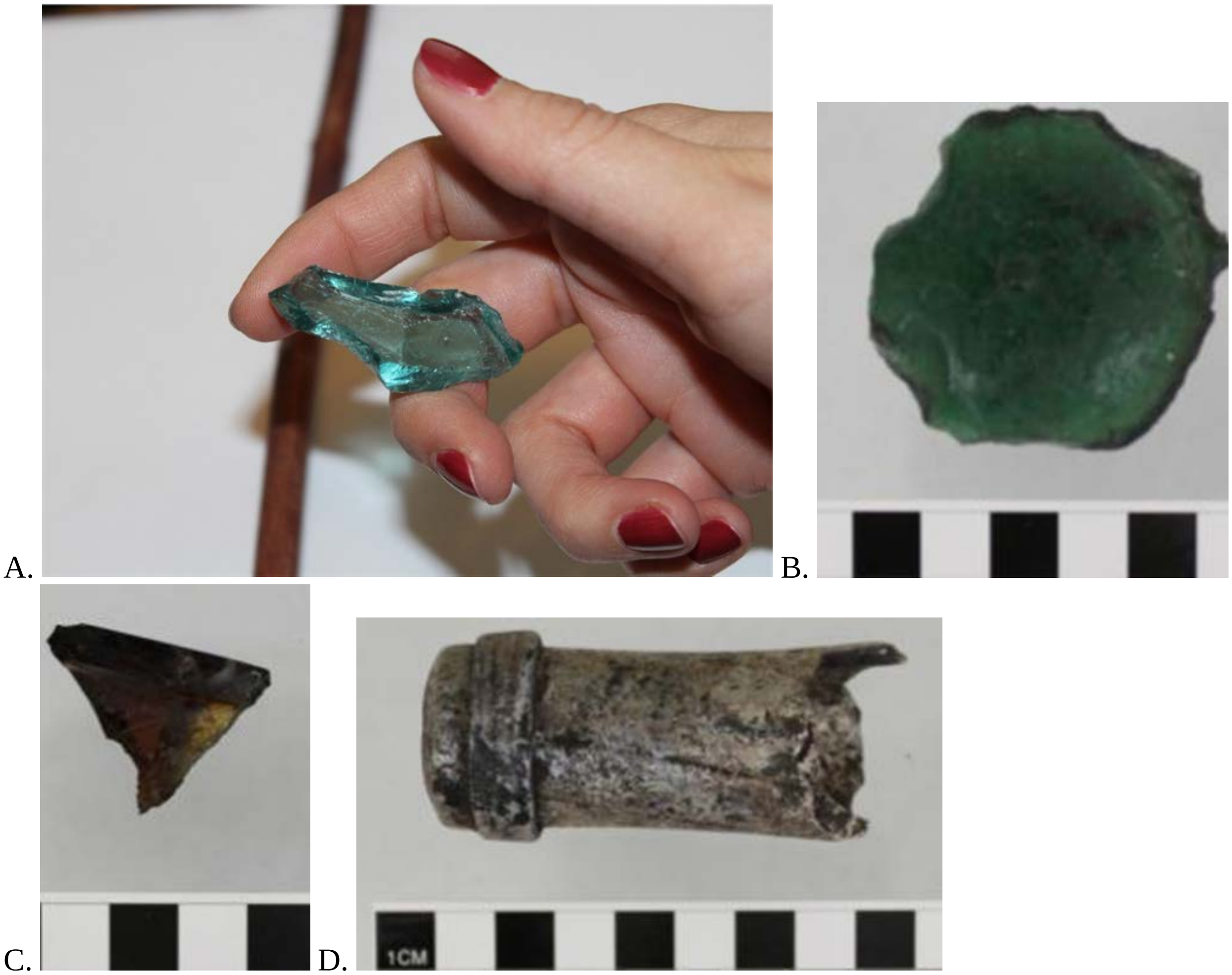
Although the lithic and faunal materials are very similar to one another in terms of their distribution on site, the historic materials differ somewhat in their distribution. That is, the historic materials are primarily concentrated in the northwest portion of the site, even though a few materials were found elsewhere. Materials such as machine-cut and wire nails, window glass, milled lumber and wood fragments, broken whiteware and stoneware ceramics, bottle glass, and glass reworked into chipped tools were found in this northwestern portion of the site. Very few of the historic artifacts were chronologically diagnostic. One such item, a champagne finish and neck of a mouth-blown bottle, dates somewhere between 1880 and 1920 (figure 4.8. D). Another item, a liquor bottle base with an emblem produced by the San Francisco & Pacific Glass Works, dates to between 1876 and 1902.

The nails, window glass, and milled lumber also suggest that a structure of some kind, possibly a small mobile house/shed on a sled foundation, such as the one found elsewhere on the TLRP property and depicted in figure 4.7, was placed in the northwest portion of the midden area, that is, in the center of block 14. The presence of both machine-cut and wire nails seem to suggest that the structure was occupied in the 19th and also in the 20th century. Machine-cut nails were used throughout the 19th century until the large-scale production of wire nails in the 1890s largely replaced machine-cut nails in the Far West of the United States (Sutton and Arkush 2009:168).

Figure 4.7. Image of a wooden house/shed on sleds that could be pulled by a team of horses to different parts of the property and propped up in a level position with additional blocks and beams.

A few pieces of reworked glass found on the surface of the site suggest California Indian use of this site in historic times. One piece of aqua-colored glass was shaped into a scraper with three concave working surfaces similar to those for scraping the bark off of long, narrow sticks of willow or dogbane for basket weaving or cordage (figure 4.8. A). This item was collected from the northwest portion of the midden area. A green bottle bottom was also found that has similar concave scraping edges around its circumference (figure 4.8. B). This item was collected from the drainage to the southwest portion of the midden area. Another flaked glass object found at the site was a brown, bottle bottom reworked into a burin etcher or perforator tool (figure 4.8. C). This item was collected from the northwest portion of the midden area. Unfortunately, these flaked glass objects do not have any chronologically diagnostic markings.

Figure 4.8. A. Knapped/reworked historic, aqua colored glass scraper. B. Knapped/reworked historic green bottle glass scraper. C. Knapped/reworked historic brown, bottle burin, etcher, or perforator tool. D. Unworked champagne finish and neck of a mouth blown bottle, circa 1880 and 1920.



Geophysical Prospection

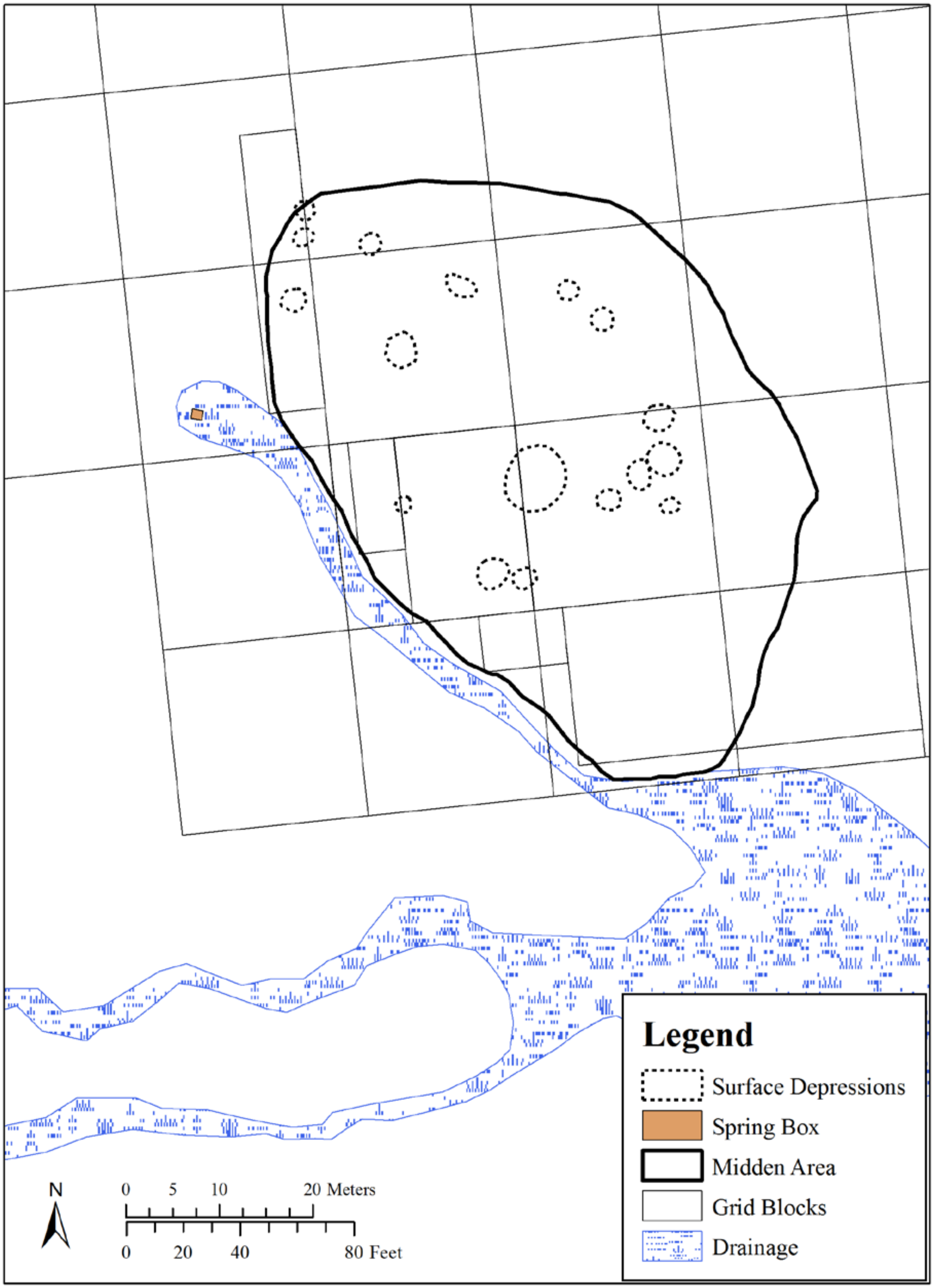
Geophysical methods, including Ground Penetrating Radar, magnetometry, and resistivity, were used as part of the assessment surveys of cultural resources during the Tolay Archaeology Project. For information about the geophysical surveys conducted at TAP-39, see chapter 6, Tolay Valley Geophysical Prospection.

High Precision Topographic Mapping with Terrestrial Light imaging, Detection, And Ranging (LiDAR)

Nels C. Nelson (1909:326), one of the first and most influential archaeologists working in the San Francisco Bay Area at the beginning of the 20th century writes, “As it is, on account of recent artificial disturbances, it is generally uncertain precisely in what state the mounds were left. Nevertheless, a few of the larger and better-preserved examples present roughly flattened tops and in two instances these surfaces are dotted with distinct saucer-like depressions, as of house pits."

Upon the initial clearing of vegetation from the surface of TAP-39 in the summer of 2013, circular depressions on the top of the mound became visible. The most regularly shaped of these circular depressions were recorded with a Trimble GPS. The thought was that these depressions could represent depressions from pit houses during the final occupation of this site by Native American people. Similar house depressions have been frequently documented in Marin and Sonoma County during the University of California Archaeological Survey. Though these features were not often investigated in great detail or described thoroughly, the frequency of these features was great enough that this attribute was included on the standard UCAS recording form (Heizer 1948). Robert Heizer (1947:263) noted the presence of numerous circular depressions from semi-subterranean houses in the Point Reyes and Drakes Bay region. Many house depressions have also been documented along the Southern Coast and in the Channel Islands region of California (Jazwa, et al. 2013).

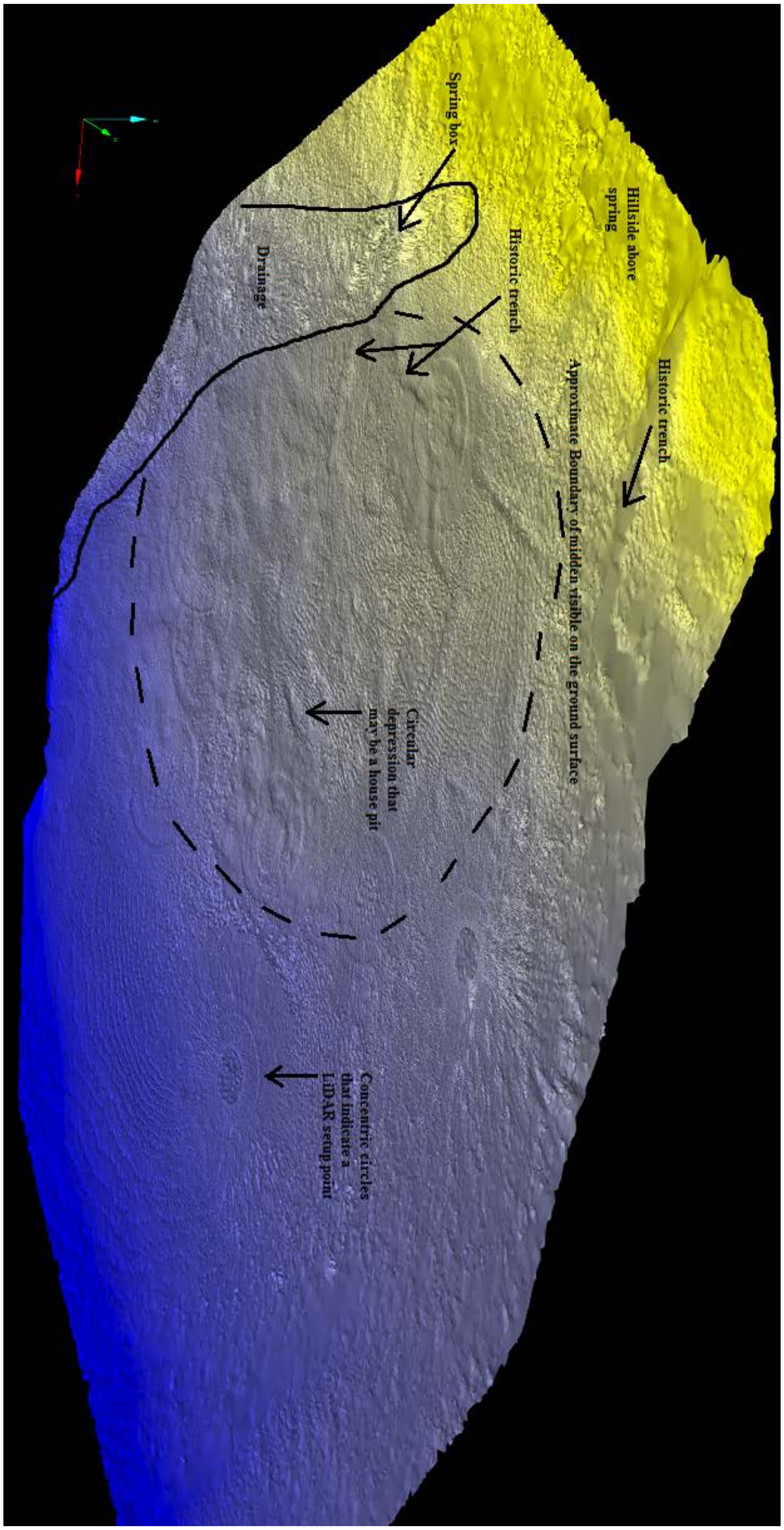
Figure 4.9. Map illustrating regularly-shaped, circular depressions on the ground surface of TAP-39.



One particularly good example of house depressions that were investigated in Central California is Clement Meighan's (1953) study of the Thomas Site, a traditional Coast Miwok village site. This site was also resurveyed more recently by Tsim Schneider (2010). Twelve depressions were recorded at the Thomas site, most of which were clustered at the highest elevation in the center of the mound. Meighan (1953) excavated one of the depressions and found burned redwood planks from a conical bark house structure. These findings may help us interpret the depressions present at TAP-39, though TAP-39 being an interior site, the materials for constructing the house would have differed. Houses in Central California were most likely constructed with willow frames and tule or grass thatch if the bark from redwoods was not available (Barrett 1916; Kroeber 1972[1925]-a, 1972[1925]-b)

One complicating factor in investigating surface depressions is teasing out the anthropogenic depressions from those created by cows, pigs, rodents and other animals. Bioturbation can cause tremendous damage to archaeological sites in the forms of trampling, rooting around for food or for curiosity, scratching on protruding on rocks or posts, and burrowing. As a result, I had low confidence in my ability to interpret the origin of the more irregular depressions, and they were not recorded with GPS. In order to take into account these multiple factors in the surface level investigation of house depressions, I decided to map the topography of the mound as well as the surrounding landscape in order to look for more general patterns that may not be apparent on the ground at the site. Thus, I relied on a high precision Terrestrial Light imaging, Detection, And Ranging (LiDAR) system (the I-Site 4400 from Maptek) to map the surface features of this site (figure 4.10).

Figure 4.10. Surface rendering of LiDAR point cloud from TAP-39 showing multiple surface features including circular depressions, undulating topography of the top of the midden, and historic trenches for pipes connected to the spring boxes.



LiDAR was able to precisely map the highly undulating surface topography on this site, historic features/disturbances, and some very regular depressions, which aligned with crew observations using GPS during the initial surface pedestrian survey. There were some difficulties in post-processing the data, and so not all of the concentric rings around the setup points of the LiDAR machine were able to be smoothed out completely, which is an unfortunate obscuring biproduct of this type of topographic survey. Visual analysis of the features across the surface of the site showed linear features representing water lines and trenches extending from spring boxes, which are either historic or modern features and disturbances to the site. This additional information about disturbance to the site guided decisions about excavation to areas that showed no signs of disturbance. Another insight gained from the LiDAR study is that the top of this mound was relatively flat like a platform rather than a half dome shape. This seems to make sense considering the above mentioned description from Nels Nelson (1909:326) of the better-preserved mounds as having flat tops and saucer-like, house depressions.

Figure 4.11. Point cloud generated from LiDAR data showing the flat platform-like top of the midden (light-colored area in the center of the image).

Summary of All Subsurface Investigation

The following table summarizes the total amount of subsurface investigation at TAP-39 during the 2013 and 2014 field seasons. The table is separated into Excavation Units (EU) and Auger Units (AU), because they are very different types of operations in terms of purpose and extent. The first measure representing the amount of excavation at TAP-39 is the surface area of each unit with a total of all units at the bottom of the column. The next measure is the total depth for each unit. The third measure is the total volume in cubic meters for each unit and the total for all units at the bottom of the column. The final measure is volume in liters of soil for each unit and the total for all units at the bottom of the column. The final column gives an explanation of the context of each unit. “Offsite” indicates a unit that was placed outside of the surface boundaries of the midden soils of the site. These units may have contained sparse lithic or other materials, but not any recognizable midden soil. One unit, EU 2 was placed outside of the surface boundary of the midden soils, but upon excavating this unit, buried intact midden soils were discovered.

Because this unit has both components, it is given the context “Offsite / Gen. Midden” to accurately represent all of its constituents. “Generalized midden” represents contexts within the midden area of the site that are not discrete, interpretable contexts. The “House Interior” context indicates the area above a clay house floor that contained much darker, softer midden soil with more charred botanical materials than other generalized midden contexts. Though this context may still represent a “mixed” non-discrete context, its association with the clay house floor allows for more solid interpretations of some activities associated with this area than generalized midden within other parts of the site. The “House Floor” context indicates a discrete clay floor of a structure.

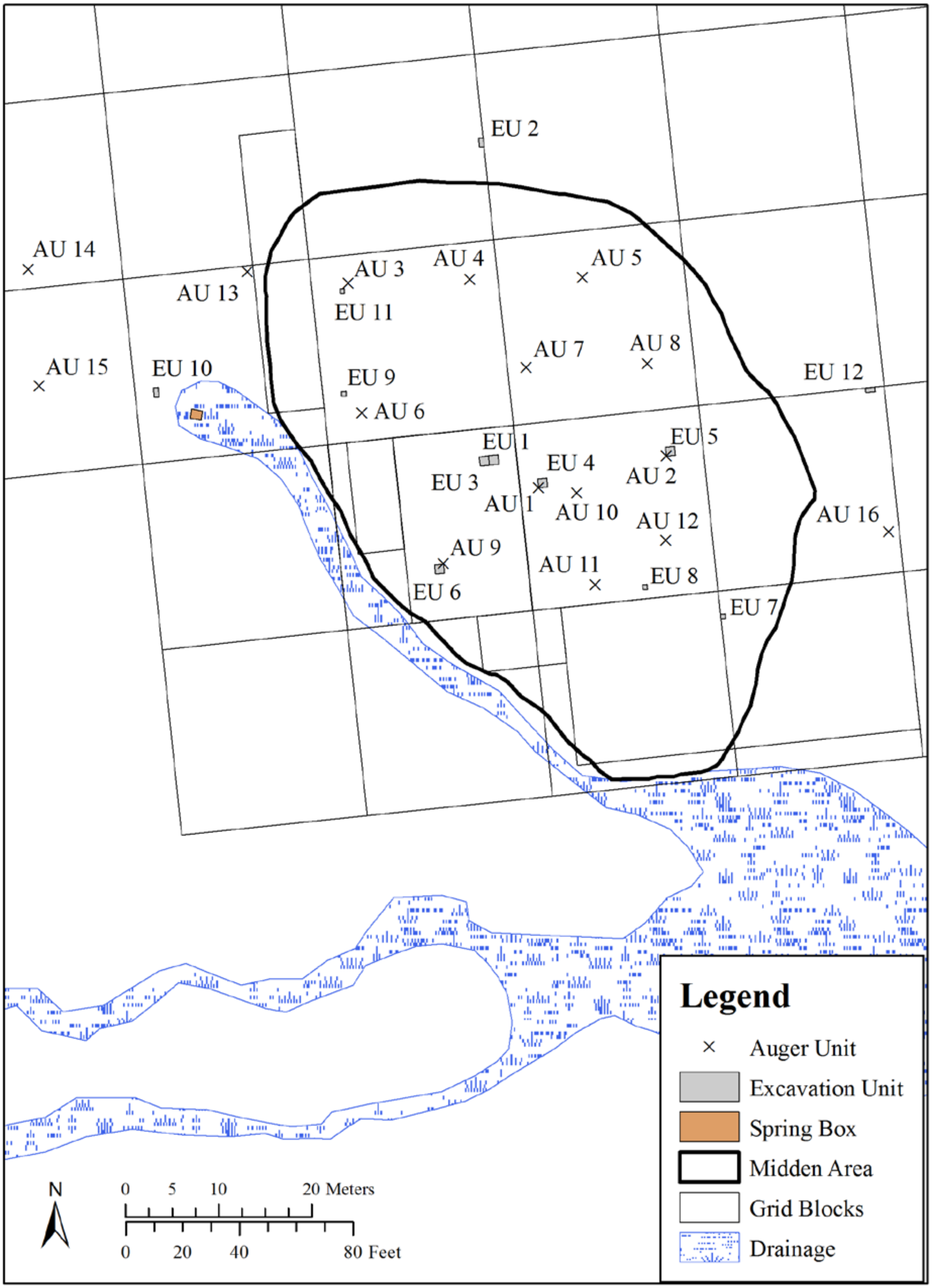
The conventions used to indicate depth for all units are measured in centimeters (cm) from either Below Datum (BD) or Below Surface (BS). Each EU had a specific unit datum which was usually the nail at the highest corner of the unit. The depth measured from the datum for these units is designated BD. All AUs were measured with marks on the auger shaft at 20 cm intervals in reference to the actual ground surface. These depth measurements are designated BS. All measurements are metric unless otherwise noted, and all soil color and texture designations follow charts and descriptions in the *Munsell Soil Color Book*, a standard used in geology and archaeology.

Table 4.1. Summary of dimensions and contexts of excavation and auger units at TAP-39.

Excavation Unit	**Area (m^2)**	**Depth (m)**	**Vol (m^3)**	**Vol (L)***	**Context**
EU 1	1.00	0.55	0.55	529.25	House Interior
EU 2	0.50	2.00	1.03	568.00	Offsite/Gen. Midden
EU 3	1.00	0.51	0.51	538.00	House Interior
EU 3.13	0.04	0.04	0.00	4.00	House Floor
EU 4	1.00	0.40	0.40	361.00	Generalized Midden
EU 5	1.00	0.20	0.20	100.00	Generalized Midden
EU 6	1.00	0.08	0.08	22.00	Generalized Midden
EU 7	0.25	1.60	0.41	348.50	Generalized Midden
EU 8	0.25	1.60	0.40	279.00	Generalized Midden
EU 9	0.25	1.50	0.38	399.00	Generalized Midden
EU 10	0.50	0.49	0.25	267.00	Offsite
EU 11	0.25	0.79	0.20	165.00	Generalized Midden
EU 12	0.50	1.00	0.50	592.00	Offsite
TOTAL	7.54		4.89	4172.75	
Auger Unit	Area (m^2)	Depth (m)	Vol (m^3)	Vol (L)*	Context
AU 1	0.008	1.00	0.008	7.85	Generalized Midden
AU 2	0.008	1.40	0.011	11.00	Generalized Midden
AU 3	0.008	0.65	0.005	5.11	Generalized Midden
AU 4	0.008	0.20	0.002	1.57	Generalized Midden
AU 5	0.008	0.60	0.005	4.71	Generalized Midden
AU 6	0.008	1.40	0.011	11.00	Generalized Midden
AU 7	0.008	0.60	0.005	4.71	Generalized Midden
AU 8	0.008	0.80	0.006	6.28	Generalized Midden
AU 9	0.008	1.20	0.009	9.42	Generalized Midden
AU 10	0.008	1.40	0.011	11.00	Generalized Midden
AU 11	0.008	1.20	0.009	9.42	Generalized Midden
AU 12	0.008	1.40	0.011	11.00	Generalized Midden
AU 13	0.008	2.10	0.016	16.49	Generalized Midden
AU 14	0.008	0.40	0.003	3.14	Generalized Midden
AU 15	0.008	0.40	0.003	3.14	Generalized Midden
AU 16	0.008	0.70	0.005	5.50	Generalized Midden
TOTAL	0.13		0.12	121.34	
EU+AU TOTAL	7.67		5.01	4294.09	

*EU volumes were measured in the field. AU volumes are estimates based on cubic volume.

Figure 4.12. Map of excavation and auger units at TAP-39.



The following sections will give a more detailed overview of the stratigraphy and findings from excavated contexts within each of the various EUs and AUs.

Augering

Auger units were excavated down to the subsoil below the midden soil of the archaeological site unless stopped by an impassible rock or unless sensitive materials were recovered from the soil in the auger bucket. If sensitive materials were encountered in any of the augers, all work stopped in that area and all materials from those augers were returned to the unit and backfilled after the tribe and appropriate agencies were notified and had a chance to assess the situation. The auger used for this project had a bucket measuring 4 inches or 10 centimeters in diameter. Each auger level was excavated in arbitrary 20 cm levels, and the soil was dry-screened with a 1/8-inch mesh, except for Auger Unit (AU) 10. The soil from each 20 cm level from AU 10 was retained as a flotation sample. Before bagging this material, it was passed through a 1/8 inch screen to check for sensitive materials. If sensitive materials had been found, the samples would have been reburied. Since no sensitive materials were found in AU 10, these samples were processed with other floatation samples.

Auger Unit 1. This AU contained obsidian and non-obsidian debitage, marine shell (mussel, oyster, and barnacle), faunal remains, one shell bead (at 0-20 cm BS), charred botanicals, and Fire Cracked Rock (FCR). The Munsell color and texture of the midden soil were consistently 10YR 3/1 or 2/1 and friable. As this AU approached the clay subsoil around 100 cm BS, the soil in the auger bucket became less friable because of higher clay content in the midden at this depth. This AU did not reach the end of midden soils, because it was stopped by an immovable rock.

Auger Unit 2. This AU contained obsidian and non-obsidian debitage, marine shell (mussel, oyster, and barnacle), faunal remains, charred botanicals, and Fire Cracked Rock (FCR). The Munsell color and texture of the midden soil were consistently 10YR 3/3 or 2/2 and friable. This AU reached the subsoil at about 110 cm BS at which point the Munsell color and texture of the soil were 10YR 3/1 and not friable. Between 120 to 140 cm BS, the soil transitioned to a very light-colored matrix of volcanic ash. The Munsell color of this ash was 10YR 7/3.

Auger Unit 3. This AU contained obsidian and non-obsidian debitage, marine shell (mussel and oyster), faunal remains, and Fire Cracked Rock (FCR). The Munsell color and texture of the midden soil were consistently 10YR 2/2 and friable. This auger encountered an immovable rock, and so the unit concluded at about 65 cm BS.

Auger Unit 4. This AU contained obsidian and non-obsidian debitage, marine shell (mussel), faunal remains, Fire Cracked Rock (FCR), and a whiteware ceramic fragment. The Munsell color and texture of the midden soil were consistently 10YR 2/2 and friable. Sensitive materials were recovered from the auger bucket between 0-20 cm BS, so the AU was concluded at 20 cm BS, and all materials were reburied in their original location.

Auger Unit 5. This AU contained obsidian and non-obsidian debitage, marine shell (mussel), faunal remains, Fire Cracked Rock (FCR), and a ceramic fragment (at 20-40 cm BS). The Munsell color and texture of the midden soil were consistently 10YR 3/2 and friable. Sensitive materials were recovered from the auger bucket between 40-60 cm BS, so the AU was concluded at 60 cm BS, and all materials were reburied in their original location.

Auger Unit 6. This AU contained obsidian and non-obsidian debitage, marine shell (mussel, oyster, and barnacle), faunal remains, charred botanicals, and Fire Cracked Rock (FCR). The Munsell color and texture of the midden soil were consistently 10YR 3/2 or 2/2 and friable. This AU reached the subsoil between 100-120 cm BS at which point the Munsell color and texture of the soil were 10YR 2/2 and not friable. Between 120 to 140 cm BS, the clay soil had a very light-colored matrix of volcanic ash mixed into it, but the ash was not as distinct of a stratigraphic change as in other units. The Munsell color of soil in this level was 10YR 4/2.

Auger Unit 7. This AU contained obsidian and non-obsidian debitage, 1 chert core, marine shell (mussel), faunal remains, charred botanicals, and Fire Cracked Rock (FCR). The Munsell color and texture of the midden soil were consistently 10YR 2/2 and friable. Sensitive materials were recovered from the auger bucket between 40-60 cm BS, so the AU was concluded at 60 cm BS, and all materials were reburied in their original location.

Auger Unit 8. This AU contained obsidian and non-obsidian debitage, marine shell (mussel and oyster), faunal remains, charred botanicals, and Fire Cracked Rock (FCR). The Munsell color and texture of the midden soil were consistently 10YR 2/2 and friable. This AU did not reach the end of midden soils, because it was stopped by an immovable rock between 60-80 cm BS.

Auger Unit 9. This AU contained obsidian and non-obsidian debitage, marine shell (mussel, oyster, and barnacle), faunal remains, charred botanicals, and Fire Cracked Rock (FCR). The Munsell color and texture of the midden soil were in the range of 10YR 3/1-3/3 or 2/1-2/2 and friable. This AU reached the subsoil between 100 to 120 cm BS at which point the Munsell color of the soil was 10YR 3/4 with some light brownish sand mixed into the clay.

Auger Unit 10. This AU contained obsidian and non-obsidian debitage, marine shell (mussel, oyster, clam, and barnacle), faunal remains, charred botanicals, clay with impressions (unsure whether this is an environmental phenomenon or daub from house construction materials), and Fire Cracked Rock (FCR). There were many more materials in this auger unit compared to others, because each 20 cm level was collected as a soil sample and processed through flotation to achieve full recovery of artifacts and botanical materials such as charred seeds. Each sample was dry screened into the sample bag prior to collection to check for any potential sensitive materials. No sensitive materials were encountered in this AU. The midden soil ended at clay subsoil between 120 to 140 cm BS.

Auger Unit 11. This AU contained obsidian and non-obsidian debitage, marine shell (mussel, oyster, and barnacle), one clam shell disk bead, faunal remains, charred botanicals, and Fire Cracked Rock (FCR). The Munsell color and texture of the midden soil were consistently 10YR 2/2 and friable. This AU reached the subsoil between 100 to 120 cm BS at which point the Munsell color of the soil was 10YR 3/4 with some light brownish sand mixed into the clay.

Auger Unit 12. This AU contained obsidian and non-obsidian debitage, marine shell (mussel, oyster, and barnacle), faunal remains, charred botanicals, and Fire Cracked Rock (FCR). The Munsell color and texture of the midden soil were consistently 10YR 2/2 and friable. This AU reached the clay subsoil between 120 to 140 cm BS at which point the Munsell color of the soil was 10YR 2/1. This clay soil quickly transitioned into the volcanic ash layer. The Munsell color of this matrix was 10YR 8/2.

Auger Unit 13. This AU was placed just below the hillside along the western boundary of midden soils visible on the surface of the site. This AU only contained a few pieces of obsidian and non-obsidian debitage. Between 0 to 20 cm BS the soil was composed of dark clay which transitioned into dark silt loam, midden soil at 20 cm BS. The midden soil gradually transitioned into clay subsoil between 60-80 cm BS. No artifacts except those brushed down from the side walls of the upper levels were found after 80 cm BS. This unit was continued into the subsoil in order to provide better information about the geology underlying the site. The dark brown clay soil from 60 to 80 cm BS transitioned into a brighter orange, wet clay at about 120 cm BS. This orange clay persisted to 200 cm BS where it became very gravelly and wet. This AU encountered a large immovable rock (or potentially bedrock) at 210 cm BS. The soil at this depth was lighter in color than the previous level and contained a little less gravel. No volcanic ash layer was encountered.

Auger Unit 14. This AU was placed mid-way up the hillside above the site and the springs. The purpose of this AU was to investigate the geology of the hillside and to check if there were other midden deposits or cultural materials in the subsurface outside of the midden portion of TAP-39. This AU only contained a few pieces of obsidian and non-obsidian debitage. The soil was a dark clay loam and was friable. The auger encountered an immovable rock (or potentially bedrock) between 20 to 40 cm BS. Some of this degrading rock broke off into the auger bucket and were collected as part of the soil sample.

Auger Unit 15. This AU was also placed mid-way up the hillside above the site and the springs. Since AU 14 was stopped by an immovable rock, AU 15 was placed about 10 meters away to investigate this area and potentially avoid what was blocking AU 14. This AU only contained a couple of pieces of obsidian and non-obsidian debitage. The soil was a dark clay loam and was friable. The auger encountered an immovable rock (or potentially bedrock) between 20 to 40 cm BS. Some of this degrading rock broke off into the auger bucket and were collected as part of the soil sample. Since both AU 14 and AU 15 encountered degrading rock at the same depth, it is probable that this is very shallow bedrock forming the underlying structure for the hill and the springs at the base of the hillside.

Auger Unit 16. This AU was placed to the east of the visible boundary of midden soils from TAP-39 to investigate whether or not the midden soil continued underground any further east outside of the visible surface boundary. This AU only contained a few pieces of obsidian and non-obsidian debitage. The soil from 0-40 cm BS was dark clay which transitioned into a light gray clay between 40-60 cm BS. This AU reached the ash or tuff layer at about 70 cm BS, and the auger was not able to dig any further below it because the matrix was too compact.

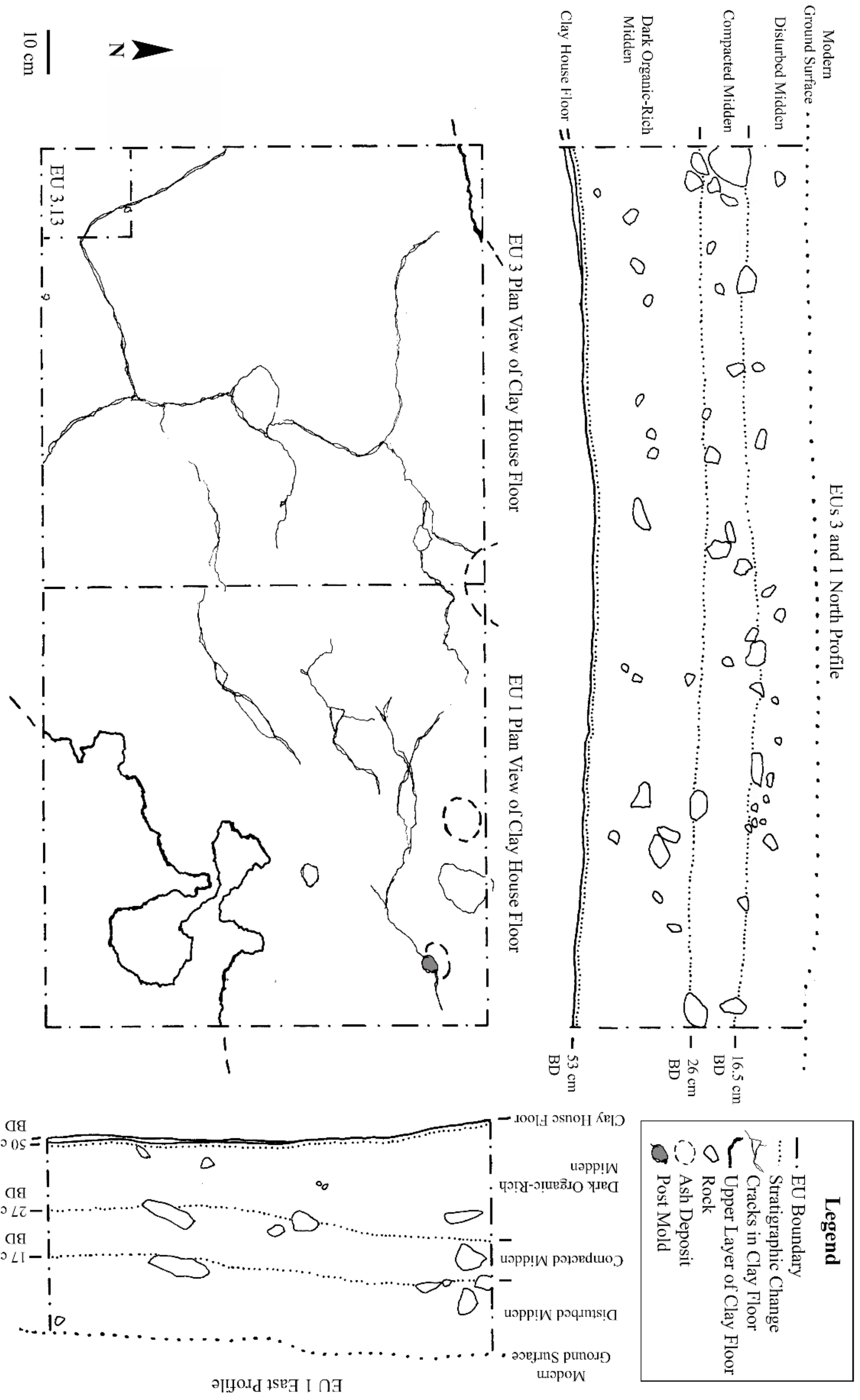
Excavation

Excavation of units at TAP-39 was contingent on FIGR committee approval and the findings from non-invasive and low-impact prospection methods, such as LiDAR topographic mapping, geophysical prospection, and surface collection, as was stated in the original project proposal. These units consisted of 1 m by 1 m standard Excavation Units (EUs) and 0.5 m by 0.5 m quarter EUs. All of these units were hand excavated with trowels. During the excavation of all units on site, we encountered rodent burrows throughout our units. As a result, these units were excavated in 10 cm arbitrary levels (unless a stratigraphic change or feature was identified) in order to preserve some sense of vertical separation between contexts or broad components that could later be identified via precise AMS radiocarbon dating (see Appendix B). All soil, unless collected as a flotation or intensive soil sample, was dry-screened with 1/8-inch mesh.

Excavation Unit 1 and 3. These two 1 m by 1 m units were excavated to investigate a planar reflection in the Ground Penetrating Radar data that was believed to correspond to a circular house pit or formal floor similar to those described by other scholars in California (e.g. Arnold, et al. 1997; Gamble 1995; Grenda, et al. 1998; Jazwa, et al. 2013; Meighan 1953; Nelson 1909; Torben C. Rick 2007). Excavation Unit (EU) 1 was excavated first and confirmed the presence of the floor followed by an expansion of the investigation with another 1 meter by 1 meter unit (i.e. EU 3) to the west of EU 1. EU 3 was placed to the west of EU 1 to investigate the center of the clay floor and evaluate whether there was a hearth in the center of this structure which could potentially yield different kinds of botanical materials than the rest of the structure.

The ending depth of EU 1 was 54.5 cm BD. This was also the depth of the top of the house floor in the southwest corner of EU 1. The ending depth of EU 3 was 51 cm BD. One small 20 cm by 20 cm square portion of the house floor (designated EU 3.13) was excavated to investigate the thickness and constituents of the house floor. Level 7.1 from 51 to 53 cm BD and level 7.2 from 52 to 55 cm BD constitute the arbitrary levels of the house floor. The thickness of the compact clay floor was about 3 to 4 cm. The division between levels 7.1 and 7.2 was decided arbitrarily to ensure that the excavation of level 7.1 would include only materials embedded in the actual house floor rather than materials from beyond the floor clinging to the bottom of it. This separation was important for accurate dating of the clay floor itself. Level 7.2 stopped at the midden soil underlying the house floor. Originally, it was the intention to continue excavation in these units down to subsoil in 2014 and sample the house floor feature for micromorphological and microstratigraphic analyses of construction and use. However, sensitive material was discovered during lab analyses of materials in the 2013-2014 academic year that prompted additional consultation with the tribe and appropriate agencies and the decision to rebury all materials from these two units. This discovery also prompted more rigorous, regular checks for sensitive materials in the field during the subsequent 2014 field season.

Figure 4.13. Profile and planview drawings of EUs 1 and 3. Planview is drawn at a depth of about 53 cm BD or the surface of the house floor.



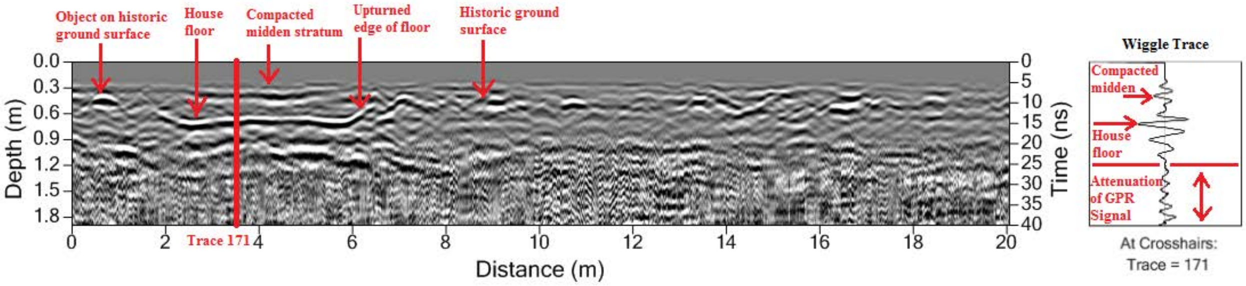
In both EU 1 and 3, the density of artifacts is much lower in the first two levels from 4-19 cm BD than levels 3, 4, and 5. In particular, delicate materials such as faunal remains and charred botanical materials were much better preserved in levels 3 to 6. Other materials included obsidian and non-obsidian debitage and tools (unifaces, bifaces, scrapers, projectile points, and drills), worked bone tools (pressure-flaker antler tines, thick pointed tools, slim awls), *Olivella* shell beads, clam shell disk beads, refuse from bead production including a whole *Olivella* shell with square cut and one square *Olivella* bead blank broken linearly through its centerline and the drill hole, amorphous hardened clay nodules with plant impressions (potentially architectural daub stuck between grass thatch to patch small holes within a structure), non-ferrous metal grommets, metal clasp parts, metal wire, machine-cut nails, flat/window glass, bottle glass (potentially flaked), and red/brown stoneware ceramics with glaze on interior side only.

AMS (Accelerator Mass Spectrometry) radiocarbon dates of charred seeds or vegetative material embedded in level 7.1 (or the upper level of the house floor) indicate that the clay house floor itself dates to roughly 1473-1645 Cal years BP (see Appendix B). AMS radiocarbon dates from levels 3 to 6 above the house floor are variable and contain multiple intersects making interpretation difficult. However, most of these intercepts in the data exist in the range between 1645 and 1940. Some radiocarbon dates came back as modern and some pre-date the house floor by 1000 years (see Appendix B). These modern and very old dates as well as physical evidence of active rodent burrowing show that there has been bioturbation and some mixing of soils in this context. Other factors to consider in interpreting the dates of the house floor and occupation of this space is the construction and retirement of this structure. If a foundation for this structure was dug into the ground making it semi-subterranean, the cut into the ground could have exposed older botanical materials which were embedded in the clay as the floor was being constructed. Similarly, the infilling of a semi-subterranean structure could have mixed materials from exterior contexts that could produce reverse stratigraphy or a more complex, mixed context to interpret.

That being said, based on the AMS dates and the late and historic period artifacts found above the house floor, it is safe to say that all of these materials are younger than 1500 years BP. The machine-cut nails may strengthen the case that this portion of the site was occupied earlier than 1900, because the large-scale production of wire nails in the 1890s largely replaced machine-cut nails in the Far West of the United States by this time (Sutton and Arkush 2009:168). Taking a small amount of liberty with the data, it is reasonable to assume several scenarios are possible. It is possible that this structure is not semi-subterranean and the date from the clay floor is more representative of the time of construction and occupation of this structure between 1473-1645 Cal years BP. This floor could have also been semi-subterranean and the date from the clay house floor predates the actual date of construction and subsequent occupation. In this scenario, there are three possible variants. First, the house could have been constructed, occupied, and retired before contact with Europeans. In this scenario, the historic materials near the house floor could be the result of bioturbation and mixing of soils from later Historic Period occupations elsewhere on the site. Second, the house could have been constructed and occupied before contact with Europeans and retired after contact (potentially because of forced removal by Spanish mission *padres*). In this scenario, there could have also been a reoccupation of the broader site in the Mexican or American Periods. Third, the house could have also been constructed, occupied, and retired after contact (during either the Mexican or American Periods while providing labor on surrounding ranchos or farms).

Upon reanalyzing the Ground Penetrating Radar data (see chapter 5, Tolay Valley Geophysical Prospection) with the addition of radiocarbon dates, stratigraphic profile drawings, and artifactual materials provided by the excavation of EUs 1 and 3, it appears that this structure may have been semi-subterranean. The geophysical data show that the edges of the floor turn up as though part of the walls of a broad, shallow depression or pit (figure 4.14). Further up in the Ground Penetration Radar (GPR) profile, the compact midden soils of level 3 (see also EUs 1 and 3 planview drawing) are visible above the house floor and outside of the house floor at the same level are multiple point reflections that appear at the same depth throughout the profile. These point reflections are objects resting on a historic surface, and level 3 is the compacted top of historic fill when the house was retired and the house pit was filled in. Having established that the house was semi-subterranean, it is safe to say that the AMS radiocarbon date for the clay house floor pre-dates its actual construction. Thus, it is likely that this house was constructed and occupied around the time of contact with Europeans or it was constructed and occupied after contact in the Historic Period.

Figure 4.14. GPR Profile from Block 30 highlighting the stratigraphy and features observed in EUs 1 and 3.



Excavation Unit 2. The location of this 1 m by 0.5 m unit was selected to provide an offsite control sample from just beyond the edge of midden soils visible on the surface of the site. As this unit was excavated, it was found that buried midden soils were present and constitute a continuation of midden soils from the main midden site area under the current ground surface (which is probably overburden clay soils eroding from cattle traffic on the nearby hillside). This side of the midden most likely continues further north and “feathers out” or tapers in thickness underground as it moves beyond the visible boundary of midden soils on the surface. The overburden soils from 0 to 41.4 cm BD contained mainly small amounts of obsidian and chert lithics and small fragments of faunal bone. The starting depth of midden soils in this unit was about 41.4 cm BD. The ending depth of midden soils in EU 2 was between 120 to 160 cm BD. The midden soils contained fire cracked rock, some marine shell (primarily mussel), obsidian, chert and other lithic materials, paleoethnobotanical materials (charred wood, seeds, and other plant parts), and faunal bone. This unit was augered past 100 cm BD with 20 cm levels, because midden soils continued down to 160 cm BD, and cultural materials such as shell, obsidian and burnt bone continued albeit very sparsely to a depth of about 200 cm BD where excavators ended the unit. Between 100 to 120 cm BD, there was a layer of large cobbles (10 cm in diameter) that the auger could not pass through. The crew excavated a shovel test pit around the auger hole down to 140 cm BD to pass through this layer of cobbles, and then the crew continued augering down to 200 cm BD. Between 140 to 160 cm BD, the soil transitioned from midden to a dark clay subsoil. Between 160 to 180 cm BD, the subsoil changed from dark clay to a lighter gray, slightly speckled with orange/brown clay. There was still burnt bone in this soil (clearly embedded in the clay rather than having fallen into the auger hole from above), and so augering continued down to 200 cm BD where the unit ended.

Excavation Unit 4. This 1 m by 1 m unit was placed to investigate a large planar reflection in the GPR data similar to the one from EU 1 and 3 that was found to be a clay house floor. This unit was also inside of the footprint of a large circular, surface depression that was suspected to be a depression from a potential house pit. The midden soils contained fire cracked rock, some marine shell (primarily mussel), obsidian, chert and other lithic materials, paleoethnobotanical materials (charred wood, seeds, and other plant parts), faunal bone, stone bead, shell beads, metal fragments, plastic, whiteware ceramic fragments, glass bead/button, non-ferrous metal grommet, and bottle glass. The presence of sensitive material at about 39.5 cm below the EU 4 datum resulted in the conclusion of excavation in this unit before the expected depth of the GPR feature. Excavation revealed a feature composed of compacted rocks, many of which were about 5 cm in size. Four 1 m by 1 m surface units (sod stripped and top soil scrapped not more that 1 to 2 cm BS) were placed around EU 4, one surface unit adjacent to the west and north sides of EU 4 and two units to the east. These surface units revealed an extensive rock/gravel feature within the footprint of the circular depression with a concentric circle devoid of many stones or compaction in the center of the circular depression.

A patch of dried, old grass and cow dung was observed underneath one of the compacted rocks located between the two eastern surface units off of EU 4. There were also some scraps of black, plastic pipe in these surface units, and a metal studded T post was found just to the south of the SW corner of EU 4, even though there was no formal surface unit in that direction. This rock/gravel feature in a depression represents a cattle watering area. A trough was placed here, fed by a plastic pipe from the spring, and rock and gravel were placed around the trough so that the soil would not become too sodden and muddy when the cows splashed the water around. Elsewhere on-site and not associated with this area, a circular metal trough (about the same diameter as the concentric circle devoid of stones) and a rectangular metal trough were pulled off of the site after recording their location with GPS. Over time, the constant cattle traffic to the circular trough placed in this area compacted the soil around the trough, essentially paving the area around the trough with the rocks and gravel. The studded T Post was most likely driven into the ground to hold the trough in place and was pulled out of the ground when the trough was removed or knocked over by cattle that may have used it as a scratching post. The question remains as to whether the large depression was present before the trough was placed due to the sagging of soils into a pit structure below or the depression was created by the cattle activity around the trough. If the depression was already present, this location could have been chosen as a good site to place the trough because the gravel within the depression would be less likely to disperse across the site than gravel laid on a flat surface under heavy cattle traffic.

As a note, I asked Glen Mohring (H & L Mohring Ranch) during the field season on June 18, 2014 about watering cattle from the springs near the site (as there are other springs and stock ponds on the property where cattle are currently watered). Mr. Mohring has ranched cattle with his family's business at the property since 1977, and he did remember watering cattle at this specific place. He also confirmed that the gravel was used in tandem with the troughs. When I asked him about the round trough specifically, he said it was positioned straight out from the spring, and it remained in place until he moved it. He was not precise about the locations on the site or timing of his use and removal of the round trough. Mr. Mohring also said that he had never used planks of lumber to support the troughs. This may add validity to the interpretation of the milled wood/lumber fragments and nearly-whole boards that were found elsewhere on the surface of the site as having been incorporated into an old, historic structure (possibly a dwelling) rather than used individually for modern troughs. The troughs are the only significant historic structure (though relatively mobile) currently present on or near the site other than metal and plastic pipe systems connected to spring boxes. The spring boxes are too small to have incorporated the longer wooden boards on the surface of the site.

Excavation Unit 5 and 6. These two 1 m by 1 m units were placed to further investigate the spatial layout of the site. Unit 5 was placed within the footprint of a circular, surface depression on the eastern side of the site. GPR data for this area showed high amplitude reflections that might indicate a surface or domestic space in this portion of the site. Unit 6 was placed in an area with very few if any medium or high amplitude reflections in the southwest portion of the site. The purpose of placing a unit in this area was to investigate an area with no observed geophysical features to provide a control for the units where targeted features were observed in the geophysical data. Both of these units ended prematurely due to the presence of sensitive material close to the surface in the first level or two (0 to 20 cm BD) of excavation, and all materials from these units were returned and reburied.

Excavation Unit 7. This 0.5 m by 0.5 m excavation unit was placed on the southeast side of the site in order to provide a controlled column of flotation samples throughout excavation of this quarter-unit from the surface of the site to its basal deposits. The flotation samples from this unit provide information about the botanical and faunal materials throughout the entire range of occupation of this portion of the site and allow for the interpretation of environmental change through time. This unit is composed of dark midden soils with some fire cracked rock and various densities of marine shell (primarily mussel). This unit also contained obsidian, chert and other lithic materials, an eccentric (elongated) stone bead or pendant perforated at one end, paleoethnobotanical materials (charred wood, seeds, and other plant parts), and faunal bone. This unit was excavated arbitrarily in 10 cm levels, and the total depth of midden soils was about 120 cm BS. No changes in the color or texture of the soil were extant from visible stratigraphic changes (except for the change from midden soil to subsoil at the bottom of the unit) and anthropogenic features. Many rodent burrows—some hollow and still actively used, and other old burrows represented by lighter-colored soil stains—were observed throughout all levels of excavation to a depth of about 60 to 80 cm BS. After 120 cm BS, the unit was too deep to excavate with trowels, and so we used an auger to excavate 20 cm arbitrary levels down to 160 cm BS. We excavated two different auger holes in the center of the unit in two additional levels from 120 to 140 cm BS and from 140 to 160 cm BS. The soil from both auger holes in each level were combined as a flotation single flotation sample for that level. The soil transitioned from midden to dark clay between 120 to 140 cm BS. The soil transitioned again from dark clay to light gray clay and chunks of white volcanic ash or tuff between 140 to 160 cm BS.

Excavation Unit 8. This 0.5 m by 0.5 m excavation unit was placed on the southeast side of the site (though further east or higher up on the mound than Unit 7) in order to provide a controlled column of flotation samples throughout excavation of this quarter-unit from the surface of the site to its basal deposits. The flotation samples from this unit provide information about the botanical and faunal materials throughout the entire range of occupation of this portion of the site and allow for the interpretation of environmental change through time. This unit is composed of dark midden soils with some fire cracked rock and various densities of marine shell (primarily mussel). This unit also contained obsidian, chert and other lithic materials, paleoethnobotanical materials (charred wood, seeds, and other plant parts), and faunal bone. This unit was excavated arbitrarily in 10 cm levels, and the total depth of midden soils was about 120 cm BS. No changes in the color or texture of the soil were extant from visible stratigraphic changes (except for the change from midden soil to subsoil at the bottom of the unit) and anthropogenic features. Some roots and many rodent burrows—some hollow and still actively used, and other old burrows represented by lighter-colored soil stains—were observed throughout all levels of excavation to a depth of about 60 to 80 cm BS. The transition between midden soils and clay was gradual and not quite complete at 120 cm BS, so two auger units were excavated past 120 cm BS in order to ascertain at what depth the solid clay subsoil was present without any trace of midden soils or artifacts. The two auger levels were excavated in 20 cm arbitrary levels, the second auger level ending at a depth of 160 cm in solid clay soil. No volcanic ash/tuff was encountered in the subsoil of this unit at this depth.

Excavation Unit 9. This 0.5 m by 0.5 m excavation unit was placed on the northwest side of the site in order to provide a controlled column of flotation samples throughout excavation of this quarter-unit from the surface of the site to its basal deposits. The flotation samples from this unit provide information about the botanical and faunal materials throughout the entire range of occupation of this portion of the site and allow for the interpretation of environmental change through time. This unit is composed of dark midden soils with some fire cracked rock and various densities of marine shell (primarily mussel). This unit also contained obsidian, chert and other lithic materials, paleoethnobotanical materials (charred wood, seeds, and other plant parts), faunal bone, bottle glass, window glass, machine-cut nails and uncharred wood/lumber fragments. This unit was excavated arbitrarily in 10 cm levels, and the total depth of midden soils was about 130 cm BS. Only one change in the color and texture in the soil from a discrete ash feature (at a depth of between 70 to 80 cm BS) was observed. The ash feature was impacted by an active rodent burrow, and so the quality of its integrity is low. Other rodent burrows—some hollow and still actively used, and other old burrows represented by lighter-colored soil stains—were observed throughout all levels of excavation to a depth of about 80 cm BS. At about 80 to 90 cm BS, excavators observed that the midden soils had inclusions of grey clay clods that persisted in the midden to the transition into clay subsoil. The transition between midden soils and clay was gradual and not quite complete at 130 cm BS, so one auger unit was excavated past 130 cm BS in order to ascertain at what depth the solid clay subsoil was present without any trace of midden soils or artifacts. The auger level was 20 cm in depth ending at 150 cm BS in solid clay soil, but there were still artifacts present at this depth. No volcanic ash/tuff was encountered in the subsoil of this unit at this depth.

Excavation Unit 10. This 1 m by 0.5 m excavation unit was placed to the west of the midden boundary on the hillside above the spring to provide a control unit in the offsite clay soils around the midden portion of the site. Flotation samples and phytolith samples were collected from these units to provide context for the onsite densities of botanical, faunal, and artifactual materials present in the midden. The phytolith samples will be used to assess the persistence of or changes in grasslands near the site through time. The goal with phytolith sampling overall in the project is to eventually collect additional samples throughout the Tolay Valley in soils well away from the archaeological sites to assess whether the valley as a whole has been dominated by grasslands or other vegetation types (forbes, shrubs, trees, etc.) in the past. The soils were composed of dark, dry, brownish-gray clay. This unit contained very low densities of cultural materials, including: obsidian, chert and other lithic materials, paleoethnobotanical materials (charred wood, seeds, and other plant parts), and faunal bone. At about 40 cm BD, the soil transitioned to a lighter colored clay, which took on a greenish hue between 40 to 50 cm BD. At about 50 cm BD, a lot of crumbling, degraded rock was present that we interpreted to be eroding bedrock similar to what was observed in the nearby auger units, AU 14 and AU 15 at about 40 cm BS. It was possible to excavate further through the soil and degrading bedrock in this larger unit with pickaxes than in the narrower auger units with an auger bucket, but it was difficult and would have eventually become impossible to continue.

Excavation Unit 11. This 0.5 m by 0.5 m excavation unit was placed on the northwest side of the site in order to provide a controlled column of flotation samples throughout excavation of this quarter-unit from the surface of the site to its basal deposits. The flotation samples from this unit provide information about the botanical and faunal materials throughout the entire range of occupation of this portion of the site and allow for the interpretation of environmental change through time. This unit is composed of dark midden soils with some fire cracked rock and various densities of marine shell (primarily mussel). This unit also contained obsidian, chert and other lithic materials, paleoethnobotanical materials (charred wood, seeds, and other plant parts), faunal bone, bottle glass, window glass, machine-cut nails and uncharred wood/lumber fragments. The presence of sensitive material in the level between 60 to 80 cm BS resulted in the conclusion of excavation in this unit at 80 cm BS. No changes in the color or texture of the soil were extant from visible stratigraphic changes and anthropogenic features. Some roots and rodent burrows—represented by lighter-colored soil stains—were observed throughout all levels of excavation.

Excavation Unit 12. This 1 m by 0.5 m excavation unit was placed to the east of the midden boundary to provide a control unit in the offsite clay soils around the midden portion of the site. Flotation samples and phytolith samples were collected from these units to provide context for the onsite densities of botanical, faunal, and artifactual materials present in the midden. The phytolith samples will be used to assess the persistence of or changes in grasslands near the site through time. The goal with phytolith sampling overall in the project is to eventually collect additional samples throughout the Tolay Valley in soils well away from the archaeological sites to assess whether the valley as a whole has been dominated by grasslands or other vegetation types (forbes, shrubs, trees, etc.) in the past. The soils were composed of dark, dry, brownish-gray clay. This unit contained extremely low densities of cultural materials, including: obsidian, chert and other lithic materials, and faunal bone. At about 97 cm BD, the darker clay soil transitioned to a lighter gray-colored clay. As we excavated deeper to 100 cm BD where the level ended, the light gray clay was mixed with chunks of white volcanic ash or tuff.

Conclusion

In conclusion, the robust non-invasive and low-impact methods designed in close collaboration with the Federated Indians of Graton Rancheria for the TAP produced high quality data that address many goals of the project. First, three new sites were discovered throughout the valley during pedestrian survey, including one lithic scatter, one cupule rock, and one PCN/cupule/mortar rock. Second, terrestrial LiDAR survey of the surface of TAP-39 helped characterize the shape of the mound as a flat platform with undulating topography and some regular, circular depressions that may be house pits. Terrestrial LiDAR was also able to identify historic/modern trenches across the surface of the site and evaluate impacts to the site from ranching and irrigation. Third, the systematic groundstone survey and intensive surface collection of lithic, faunal, and historic materials revealed patterned distributions of artifacts across the site that constitute activity areas. Some of these areas are a food processing/grinding area near the drainage and spring to the west of the site as well as patchworks of house pits or structure floors (denoting living space) and nodes of refuse ringing the top of the mound. There was also debris from a historic building located in the northwestern portion of the site. Fourth, excavation and augering investigated components of the site identified by the geophysical survey and surface collection. One GPR planar reflection feature was confirmed to be a formal clay house floor. Excavation and augering also allowed for the collection of faunal materials and flotation samples that produced paleoethnobotanical materials. These results have allowed for further discussion of environmental change in the Tolay Valley in chapter 6 and a discussion of how Coast Miwok people returning to the Tolay Valley in the mid- to late-nineteenth century navigated the encroachment of settler colonialism within their homeland in chapter 7.

Chapter 5

Tolay Valley Geophysical Prospection

In chapter 4, I presented on all of the field methods and results from the Tolay Archaeology Project except for geophysical prospection. In chapter 5, I will discuss the methods and results of geophysical prospection or archaeological geophysics and their relevance for the study and management of tribal cultural resources in the Tolay Valley. Geophysical prospection in the TAP included Ground Penetrating Radar (GPR) and magnetometry. A third method, resistivity, was attempted, but due to instrument malfunctions, the resistivity survey was discontinued. As such, resistivity data did not play a prominent role in investigating components of the sites within the Tolay Valley, and these data are not presented here. The GPR and gradient magnetometry surveys, however, produced extremely valuable results that have led to reinterpretations and updates to old site records and new insights about sites that have never before been studied.

GPR and gradient magnetometry were both utilized during surveys at TAP-39 and the lakebed area. I will begin by describing each of these geophysical methods, and then present the results of the TAP-39 survey and the lakebed area survey. While magnetometry was not able to produce as much precise information about features to investigate at TAP-39, GPR was able to resolve images of house floors in profile and plan view that guided the excavation work in 2013. Gradient magnetometry played a prominent role in the lakebed area survey and produced results that have suggested a larger boundary for TAP-56 and a more appropriate characterization of TAP-09. Magnetometry and GPR were able to detect the presence of and define an approximate boundary for an unknown geological feature in the lakebed, probably a volcanic ash or tuff layer.

The Methods of Archaeological Geophysics in the Tolay Archaeology Project

Gradient Magnetometry

Magnetometry is a method of geophysical prospection that measures differences in the Earth's magnetic field (Aspinall, et al. 2008). These differences can represent variation in the natural geology of an area or anthropogenic modifications to the natural world. Gradient magnetometers utilize two magnetometer sensors (rather than just one for total field magnetometry) to produce a gradient reading of differential magnetic susceptibility rather than a reading of the component of the earth's total magnetic field (Aspinall, et al. 2008:29-56). Archaeologists have successfully used magnetometry and gradient magnetometry to detect very subtle magnetic features relating to human activities such as anthropogenic soils, hearths, compact floors, pits, ditches, postholes, clusters of rocks, etc. (Clark 1996:64-98).

The instrument used throughout the Tolay Archaeology Project (TAP) was a Geometrics G-858 cesium gradiometer. Each block surveyed with the gradiometer consisted of multiple survey lines that were spaced 0.5 meters apart, and surveyed either unidirectionally or bidirectionally. The advantage to surveying unidirectionally is that the data align more consistently than bidirectional surveys, but it also takes longer, because the operator must walk the instrument back to the starting line without surveying before another survey line can be completed. When operators are inconsistent in their stride or multiple operators are surveying the same grid, operator inconsistencies can produce data lines that are slightly mismatched with one another and look "striped" in the processed image. While surveying TAP-39 in 2013, striping in the data was not an issue, because there were fewer operators for the gradiometer, and they had more time to learn to use the instrument. Thus, the operators of the gradiometer surveyed bidirectionally or alternated the direction of every other survey line by 180 degrees from the first survey line of the block. While surveying the in and around the Tolay lakebed in 2014, striping in the data was an issue, because there were more less experienced operators who did not have as much time to practice surveying. Thus, the gradiometer operators for the lakebed study always surveyed unidirectionally or in the same direction as the first survey line for every line within a block.

During the survey of TAP-39 in 2013, Blocks 3, 4, 5, 8, 9, 14, 15, 16, 21, 22, 23, 29, 31, 32, 33, 34, and 35 within Grid 1 were surveyed. During the survey of the Tolay lakebed and surrounding area in 2014, all blocks in Grids 1, 2, 3, 4, 5, 6, 7, and 8 were surveyed. See the site maps of TAP-39 with geophysical contour maps overlain below for the locations of the blocks within grid 1 at TAP-39. The TAP-39 maps provided an arbitrary coordinate system rather than a real-world coordinate system in order to protect the confidentiality of this site's location. For further description of this grid, see chapter 4. For the lakebed study, eight grids were established, which are described generally below without their arbitrary or real-world relationships to one another in order to protect the confidentiality of survey and site locations from this very visible portion of Tolay Lake Regional Park. Only the geophysical contour maps are provided for these eight grids.

Ground Penetrating Radar

Ground Penetrating Radar (GPR) is a method of geophysical prospection that uses high-frequency radar pulses transmitted from an antenna in order to detect and map natural geological formations as well as anthropogenic modifications to the natural world (Conyers 2004:11-12). GPR has been used to identify architectural features such as walls and foundations as well as other anthropogenic features such as hearths, pits and floors, and historic graves in cemeteries. Much of the success of GPR in identifying subsurface features depends on how different the materials in the ground are from surrounding soils. The level of water saturation in these materials and soils when a survey is completed also affects an analyst's ability to see changes from material to material and identify features (Conyers 2012:37).

The instrument used throughout the TAP was a GSSI SIR 3000 unit. 200 mhz (megahertz), 400 mhz, and 900 mhz antennas were used to collect data. Data were collected with the 200 mhz antenna in single transects and the location of these transects was recorded using a TripMate 850 datalogger GPS. Data collected with the 400 mhz and 900 mhz antennas were collected systematically in blocks of multiple transects or survey lines. Each survey line for the 400 mhz antenna was spaced 0.5 m apart and surveyed bidirectionally. Each survey line for the 900 mhz antenna was spaced 0.25 mhz apart and also surveyed bidirectionally. During the survey of TAP-39 in 2013, Blocks 8, 9, 14, 15, 16, 21, 22, 23, 29, 31, 32, 33, 34, and 35 within Grid 1 were surveyed. During the survey of the Tolay lakebed and surrounding area, data were collected with the 400 mhz antenna in Blocks 12, 13, 14, 15, 16, 17, and 18 of Grid 3. Data were also collected with the 900 mhz antenna in Block 13 of Grid 5. The different mhz antennae emit different size waves which allow for more or less resolution and depth within the GPR data. For example, the 900 mhz antenna signal consistently reached about 60 cm below the ground surface of TAP-39 before attenuating and was able to resolve small individual objects and features. The 200 mhz antenna signal, on the other hand, reached about 1.5 m below the ground surface of TAP-39 and was able to resolve broader changes in stratigraphy, larger objects and features such as house floors.

Archaeological Geophysics at TAP-39, 2013

The purpose of the 2013 geophysical survey at TAP-39 was to investigate and gain a better understanding of the site structure, activity areas, and features before surface survey and excavation of the sub-surface deposits of the site. Since no excavation or systematic surface survey had been conducted at TAP-39 prior to this study, not much was known about the site aside from the approximate dimensions of visible midden soils and the types of artifacts that were judgmentally observed and documented by previous surveyors (E. T. Jones 2009). The discovery of circular depressions and possible house pits when the vegetation on top of TAP-39 was cleared guided the decision to survey the site with both 900 mhz and 400 mhz antennas. The reasoning behind using both was to gain more precise resolution of any near surface features with the 900 mhz antenna while still being able to survey deeper with the 400 mhz antenna, even though surveying the same areas with both antennas would more than double the time to complete the survey. A 200 mhz antenna was also used to maximize depth and explore the depth and extent of the site. The information provided by these three antennas guided the development of a plan for excavation of interpretable features, so that the placement of excavation units would be question-driven rather than exploratory. The identification of planar features led to asking questions about domestic space and dwellings within the site as well as questions about outside space where no interpretable GPR features were present.

Upon initial inspection of TAP-39, the field crew found that there was a great deal of discarded metal from old decommissioned pipes, cattle troughs, wire, barbed wire, and other items associated ranching and watering cattle from the nearby springs. If these items had been left onsite, they would have interfered with the gradient magnetometry survey and made much of the data uninterpretable. One of the SCRPD rangers offered to use a magnetic sweeper (used to clean up metallic agricultural and shop waste) to clear all of the scrap metal from off of the surface of the site. I decided against clearing the entire surface of the site in this manner, because while most of the metal on the surface of the site is modern, there are still historic metal materials (nails, spikes, a horseshoe, etc.) associated with nineteenth and early twentieth century components of the site that would have also been removed through this process. Without their spatial context, these historic metal items would not have contributed to the interpretation of the ephemeral remnants of a historic building in the northwest portion of the site. Instead of mechanical clearing of metals at the site, the field crew did their best to remove by hand all of the modern metal debris that was visible after the vegetation on site was cut. The positions of the pipes and troughs were recorded with GPS or total station, so that if remnants of the debris appeared in the magnetometry data, they would be more interpretable.

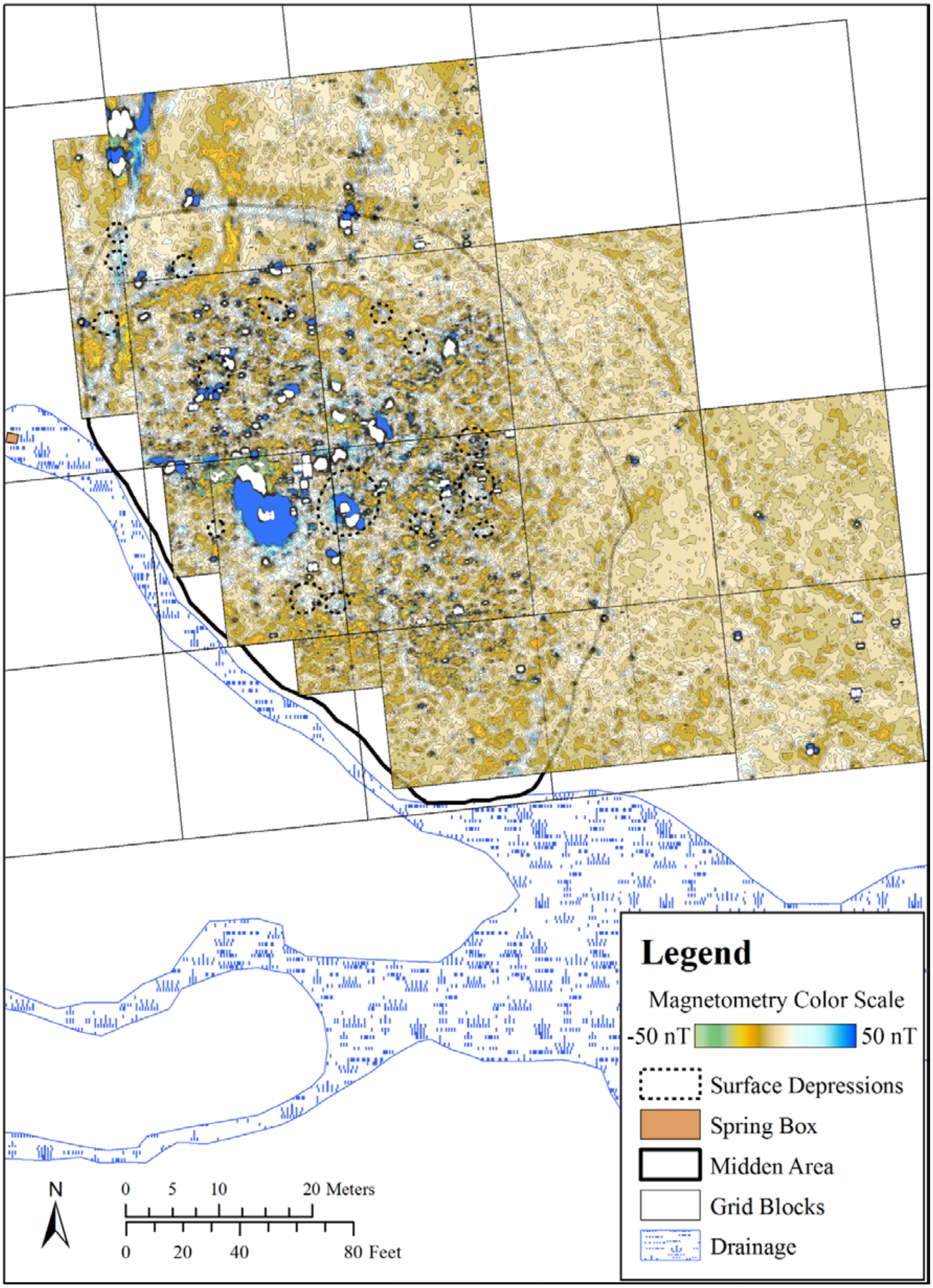
Despite our best efforts to clean up the modern metal debris from the site, the metal that was missed generated many strong magnetometry and Ground-Penetrating Radar (GPR) features throughout these datasets. It was difficult at times to predict where some of this metal was physically located during the cleanup work, because some pipes and other items were embedded in the top 10 cm of the midden soils and were not visible. Much of the remnant metal debris that was missed during the cleanup came from crumbling pieces of metal pipes that fell off while the pipes were being moved. The metal pipes extended linearly from the springs out to the middle of the midden area or beyond the limits of the midden, so some features from the remnants of these pipes in the gradient magnetometry data are readily interpretable. In some cases, the magnetic features created by the metal on site are large and obscure areas as much as five meters in diameter around the location of the metal. In these areas especially, GPR proved to be a more flexible and useful method of geophysical prospection for this particular site.

The gradient magnetometry survey of TAP-39 produced many magnetic features associated with the pre-contact, historic, and modern components of this site (see figure 5.1). The clay soils surrounding TAP-39 have very small magnetic susceptibility contrast. Represented in the topographic map below, the small magnetic susceptibility contrast is represented by very wide spaces between contour lines and colors mainly from the middle or medium range of the color scale, that is, light and dark browns. The small contrast in the clay soils beyond the boundary of the midden allow for subtle features with a range of only a few nanoteslas (nT) to appear in the magnetic data that reflect observable features on the landscape, such as a compacted cattle trail (a linear pattern of weak magnetic dipoles) running from northwest to southeast along the northeast border of the midden. This feature is most visible in blocks 8 and 9 in both gradient magnetometry and GPR data (see also the discussion of this GPR feature below). Ditches for the pipes appear as linear, high magnetic features with low magnetic shadows in blocks 8, 9 and 35. Metal also appears in this area as very high magnetic dipole features (bright white and dark blue blotches clustered tightly together).

The anthropogenic soils within the boundaries of the midden portion of the site have very large magnetic susceptibility contrast. Large magnetic susceptibility contrast is represented by very narrow spaces between contour lines and colors ranging from green/orange (low) to white/blue (high) in the color scale. Despite the large contrast which may be obscuring some subtle features, there are still some magnetic features within the midden area that can be discussed. Ditches for the pipes appear within the boundary of the midden as they did outside of it represented by high magnetic features with low magnetic shadows in blocks 8, 9, 14 and 35. Some of the pipelines, such as one that runs diagonally from southwest to northeast in the southeast quarter of block 14, are also represented by a series of high magnetic dipoles arranged linearly. The two strongest high magnetic dipoles from blocks 21 and 33 were steel, studded “T” posts that had been used at some point in time to stabilize cattle troughs. The T post in block 21 was protruding from the ground and was actively used by cattle as a scratching post surrounded by a hardened doughnut-shaped path devoid of vegetation. The crew did not remove this post, because we did not want to impact the site any more than was necessary, and the post seemed to be lodged deep into the site. The fact that it attracts cattle to the site to use it as a scratching post, though, may merit a discussion about its careful removal from the site.

Also worth noting, the areas within the surface depressions (delimited by dotted lines) are characterized by medium to high magnetic features compared to the low magnetic shadows surrounding them. These surface depression features may represent house pits where soils from the rim of the pit have slumped into or may have been pushed into the depression created by these semi-subterranean structures. Some of these could potentially have formal clay floors and others may be thin ephemeral surfaces such as those identified by Grenda et al. (1998) at CA-ORA-116.

Figure 5.1. Interpolated topographic-style map illustrating the results of the gradient magnetometry survey. The z-value shown in a “terrain” color scale represents magnetic susceptibility in terms of nanotesla (nT).



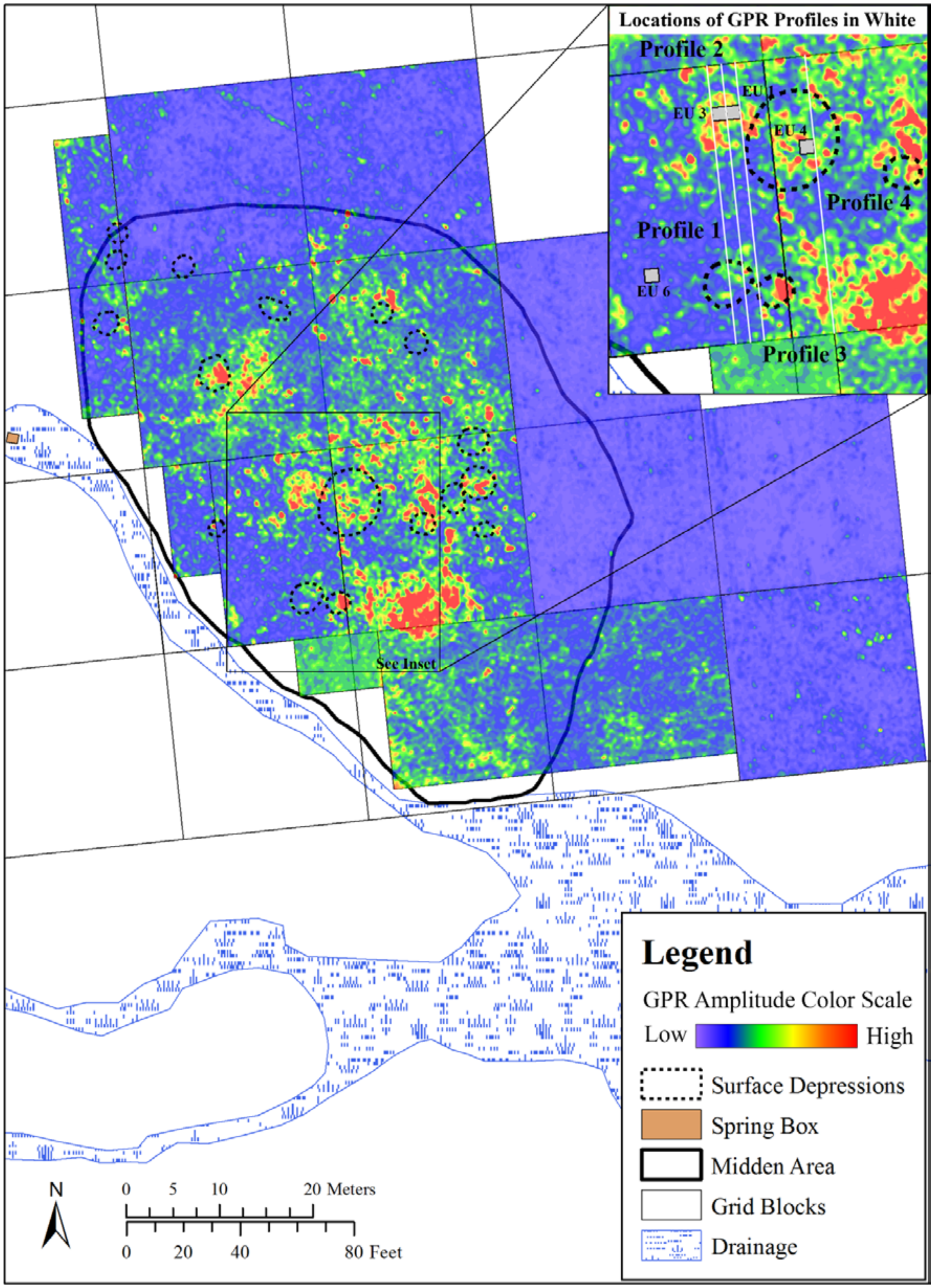
The results of the GPR survey revealed a number of components, features, and objects within the midden portion of TAP-39. These included, the depth and extent of the midden, stratigraphic horizons or objects positioned on old horizons within the midden soils, formal structure floors, individual objects, and clustered objects. The processed GPR profiles and plan view maps generated from the GPR data also showed the presence of rodent burrows, tree/shrub roots, and the “ringing” columns of stacked parabolic reflections characteristic of metal objects. These features often representing disturbance to the archaeological site obscured portions of the other data to some extent where they are located within the site.

The GPR data is constituted of a series of .dzt files representing single profiles from each survey transect within the study. These .dzt files or vertical, GPR profiles were postprocessed and analyzed visually using the “GPR Viewer” software written by Jeff Lucius in consultation with Lawrence Conyers (available from: http://www.gpr-archaeology.com/software/). Within GPR Viewer, a standard Background Removal process was applied to remove horizontal banding that is created by system noise and frequency interference (Conyers 2004:120-125). The selected images of these GPR profiles presented here were processed initially in GPR Viewer and then exported and edited in Adobe Photoshop if the format of the profile images needed any aesthetic touchup.

The vertical profiles (.dzt files) for each block were also combined and sliced horizontally into a series of plan view or slice maps at different depths using the “GPR Process” software written by Jeff Lucius in consultation with Lawrence Conyers (available from: http://www.gpr-archaeology.com/software/). This software initially produced x, y, z coordinate data separated by commas in a text file. These text files were gridded using “Surfer 8” by Golden Software, which involves interpolating these data using the Kriging Method. These plan view or slice maps were then compared with the processed profiles to assess whether the slice maps were representative of the data in the profiles. If these were not, the data were reprocessed changing factors such as the thickness of each slice and the number of slices processed. Initially, this iterative process of creation, interpretation, and revision, involved the exploration of a few key blocks (14, 15, 21, and 33) before deciding on a standard process that could be applied to all blocks throughout the site.

The slice map in figure 5.2 was the product of this process for the GPR data collected with a 900 mhz antenna. The combined profiles were cut into four slices, each one about five nanoseconds thick. The first slice ranged between a depth of -2.5 to 2.5 nanoseconds, the second slice ranged between a depth of 2.5 to 7.5 nanoseconds, the third slice ranged between a depth of 7.5 to 12.5 nanoseconds, and the fourth slice ranged between a depth of 12.5 to 17.5 nanoseconds. The third slice produced the best visibility of most of the interpretable features within these slices, and so it is the slice presented in figure 5.2.

Figure 5.2. Map illustrating Ground Penetrating Radar (GPR) data produced with a 900 mhz antenna. The depth of the slice is 7.5 to 12.5 nanoseconds. The GPR profile locations illustrated in figures 5.3, 5.4, 5.5, and 5.6 are highlighted as white lines.



In general, the clay soils outside of the midden portion of the site are characterized by low amplitude reflections or no reflections at all, represented by the blue and purple colors on the GPR amplitude color scale in the GPR slice map. As in the gradient magnetometry results, the cattle trail appears as a linear pattern of low to medium amplitude reflections running from northwest to southeast along the northeast border of the midden in blocks 8 and 9. A continuation of this cattle trail can also be seen as a very weak, linear, low-amplitude feature in the second slice (between 2.5 to 7.5 nanoseconds) of blocks 16 and 23.

Within the midden portion of the site, there are two medium to high amplitude planar reflections that showed potential to be house floors. One of these planar features is located in the northeast corner of block 33 and can be seen in the right-hand side of the GPR profiles in figures 5.3, 5.4, and 5.5. The edges of this feature begin about 1 to 2 meters outside of the northern and southern limits of EU 1 and 3 (represented by red lines), and this feature is also present within the unit area. A close up view of this feature can be seen in the left-hand side of profile 5 in figure 5.7. The second planar feature is located in the northwest corner of block 21, and can be seen in the right-hand side of profile 4 in figure 5.6. Though comparable house floors are rarely described in the geophysical literature from California, Arnold et al. (1997) were successful in imaging one such feature with GPR. In profile, the planar reflections of these floors appear similar to the cross section of a saucer or bowl with upturned edges (see profiles 1 to 5). In planview (see inset on the GPR slice map in figure 5.2), the best example of these features appears as a nearly perfect, uniform circle of high amplitude reflections, or the circular blotchy red and yellow colored area about 4 meters in diameter that is intersected by profiles 1, 2, and 3. In contrast, the planar feature (blotchy red and yellow colored area) intersected by profile 4 and roughly outlined by a surface depression (dashed line) in the figure 5.2 map inset appears somewhat in this slice but also somewhat at a lower depth than what is represented in the slice map above. This feature is not visible in its entirety with the way that these data are currently sliced.

Figure 5.3. GPR profile 1. 900 mhz antenna GPR data showing location of the west sidewall of EU 3 and a planar feature that crosses through the unit.

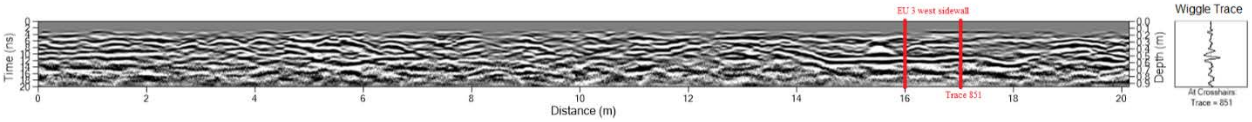


Figure 5.4. GPR profile 2. 900 mhz antenna GPR data showing location of the west sidewall of EU 1, the east sidewall of EU 3, and a planar feature that crosses through the unit.

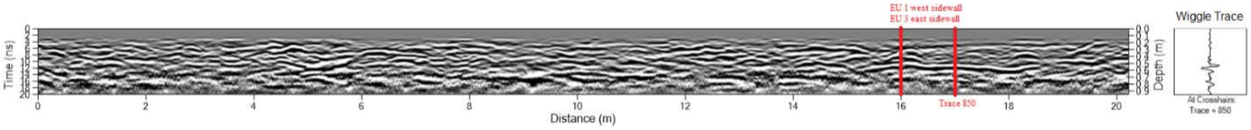


Figure 5.5. GPR profile 3. 900 mhz antenna GPR data showing location of the east sidewall of EU 1 and a planar feature that crosses through the unit.

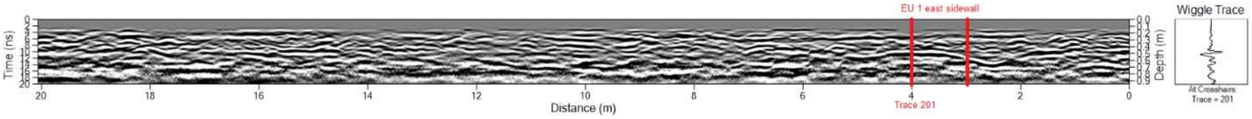


Figure 5.6. GPR profile 4. 400 mhz antenna GPR data showing location of a large planar feature. The profile is skewed vertically to make the feature more visible.

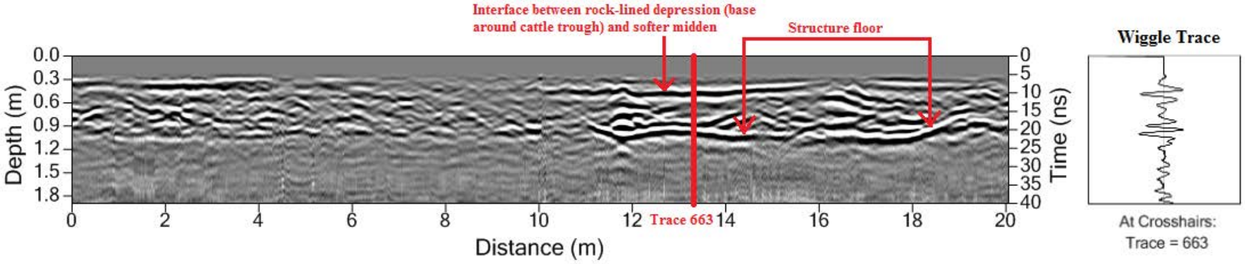
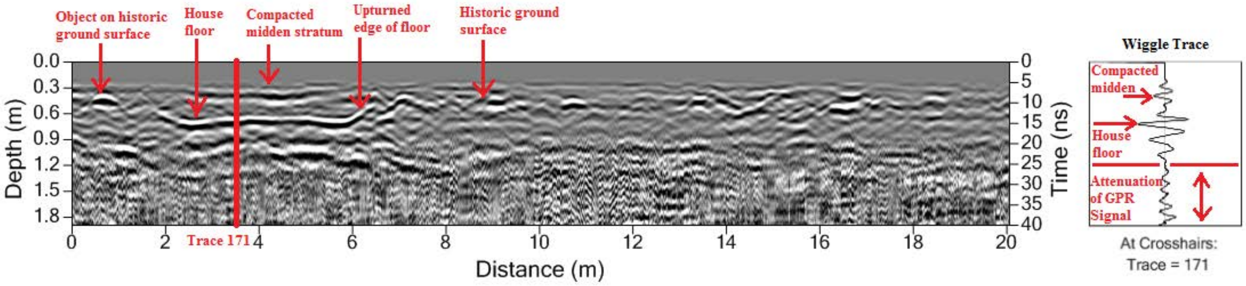


Figure 5.7. GPR profile 5. 400 mhz antenna GPR data showing a close up (vertical skewing of the profile) of the planar feature from figures 5.3, 5.4, and 5.5.



The planar feature from figures 5.3, 5.4, 5.5, and 5.7 was confirmed through excavation in EUs 1 and 3 to be a formal 3 cm to 4 cm thick, compacted clay floor with one small postmold (about 5 cm in diameter) in the northeast corner of EU 1. The approximate diameter of the footprint of this house floor is 4 meters or about 12 feet. As there were no other postmolds or features within the excavation units associated with the house floor, it is difficult to interpret the overall architecture and function of this building from excavation alone. However, combined with ethnographic accounts of similar house construction styles, the GPR data can offer a little more insight about this building.

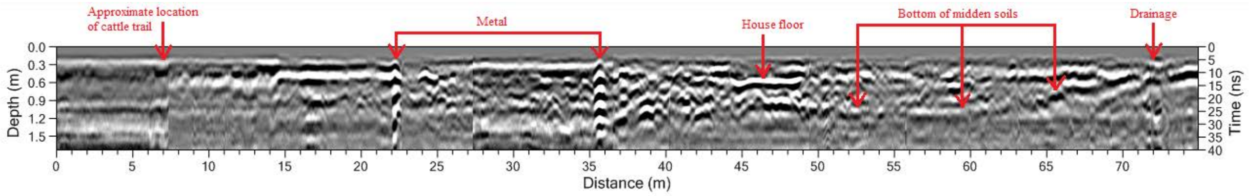
Isabel Kelly (1991:177-185) documented Tom Smith’s and Maria Copa’s descriptions of the architecture and function of Coast Miwok family dwellings (usually for six to ten people), dance houses, sweat houses, puberty buildings, brush fence enclosures for working or dancing outdoors, structures for storing food above the ground, and structures for storing special items such as clapper sticks. Generally, dwellings were circular, conical or dome-shaped, grass-thatched or covered with redwood bark, and not semi-subterranean (I. Kelly 1991:177-178). Sweathouses and dance houses were also circular, but were semi-subterranean and built with much more substantial posts to hold up earth-covered roofs (I. Kelly 1991:179-185). Since there were both smaller and larger models for these various structures, there is substantial overlap in the diameters of the footprints of each building type. Robert Heizer also questioned the statement that semi-subterranean dwellings were never used by Coast Miwok people, because there are numerous circular depressions in the Point Reyes and Drakes Bay region. Semi-subterranean buildings were also used for the dwellings of affluent individuals by neighboring Pomo tribes before historic times (Barrett 1908, 1916; Heizer 1947).

As can be seen most clearly in figure 5.7, the edges of the planar feature crossing through EUs 1 and 3 turn up in the GPR profile and continue to what appears to be an old, buried horizon or ground surface about 10 nanoseconds below the modern ground surface. Further along the profile, point reflections dot this top of this horizon which may be objects resting on the old ground surface. These data may be evidence that this structure was semi-subterranean and that the bottom of the floor was placed as much as 20 cm to 30 cm (or up to a foot) below the old ground surface at the time the building was constructed and used.

The planar feature in figure 5.6 is very similar in shape to the planar feature in figure 5.7, and it is very likely that it is another house floor. However, the planar feature from figure 5.6 has a much larger footprint than the one from figure 5.7 and is embedded deeper in the site. The footprint of the planar feature in figure 5.6 is approximately 7 meters or 21 feet in diameter. It is also approximately 20 to 25 nanoseconds, which could mean that it rests at a depth of up to 1 meter or three feet below the modern ground surface. It is unclear whether the depth of planar the planar feature in figure 5.6 is the result of it being older than the planar feature in figure 5.7. If it is also semi-subterranean, it could potentially be contemporaneous with the planar feature in figure 5.7. The planar feature in figure 5.6 could have potentially been placed between 40 cm to 60 cm below the old ground surface as an adjacent and contemporary building to the shallower building represented by the planar feature in figure 5.7. This depth is not unreasonable for some larger semi-subterranean buildings, which may have been placed as much as 100 cm to 150 cm (or 4 to 5 feet) into the ground (I. Kelly 1991:182).

The GPR data were also able to identify components of TAP-39 associated with the overall structure of the site. In 2014 while completing the Lakebed geophysics study, I was able to borrow a 200 mhz antenna. Surveying long transects across the entire site with this antenna, the GPR was able to resolve an image of the interface between the midden soils at the bottom and edges of the site and the clay soils beyond the limits of midden (see profile 6 in figure 5.8). The location of this transect was recorded with a TripMate850 data logger GPS, and the approximate locations of other landscape features such as the cattle trail and drainage are added to profile 6 below for reference. The combination of multiple GPR antennas, GPS, and topographic mapping help contextualize the broader site formation processes in the spaces where no excavation was conducted or would have been possible in the first place. This use of GPR as a dataset in its own right to answer questions about site formation processes, activity areas, social organization, and other research topics rather than a prospecting tool to find features to excavate provides a much better understanding of archaeological sites than could be known through excavation alone (Conyers 2012:183-184).

Figure 5.8. GPR profile 6. 200 mhz antenna GPR data showing location of the planar feature (house floor) from figures 5.3, 5.4, 5.5, and 5.7, and the bottom of midden soils.



Archaeological Geophysics in and Around the Tolay Lakebed Area, 2014

In preparation of the master plan for Tolay Lake Regional Park and to assess the impacts to sites associated with the lakebed from restoration work in this area (involving the removal of up to 1 meter of soil from the lakebed), a study designed by LSA Associates Inc. (2010) and implemented by Tom Origer and Associates was carried out in the Fall of 2011 (Loyd 2011). The study focused on defining the boundaries of these sites. Origer and Associates only found four obsidian flakes outside of the pre-existing boundary of one of these sites, and no archaeological resources were found in the lakebed site during the study. Loyd (2011:3) concluded that either the research design was not suited to evaluate the resources under investigation, the site boundaries were incorrect, or the charmstones collected over the past century had depleted the area of this type of resource. Loyd (2011:3) suggested that a much more efficient way of assessing the resources within the lakebed would be to disk plow this area. The lakebed had been plowed for many decades, and so Loyd (2011:3) states that more disking may not necessarily damage this site any more than it has been damaged already. However, disk plowing is still a destructive method and has the potential to damage artifacts that are churned up to the surface by the plow. In addition, plowing can only reveal information about charmstones and other cultural resources within the top 20 cm to 30 cm of the lakebed sediments. If there are other cultural materials buried below 20 cm to 30 cm, then these materials will not be discovered or considered in this type of assessment.

As the Tolay Advisory Group discussed SCRPD plans for restoring the lake, I proposed an alternative method to evaluating the cultural resources in the lakebed without any ground disturbance, which was geophysical survey (i.e. magnetometry, ground penetrating radar, and resistivity) and pedestrian survey of the cleared survey blocks. Surveying a large piece of a landscape in its entirety with geophysical equipment improves the resolution of a study far more than the resolution provided by individual STPs over the same amount of space. The increased resolution over larger areas provided by the geophysical methods could allow researchers to locate smaller cultural features (e.g. clusters of rocks where they are not expected based on the surrounding natural background) rather than using the STP method that is designed to locate extensive sites with dense deposits (e.g. midden sites or lithic scatters) and define the boundaries of these deposits. One limitation to geophysics, however, is that tribal cultural resources can be very subtle. The identification of these resources in geophysical data often requires some amount of sub-surface testing in order to confirm their presence.

The primary goal of the 2014 geophysics field season was to evaluate the location and character of the lakebed or “charmstone site,” at Tolay Lake through the use of geophysical surveying techniques (primarily magnetometry and secondarily ground penetrating radar). The questions that this study attempts to address are as follows: 1. Are archaeological resources in and around Tolay Lake detectable through the use of geophysical prospection? 2. Are many or only a few charmstones left in the lakebed? 3. Are individual charmstones distributed randomly throughout the lakebed or are there discrete clusters of charmstones in patterned distributions?

Grid System for Tolay Lakebed Study Area

The geophysical survey of the Tolay lakebed and surrounding areas consisted of mainly magnetometry data collection, but also included limited Ground Penetrating Radar (GPR) data collection. The area surveyed was organized into eight independent, arbitrary grid systems. Each grid was established and mapped with a Sokkia SET 530R3 total station. These eight separate grids each used a different arbitrary coordinate system, because this method of establishing multiple arbitrary grids allowed for these grids to be quickly set up in any direction with accuracy over vast distances that needed to be mowed by SCRPD rangers. As can be seen in the table below, some of these grids extended for hundreds of meters and none were oriented to true north. Using a real-world coordinate system to establish the grids would have been prohibitive considering the circumstances and goals of the study.

Each arbitrary grid was composed of numerous smaller segments or survey blocks (see table 5.1). The dimensions of each grid and the number and dimensions of survey blocks within a grid are described in the table below. The locations of all corners of all blocks in the eight grids were recorded with a Trimble GeoXH6000 GPS unit and a Tornado antenna using the WGS 1984 UTM Zone 10 coordinate system. After differential correction of all the GPS data collected for the lakebed study with the Trimble GeoXH6000 instrument, 89.17% of the estimated accuracies ranged between 0 cm to 5 cm, 10.49% of the estimated accuracies ranged between 5 cm to 15 cm, 0.05% of the estimated accuracies ranged between 15 cm to 30 cm, 0.02% of the estimated accuracies ranged between 30 cm to 50 cm, 0.14% of the estimated accuracies ranged between 0.5 m to 1 m, 0.07% of the estimated accuracies ranged between 1 m to 2 m, and 0.06% of the estimated accuracies ranged between 2 m to 5 m. For exact UTM coordinates of grid locations, block corners, isolate artifacts or any other feature discussed in this report, contact the Federated Indians of Graton Rancheria.

Table 5.1. Survey grid and block specifications for Tolay lakebed area geophysics study.

Name of Grid	Grid Dimensions	Number of Blocks	Block Dimensions
Grid 1	100 m x 40 m	10	20 m x 20 m
Grid 2	160 m x 5 m	8	20 m x 5 m
Grid 3	400 m x 5 m	20	20 m x 5 m
Grid 4	660 m x 5 m	33	20 m x 5 m
Grid 5	440 m x 5 m	22	20 m x 5 m
Grid 6	160 m x 5 m	8	20 m x 5 m
Grid 7	480 m x 5 m	24	20 m x 5 m
Grid 8	340 m x 5 m	17	20 m x 5 m

The locations of these grids were chosen in order to investigate as broad of an area of the lakebed as possible. Grid 1 was much shorter and wider than the other grids. The purpose of this grid was to evaluate whether the site boundary of TAP-56 extended beyond what was mapped during previous surface surveys. The other seven grids are long and narrow in order to investigate the potential presence or absence of subtle archaeological resources across vast and diverse areas within and nearby the lakebed.

Grids 2, 5, 6, and 8 extend from the center of the lakebed out to the edges or uplands around the lakebed in four different locations to characterize any differences in magnetic susceptibility between the center of the lakebed and the land surrounding the lakebed. The results from these grids will help evaluate what the background magnetic susceptibility is across different natural resource zones within the survey area.

Grids 4 and 7 were placed parallel to the center axis of the lakebed in order to characterize the magnetic susceptibility of the lakebed along the entirety of its length. Portions of Grid 4 include the previously recorded site boundary for the lakebed site, so that we can characterize any differences in magnetic susceptibility between the area within this site boundary and the rest of the lakebed. Likewise, portions of Grids 5 and 8 include areas within the site boundary of the lakebed site and areas outside of this site boundary.

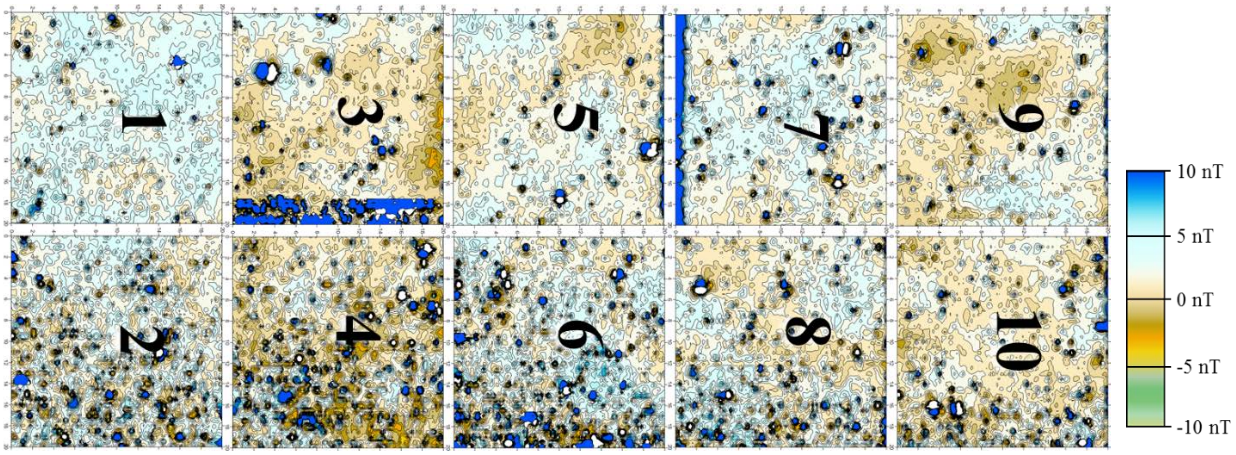
Grid 3 includes areas within the site boundary for TAP-09 and areas outside of this boundary to evaluate the differences in magnetic susceptibility between this site and the area just beyond its boundary. There is also conflicting information in previous reports about whether this site contains midden soils (Chavez 1978, 1979; Cherney 1984; Pulcheon, et al. 2008). The expectation is that if this archaeological site consists of organic-rich, anthropogenic midden soils, it will have a very different geophysical signature than the non-anthropogenic clay soils of the lakebed and surrounding areas.

The magnetometry grid contour maps below are divided into individual block segments. The x and y axes of each block map refers to the length and width of each block (measured in arbitrary meters from the bottom left corners of these blocks). The z component of each map (the contour lines and color scale) refers to the gradient magnetometry data measured in nanotesla (nT). In this kind of visualization, reading nanoteslas in the gradient magnetic field is analogous to reading meters in elevation on a topographic map. If there are “steep hills” and “deep valleys” (i.e. narrow space between contour lines and color range is blue/white and green/orange), the magnetic susceptibility of the block represented is high. If there are few hills and valleys (i.e. the space between contour lines is wide and color range is shades of brown), then the magnetic susceptibility of the block represented is low.

Grid 1

Figure 5.9 illustrates the gradient magnetic data from all blocks of Grid 1. The area in Grid 1 have a low to medium magnetic susceptibility overall. Most of the data ranges from -10 nT to 10 nT. The data in the eastern-most blocks of this grid (i.e. 2, 4, 6, 8, and 10) are characterized by many small “peaks” which are high magnetic features. These high magnetic features probably represent clusters or scatters of rocks.

Figure 5.9. Gradient magnetic data from all blocks of Grid 1 of Tolay lakebed area geophysics survey. The blocks are oriented correctly in relation to each other, and the boundary of TAP-56 (not depicted) intersects with the shared edge of blocks 2, 4, 6, 8, and 10. The real world coordinates of these blocks and their orientation in relation to true north are not presented here.



It is difficult to tell whether the clusters of high magnetic features are associated with cultural activities, but the results from Grid 1 suggest an association between these magnetic features along the eastern border of Grid 1 which is adjacent to TAP-56. Four artifacts were also positively identified on the surface in this eastern portion of Grid 1 among the scattered rocks and documented in the field. The four artifacts are a chert core, a piece of obsidian flake shatter, an obsidian complete flake, and a charmstone. No artifacts were identified in the western half of Grid 1. There were also visibly fewer rocks scattered across the surface of the western half of the grid.

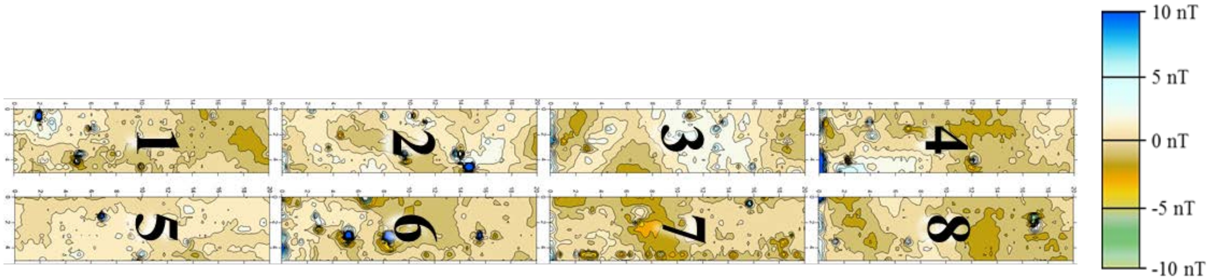
Since the western boundary of TAP-56 is only a few meters to the east of Grid 1, it may be assumed that the artifacts found in Grid 1 are associated with this site. This may indicate that artifacts and possibly anthropogenic soils from TAP-56 continue past the current site boundary into the the eastern half of Grid 1. This may also indicate that the clustering of medium to high magnetic features in the eastern half of Grid 1 also represent a continuation of the cultural materials associated with TAP-56.

The presence of only one charmstone from TAP-56 may not seem very significant. However, George Phebus (1990b:143) collected many charmstones from the surface of this site in the 1960s. The Cardoza family and visitors to Tolay during fall festivals (before this land was transferred to Sonoma County Regional Parks) most likely collected additional charmstones from this site as well as the lakebed. There are probably more charmstones in this area, and many more could potentially be found through systematic surface survey of this area (both within and outside of the boundaries of TAP-56).

Grid 2

The map in figure 5.10 illustrates the gradient magnetic data from Grid 2. The area within the blocks of Grid 2 has a low magnetic susceptibility. There are no identifiable cultural features in the gradient magnetic data for Grid 2.

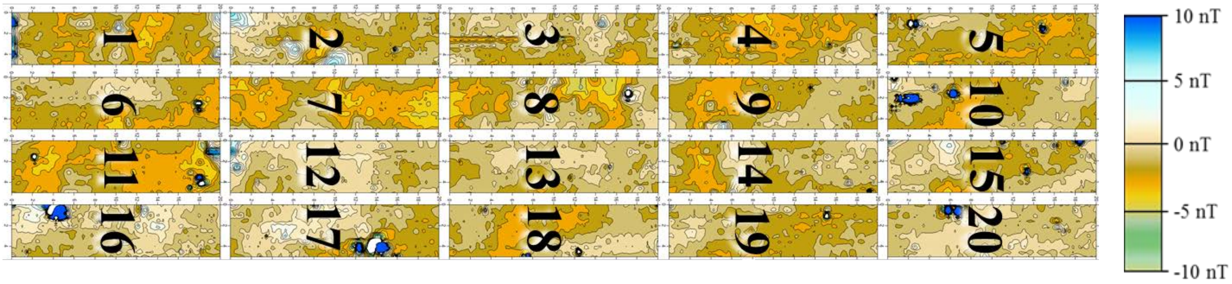
Figure 5.10. Gradient magnetic data from all blocks of Grid 2 of Tolay lakebed area geophysics survey. For convenience of presentation, these blocks are arranged in rows to fit the page. Their true position in relation to one another is a single, linear transect of blocks joined at their narrow ends in sequential order from 1 to 8.



Grid 3

The map in figure 5.11 illustrates the gradient magnetic data from Grid 3. The soils in Grid 3 have a low magnetic susceptibility with no identifiable cultural features.

Figure 5.11. Gradient magnetometry data from all blocks of Grid 3 of Tolay lakebed area geophysics survey. For convenience of presentation, these blocks are arranged in rows to fit the page. Their true position in relation to one another is a single, linear transect of blocks joined at their narrow ends in sequential order from 1 to 20.



GPR data from this area is similarly inconclusive regarding cultural features. Profile 7 in figure 5.12 shows a GPR profile from Block 4 of Grid 3, which is typical of the area outside of the TAP-09 site boundary. Profile 8 in figure 5.13 shows a GPR profile from Block 15 of Grid 3, which is typical of the area inside of the TAP-09 site boundary. These data look very similar and contain no identifiable GPR features that were caused by human modifications to the landscape. There are both planar and point reflections throughout this grid, but none of these can be identified with confidence as a cultural feature.

Figure 5.12. GPR profile 7 from block 4 of grid 3. 200 mhz antenna GPR data from natural soils outside of the boundaries of archaeological sites.

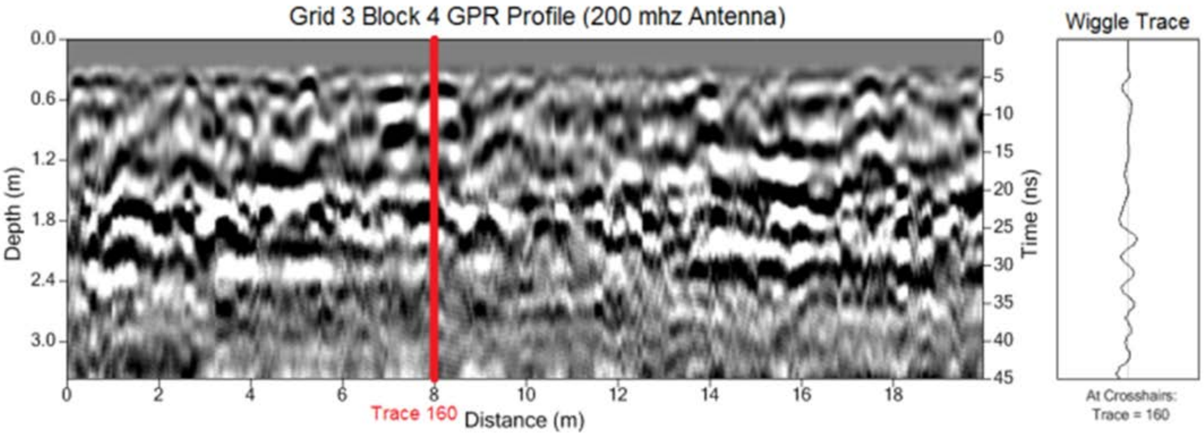
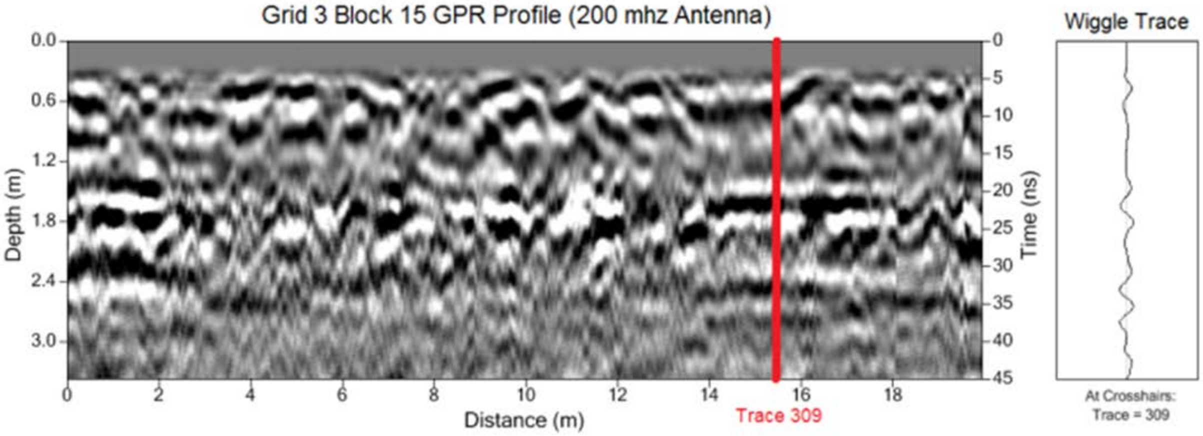


Figure 5.13. GPR profile 8 from block 15 of grid 3. 200 mhz antenna GPR data from the area within the site boundaries of TAP-09.



Some pedestrian survey was completed inside and outside of the site boundary of TAP-09, which is the site that intersects with Grid 3. The main artifact type found on this site was lithic debitage from various source materials (obsidian, chert, granite, basalt, quartz, etc.). Notable items were documented in the field and left in place. Notable items include two charmstones, one possible charmstone fragment, one hammerstone, one plow scarred basalt mortar fragment, two fragments from the same granite mortar, and possible sensitive materials. The faunal bones on the surface of this site are very white and sun bleached.

The sun damage to the bones as well as the plow scars on the basalt mortar fragment show that this site has been plowed and kept open for many years. Many of the artifacts on the surface of this site are likely an amalgamation of materials from the first 30 cm of soil below the ground level. Even though these surface finds are from a mixed context, a surface investigation of a “plowzone” (or plough zone) or a near-surface context with heavy bioturbation can be very informative about the types of materials that are deeper in this site (Gonzalez 2016; Lewarch and

O'Brien 1981; Lightfoot 2006, 2008; Steinberg 1996). Intensive surface collection with a carefully controlled spatial sampling strategy would provide much more information about the layout and composition of this site.

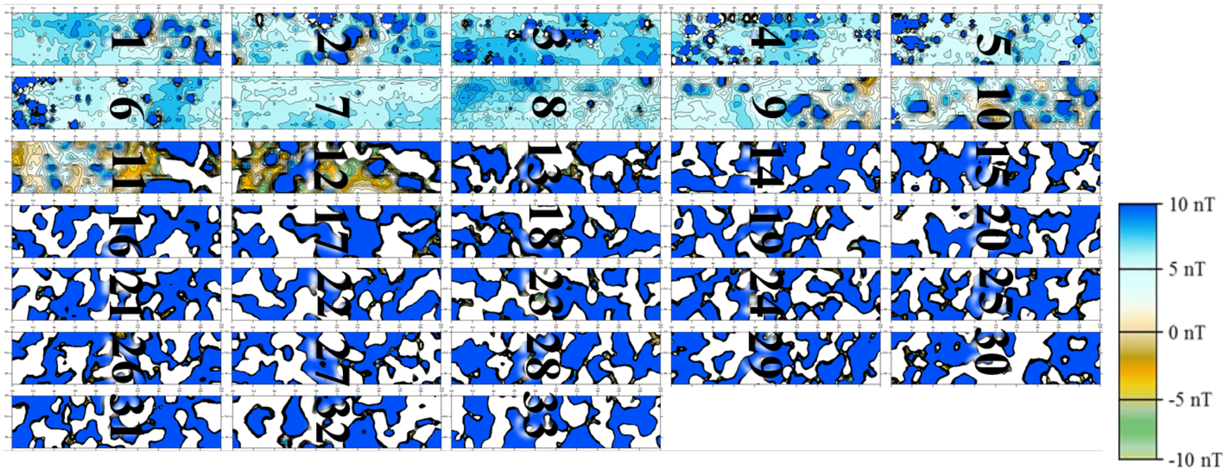
One question that this study was seeking to address at TAP-09 was whether this site was composed of midden soils and represented longer-term habitation as opposed to a more ephemeral short-term site. Pulcheon et al. (2008:54) and Meyer (1995) characterize TAP-09 as being composed of midden soils with shell. However, no shell or distinctly dark, silty, midden soils were observed at this site during the current survey in 2014. Phebus (1990b:135-136) found no shell on the site when he surveyed it in the 1960s, and he noted that the entire surface of the site was composed of the same kind of soil as the lake bottom. Chavez (1979:20) also noted that this site is located on top of a (implied natural) mounded area and stated that “no definitive evidence of actual midden soil was observed.” The soil type that was observed on the surface of this site during the current survey was dry clay with many deep cracks. To date, no systematic subsurface investigations have been completed at TAP-09. Thus, it is difficult to assess the depth and extent of potential midden soils that may be present.

Inside the previously mapped boundaries of TAP-09, there is a slight rise in topography from the lakebed floor (about 1 to 1.5 meters higher than the lakebed below). If this entire mounded area was composed of midden soils and fire altered rock like other midden sites in the Tolay Valley, the geophysical data would show distinct differences between the “onsite” midden soils and “offsite” clays. The geophysical data does not show any differences between offsite and onsite areas in the current survey of Grid 3, which seems to support the surface observations from 2014 that this site does not contain midden. These results suggest that the assessment of this site as a midden in post-1995 reports is a misinterpretation of prior reports and/or a misidentification of this site in the field. If the assessment of this site containing debris from more ephemeral activities only (e.g. tool manufacture debris and some faunal materials without midden) rather than long-term habitation, was this site used seasonally for hunting waterfowl as Cherney (1984) suggests, for ceremonial purposes as there were also charmstones at this site, or for many different purposes? The results of this study cannot at this time adequately address these questions.

Grid 4

The figure 5.14 illustrates the gradient magnetic data from Grid 4. The area within Grid 4 has a high magnetic susceptibility, and there are no identifiable cultural features in the gradient magnetic data for this grid. The high magnetic susceptibility of the soils in the lakebed was not expected. This high magnetic susceptibility is probably caused by an unknown geological feature or soil type in the center of the lakebed. The high magnetic susceptibility of this broad geological feature obscures all cultural features in the magnetic data that may have otherwise been discernible in the center of the lakebed.

Figure 5.14. Gradient magnetometry data from all blocks of Grid 4 of Tolay lakebed area geophysics survey. For convenience of presentation, these blocks are arranged in rows to fit the page. Their true position in relation to one another is a single, linear transect of blocks joined at their narrow ends in sequential order from 1 to 33.



To learn more about the unknown geological feature that is creating a high magnetic susceptibility in center of the lakebed, GPR with a 200 mhz antenna was used to generate profile images from the lakebed in Grid 4. Profile 9 from figure 5.15 and profile 10 from figure 5.16 are GPR profiles from Blocks 11 and 18 of Grid 4, respectively. These GPR profiles show a continuous, high amplitude planar reflection across the entire length of the profile at an approximate depth of 1 meter to 2.5 meters.

Figure 5.15. GPR profile 9 from block 11 of grid 4. 200 mhz antenna GPR data from natural soils in the center of the lakebed.

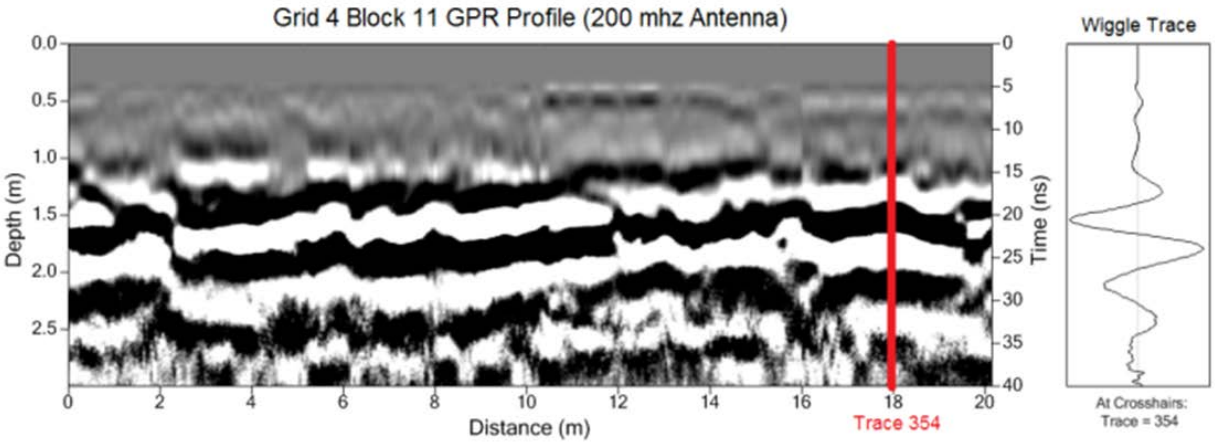
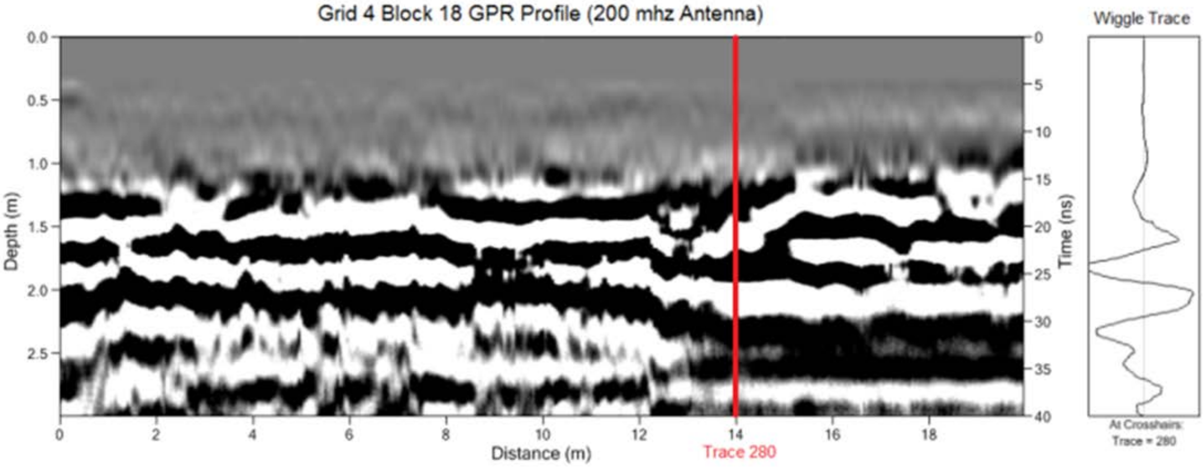


Figure 5.16. GPR profile 10 from block 18 of grid 4. 200 mhz antenna GPR data from natural soils in the center of the lakebed.



It is not clear what this planar reflection feature is. It appears to be a buried soil horizon, and may relate to a geological feature observed during the Origer STP survey (Loyd 2011). During the survey, I was able to monitor and take photographs of the stratigraphic profiles of the 0.5 m by 0.5 m STPs. Figure 5.17 shows that within the dark clay soil is a stratum of lighter gray stratum composed of what looks like volcanic ash at approximately 1 m below the surface of the lakebed.

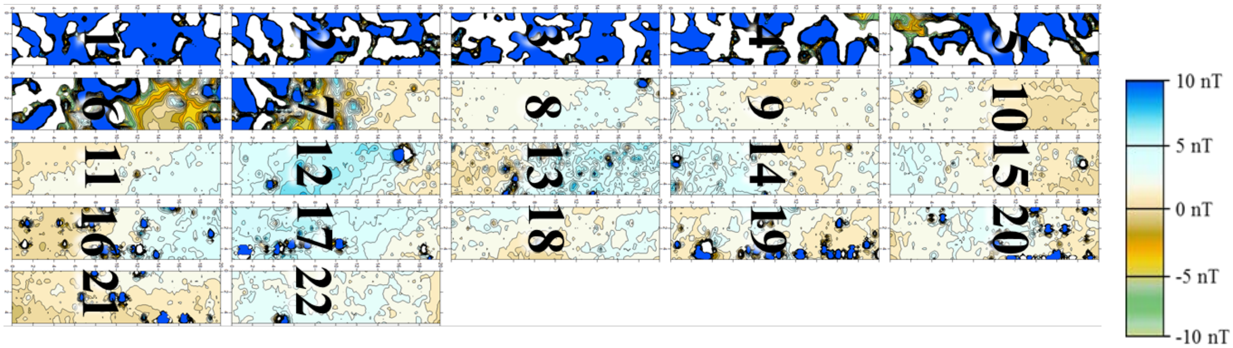
Figure 5.17. Photograph taken by the author on Oct. 31, 2011, during a survey by Origer and Associates showing lighter gray "ashy" stratum at about 1 m below the surface of Tolay Lake.

Surface pedestrian survey was conducted as part of the current geophysical survey in Grid 4. No artifacts were found in this area, because roots and cuttings from vegetation contributed to poor visibility throughout the entire grid. To survey this area adequately, the entire area would need to be mowed and the clippings completely raked and hauled away. This kind of clearing work was beyond the scope of the current survey. To add some positive data to this discussion, George Phebus (1990b:147) reports finding 20 charmstones in the lakebed area. Phebus (1990b:147) also reports that the Cardozas found many others in this area.

Grid 5

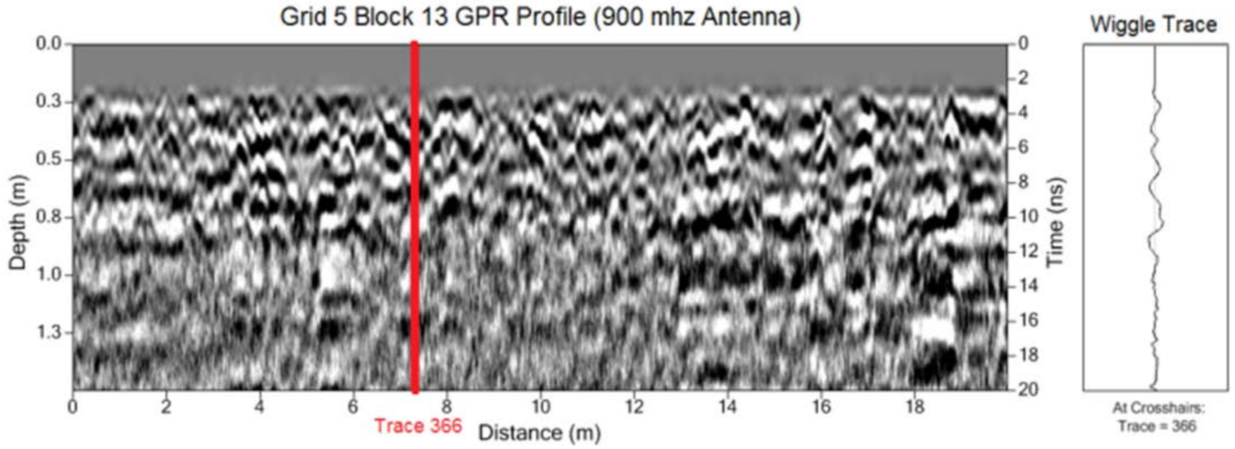
Figure 5.18 illustrates the gradient magnetic data from Grid 5. The area in the western third of Grid 5 have a high magnetic susceptibility, and the area in blocks to the east of the first third have a low magnetic susceptibility. Within Blocks 6 and 7 a transition occurs from high magnetic susceptibility to medium and low magnetic susceptibility. It seems that this area within Blocks 6 and 7 of Grid 5 is the eastern extent of the unknown geologic feature or soil horizon identified in Grid 4.

Figure 5.18. Gradient magnetometry data from all blocks of Grid 5 of Tolay lakebed area geophysics survey. For convenience of presentation, these blocks are arranged in rows to fit the page. Their true position in relation to one another is a single, linear transect of blocks joined at their narrow ends in sequential order from 1 to 22.



For the most part, there are no identifiable cultural features in the gradient magnetic data for Grid 5. Block 13 of Grid 5 may be an exception (see figure 5.19). The magnetic data contour lines in Block 13 are much closer together, and there are subtle peaks present which indicate medium to high magnetic features. This area may contain a higher number of rocks, some of which could potentially be charmstones. But without further study, it is uncertain whether the magnetic features in this block represent natural or cultural features. No artifacts were observed on the surface of the block, though there were many natural, unmodified rocks in this area. Profile 5 below shows a 900 mhz GPR profile from Block 13 of Grid 5. There are many small point reflections, however, no distinct cultural features are discernible.

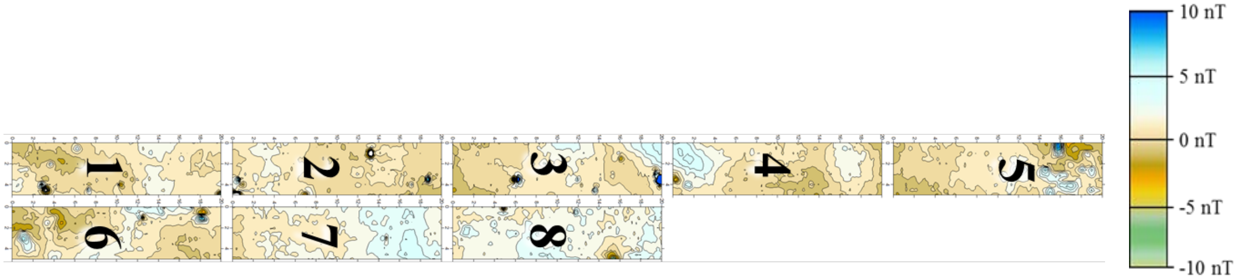
Figure 5.19. GPR profile 11 from block 13 of grid 5. 900 mhz antenna GPR data. The abundance of small point reflections is uncharacteristic of much of the area in and around the lakebed.



Grid 6

Figure 5.20 illustrates the gradient magnetic data from Grid 6. The area within Grid 6 has a low magnetic susceptibility and there are no identifiable cultural features in the gradient magnetic data for Grid 6.

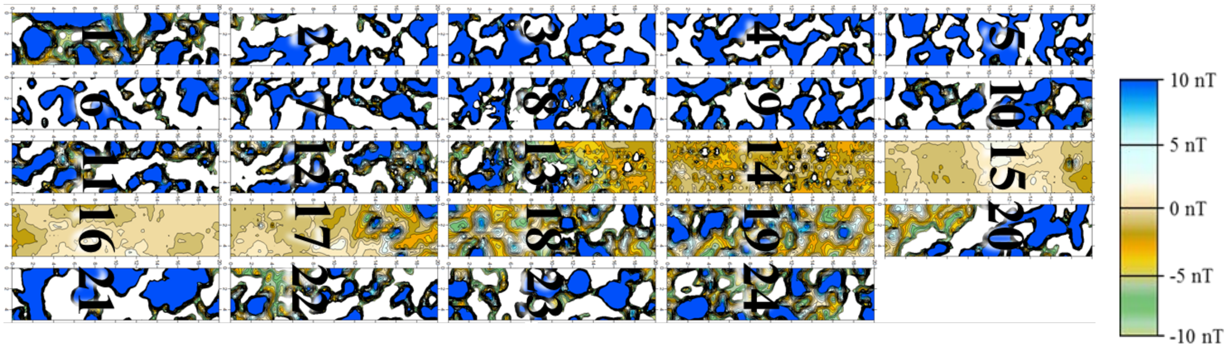
Figure 5.20. Gradient magnetometry data from all blocks of Grid 6 of Tolay lakebed area geophysics survey. For convenience of presentation, these blocks are arranged in rows to fit the page. Their true position in relation to one another is a single, linear transect of blocks joined at their narrow ends in sequential order from 1 to 8.



Grid 7

Figure 5.21 the gradient magnetic data from Grid 7. The area within Grid 7 has a high magnetic susceptibility with some patches of medium and low magnetic susceptibility. There are no identifiable cultural features in the gradient magnetic data for Grid 7.

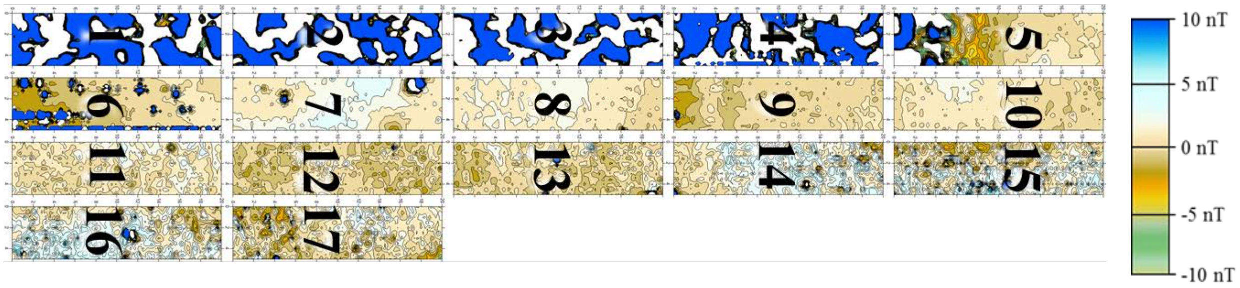
Figure 5.21. Gradient magnetometry data from all blocks of Grid 7 of Tolay lakebed area geophysics survey. For convenience of presentation, these blocks are arranged in rows to fit the page. Their true position in relation to one another is a single, linear transect of blocks joined at their narrow ends in sequential order from 1 to 24.



Grid 8

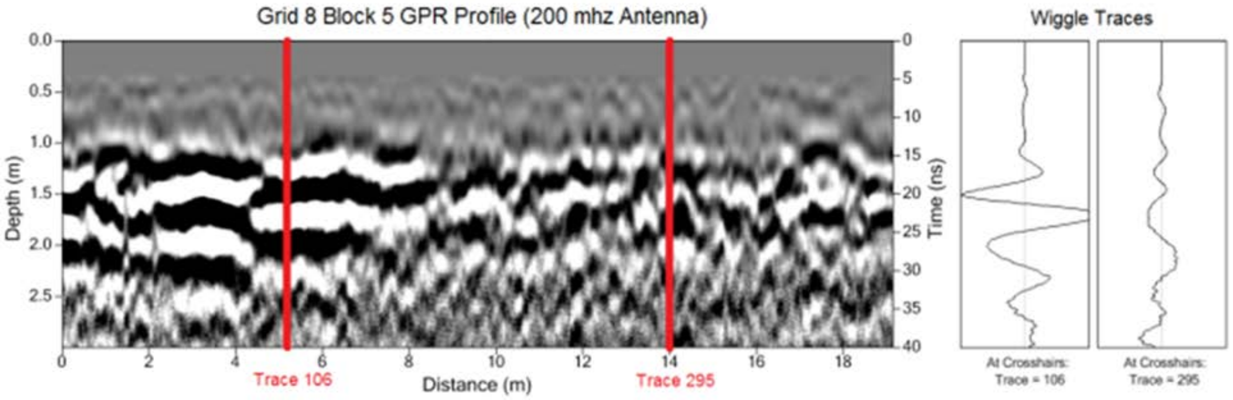
Figure 5.22 illustrates the gradient magnetic data from Grid 8. The area within the western-most quarter of Grid 8 have a high magnetic susceptibility, and the area within the blocks from the other three quarters have a medium to low magnetic susceptibility. Within Block 5, a transition occurs from high magnetic susceptibility to medium and low magnetic susceptibility. It appears that this is area within Block 5 of Grid 8 is the eastern extent of the unknown geologic feature or soil horizon identified in Grid 4.

Figure 5.22. Gradient magnetometry data from all blocks of Grid 8 of Tolay lakebed area geophysics survey. For convenience of presentation, these blocks are arranged in rows to fit the page. Their true position in relation to one another is a single, linear transect of blocks joined at their narrow ends in sequential order from 1 to 17.



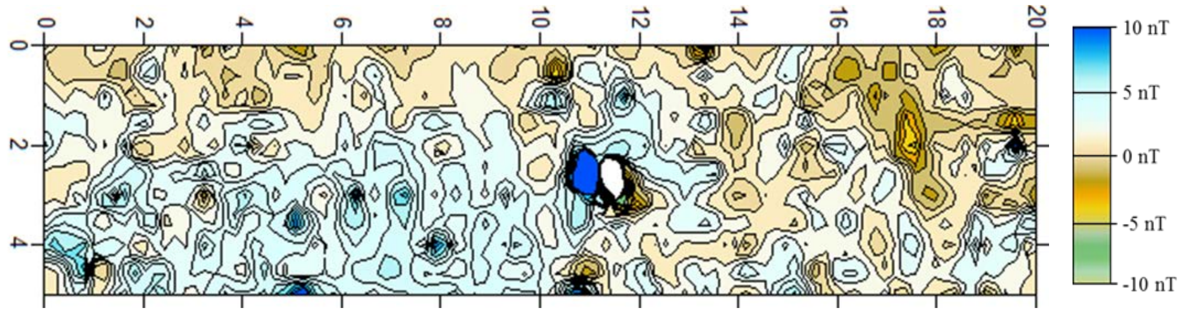
The gradient magnetometry data are corroborated by the GPR data for this block. Profile 6 in figure 5.23 shows a GPR profile in Block 5 of Grid 8. The high amplitude planar reflection (similar to that in Grid 6) ends at exactly the same point that the high magnetic feature ends in the magnetometry data.

Figure 5.23. GPR profile 12 from block 5 of grid 8. 200 mhz antenna GPR data showing the transition in the lakebed from soils with no high amplitude, planar feature to soils with this high amplitude, planar feature.



For the most part, there are no identifiable cultural features in the gradient magnetic data for Grid 8. Block 16 of Grid 8 (see figure 5.24) may be an exception. The contour lines representing the gradient magnetic data in the image below from Block 16 are much closer together, and there are many subtle peaks present indicating medium to high magnetic features. This area may contain many rocks, some of which may be charmstones, which are causing this pattern to occur. Without further study, it is not certain whether the results from this block represent natural or cultural features.

Figure 5.24. Gradient magnetometry data from block 8 of Grid 16 of Tolay lakebed area geophysics survey showing many clustered peaks that are uncharacteristic of the other blocks within this grid.



Conclusions

The incorporation of geophysical survey methods, such as gradient magnetometry and Ground Penetrating Radar (GPR), within the larger Tolay Archaeology Project have proved to be very beneficial for understanding the structure of the archaeological sites and the surrounding landscape within the Tolay Valley. The results of these surveys provided information that formed the basis for the subsurface excavation portion of the project research design. The geophysical results have also been used to refine archaeological interpretations of the excavated portions of these sites. There is no doubt that these geophysical survey results from 2013 and 2014 will continue to provide many more insights and re-interpretations of the tribal cultural resources of the Tolay Valley as the data are reprocessed and more surveys are added to the geophysical information database that is developing out of the Tolay Archaeology Project.

The most compelling findings from the current geophysical dataset are the formal house floors imaged at TAP-39 with GPR. One house floor is 4 m in diameter and another is 7 m in diameter. The function of these buildings is unknown, but the upturned edges of the floors in the GPR profiles indicate that these buildings may have been semi-subterranean. GPR was also able to image the interface between the basal midden deposits and the clay soils below the site. This information in combination with auger and excavation unit data provides maximum depths for the site and an approximate basal topography.

The potential for magnetometry to locate archaeological resources in and around the ancient Tolay lakebed and surrounding area is variable. Outside the lakebed, the magnetic susceptibility of the clay soils is very low. In the center of the lakebed, however, there is an unknown geological feature or buried soil horizon that has a very high magnetic susceptibility. This feature spans the entire north-south length of the lake (over 1 km) and most of its width at the northern end of the lake (most likely 300 meters or more). The high magnetic susceptibility in the center of the lakebed obscures any cultural features that might otherwise be detectable. Thus, the composition and extent of the lakebed or “charmstone site” cannot be assessed through magnetometry survey. There is a good possibility that future ground disturbing activities in and around the lakebed will uncover more charmstones, because a few were found on the surface during the geophysical survey. The site boundary of the lakebed or charmstone site should be expanded to include the entire lakebed area as similar to how Chavez (1978, 1979) draws the boundary of this site. This expansion of the lakebed site would also reflect the fact that the entire lake is a sacred place for the Federated Indians of Graton Rancheria.

The geophysical survey of TAP-56 and TAP-09 also provided significant updates to the information in the records for these sites. The magnetometry and surface surveys of TAP-56 support the need to expand the site boundary of TAP-56 about 10 m to 20 m past the currently mapped boundary of this site. Magnetometry and surface survey of TAP-09 indicate that it is more appropriate to describe TAP-09 as a lithic scatter with some bone and no shell or midden soils than a long-term habitation site with midden. The area within the site boundaries for TAP-09 had a very similar magnetic susceptibility to the surrounding clay soils, which is not what is expected if this site contained significant midden deposits from long-term occupation. The activities associated with TAP-09, though no less important than midden sites (especially because sensitive materials were found on the surface at this site), should be revised to reflect the lack of midden. More appropriate interpretations of this site are short-term occupation or special use, but it is not clear without further investigation what the range of uses for this site might be.

Chapter 6

Results of Faunal and Paleoethnobotanical Analyses from Excavated Contexts

In chapters 4 and 5, I discussed the methods and results of fieldwork completed in the Tolay Valley from 2013 to 2014. In chapter 6, I will expand on the methods and results of lab analyses of the paleoethnobotanical and faunal materials collected during excavation and surface collection at TAP-39. Generally speaking, paleoethnobotanical materials are very small and fragile materials, so special soil flotation samples were collected and processed in order to consistently recover materials such as charred wood, nutshell, seeds, geophytes, and other charred plant parts. Faunal materials are more damage resistant than charred botanical materials and are generally larger, so they could be recovered straight from the field screens as well as from the flotation samples. In this chapter, I will discuss methods for processing and analyzing these two datasets. The paleoethnobotanical materials were processed and analyzed in the McCown Laboratory at UC Berkeley by Rob Cuthrell and myself under the supervision of Rob Cuthrell. The faunal materials were analyzed by Michael Stoyka and Whitney McClellan at Sonoma State University. I will also discuss what the diverse taxa of plants and animals from TAP-39 suggest about the kind of environment that existed in the Tolay Valley before contact and how this environment was maintained through traditional management practices. I will also address impacts and changes to the environment and Coast Miwok hunting and gathering practices in the Tolay Valley after the arrival of Europeans.

Introduction

Aside from a cursory description of the village of Cholequebit (probably near Sear's Point today) as a good disembarking spot in 1811 as the first two Alaguali people were baptized (Milliken 2009:76), the first documentation of Tolay Lake or the *Laguna de Tola* and the surrounding landscape within the Tolay Valley appears in the June 27, 1823 diary entry of Father Jose Altimira (1823:3; 1860:59). In an effort to establish a new mission community in the North Bay, Father Altimira embarked on an expedition by boat from the Presidio at San Francisco to the mission at San Rafael and by land from San Rafael to the Sonoma Valley. During his journey, Father Altimira stopped and recorded an entry in his journal at the northern end of the Tolay Valley on June 27th, the third day of his expedition. He describes seeing sufficient grass on the hills for raising cattle and oak groves on the hilltops and in the *cañadas* or gullies/ravines (Altimira 1860:59).

Multiple lines of evidence from, tribal oral knowledge, ethnography, ethnohistory, and archaeological and biological studies have helped further reconstruct what the pre-contact landscape looked like in the Tolay Valley beyond what can be gathered from ethnographies and ethnohistories alone (Altimira 1860:59-61; DeAntoni 2015; I. Kelly 1991; LSA Associates 2009; LSA Associates Inc. 2007; Moorehead 1910:106-109). Although the valley was primarily composed of grasslands, the analysis of charred wood from TAP-39 contributes greater resolution to the picture of the pre-contact environment in the Tolay Valley, which was also composed of extensive stands of shrubs such as Ceanothus (*Ceanothus*), California coffeeberry

(*Frangula*), coyote brush (*Baccharis*), toyon, (*Heteromeles*), and California wax myrtle (*Morella*) (DeAntoni 2015). Some of these shrubs such as Ceanothus (*Ceanothus*) and California wax myrtle (*Morella*) are not currently growing in the valley today (LSA Associates 2009; LSA Associates Inc. 2007). Oak woodlands (*Quercus*), willow (*Salix*), and California bay laurel (*Umbellularia*) were also abundant in gullies, drainages, and riparian zones in pre-contact times as well as today (DeAntoni 2015; LSA Associates 2009; LSA Associates Inc. 2007).

The results of lab analyses of archaeological macrobotanical materials recovered at TAP-39 during the Tolay Archaeology Project in 2013 and 2014 indicate that a number of other plants and animals important to Coast Miwok people were also present in pre-contact times in the Tolay Valley. Some of these plants include various kinds of grasses (*Poaceae*), clovers (*Trifolium*) and tarweeds (*Madia*) that were toasted, ground and made into *pinole* or seed cakes. Acorn from oaks (*Quercus*), peppernuts from bay laurel trees (*Umbellularia*), soaproot (C*hlorogalum*) and varieties of "Indian potatoes" (*Brodiaea*) were also prepared and eaten. Coast Miwok people in the Tolay Valley also hunted and ate waterfowl that were passing through the valley on migration routes, grassland adapted-species of mammals living within the valley, and fishes that thrive in the fresh, brackish and saltwater creeks and sloughs that were prevalent around San Pablo Bay and the Petaluma River. Waterfowl such as ducks (*Anas*) and geese (*Anserinae*) were common as well as various kinds of field rodents (*Rodentia*), jack rabbits (*Lepus californicus*) and deer or elk (*Cervidae*). Sturgeon (*Acipenser*), bat ray (*Myliobatis*) and Sacramento hitch (*Lavina exilicauda*)[2] are common types of fishes that were procured from the Petaluma River or San Pablo Bay and brought back into the Tolay Valley.

The high densities of grass (*Poaceae*) and clover (*Trifolium*) seeds in the botanical samples and the presence of grassland indicator species such as jack rabbits (*Lepus californicus*) in the faunal assemblage indicate that the Tolay Valley was an open grassland environment. More radiocarbon dating is needed to solidify the chronology of the various excavated components of TAP-39. However, the dates that have already been assigned to different contexts throughout the site indicate that grasslands persisted for thousands of years in the Tolay Valley before contact with Europeans (see Appendix B). This implies that the Tolay Valley was actively managed by Coast Miwok people to keep other vegetation types from encroaching on this grassland valley for thousands of years as well.

Paleoethnobotanical Materials

Macrobotanical Sampling and Lab Methods

During archaeological fieldwork at TAP-39, 104 flotation samples were collected overall. A standard soil sample was collected and processed through flotation for every non-discrete context. This sampling strategy also included collecting one standard sample for each arbitrary level excavated within discrete contexts. These standard flotation samples were collected through "scatter" sampling according to methods recommended by Lennstrom and Hastorf (1992) and Cuthrell (2013b) in order to maximize the richness and diversity of macrobotanical materials

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[2] The fish identified as Sacramento Hitch (*Lavina exilicauda*) in this faunal dataset may in fact be Sacramento Splittail (*Pogonichthys macrolepidotus*). See the discussion of fish taxa and notes associated with figure 6.17 for a fuller discussion of this discrepancy in identification.

within the flotation samples. While excavating a single non-discrete context or arbitrary level, 0.5-1.0 liter amounts of soil were periodically placed into a marked bucket until the correct literage for the sample was reached (usually either 5 or 10 liters). This strategy was thought to more accurately represent the overall context than a bulk sample collected from one area only (Cuthrell 2013b:320; Lennstrom and Hastorf 1992). 16 of the standard samples from TAP-39 were 10-liter standard scatter samples and 71 samples were 5-liter standard scatter samples.

Bulk flotation samples were collected in two instances. The soil from 1 auger EU out of 12 was collected as bulk samples for flotation rather than being dry-screened. One sample from this EU was collected for every 20cm of depth. Augers were also used when some 50cm x 50cm EUs became too deep to excavate with a trowel, usually below 120cm. The basal levels of these EUs were augered and the soil from these arbitrary 20cm auger levels was collected as flotation samples. There was a total of 12 bulk samples from auger EUs throughout the site. Bulk samples were also collected within discrete contexts such as ash lenses, floors or other deposits. There was a total of 5 bulk samples of various volumes collected from discrete contexts in the site.

The flotation machine used in this study consisted of a large plastic bin (about 1 meter in length by 0.5 meters in width by 0.5 meters in depth) with a metal spout that was bolted and sealed with epoxy to a cut in the lip of the bin. A black “no-see-um” mesh (1.27 mm or 0.05 inches) or a tan agriculture mesh (0.1 to 0.5 mm or 0.004 to 0.002 inches) was draped over the lip of the bin and held in place with heavy duty clips. The mesh sagged into the basin about 10 cm from the bottom and overlapped with the metal spout. Another metal spout was also placed on top of the mesh to “sandwich” it between the two metal spout pieces. A hose was placed between the mesh and the basin with the end at the bottom of the basin to slowly fill with water. The water ran over the spout and into a 5-gallon bucket below. This bucket had a hole cut out of the side at the bottom for water to pass through and into a drain in the lab or out onto the ground if outside. A fine chiffon fabric was placed over the lip of the bucket and attached with heavy duty clips. The chiffon fabric sagged into the bucket about 10-20 cm. Flotation samples were placed into the main bin filled with water and “massaged” or “fluffed” upwards with the flotation operator’s hands to ensure that the small botanical and large rock, shell and bone constituents in the sample would separate from the soil. The soil would sink to the bottom of the basin while heavy materials (such as rock, shell, bone, lithics, etc.) would remain on top of the mesh in the bin. These materials are referred to as the “heavy fraction.” The lighter materials (such as seeds, charcoal, vegetative matter, very small rocks and pebbles, microlithics, otoliths, fish scales, tiny bones, etc.) would float to the surface of the water, run over the spout, and become caught in the chiffon mesh of the bucket below the spout. These materials are referred to as the “light fraction.” The botanical materials from this light fraction will be the materials discussed in this chapter.

Some flotation samples contained an abundance of clay content which clumped into thumb-sized or even fist-sized balls that were difficult to break apart. In order to help gently break apart these materials, these samples were pre-soaked and deflocculated with a weak solution of sodium hexametaphosphate and water for at least one hour before subjecting the sample to the flotation process. Sodium hexametaphosphate was used instead of other deflocculates (such as baking soda or sodium bicarbonate) used by field archaeologists because sodium hexametaphosphate does not have any carbon content that could contaminate samples selected after the flotation process for radiocarbon dating. The first round of deflocculation was sometimes not enough to provide clean seeds for analysis, so some samples were deflocculated again in order to clean them further and increase the visibility of morphological features used to identify them. A standard control of 50 poppy seeds was inserted into select samples to provide a measure of the seed recovery rate of the samples throughout the flotation processing.

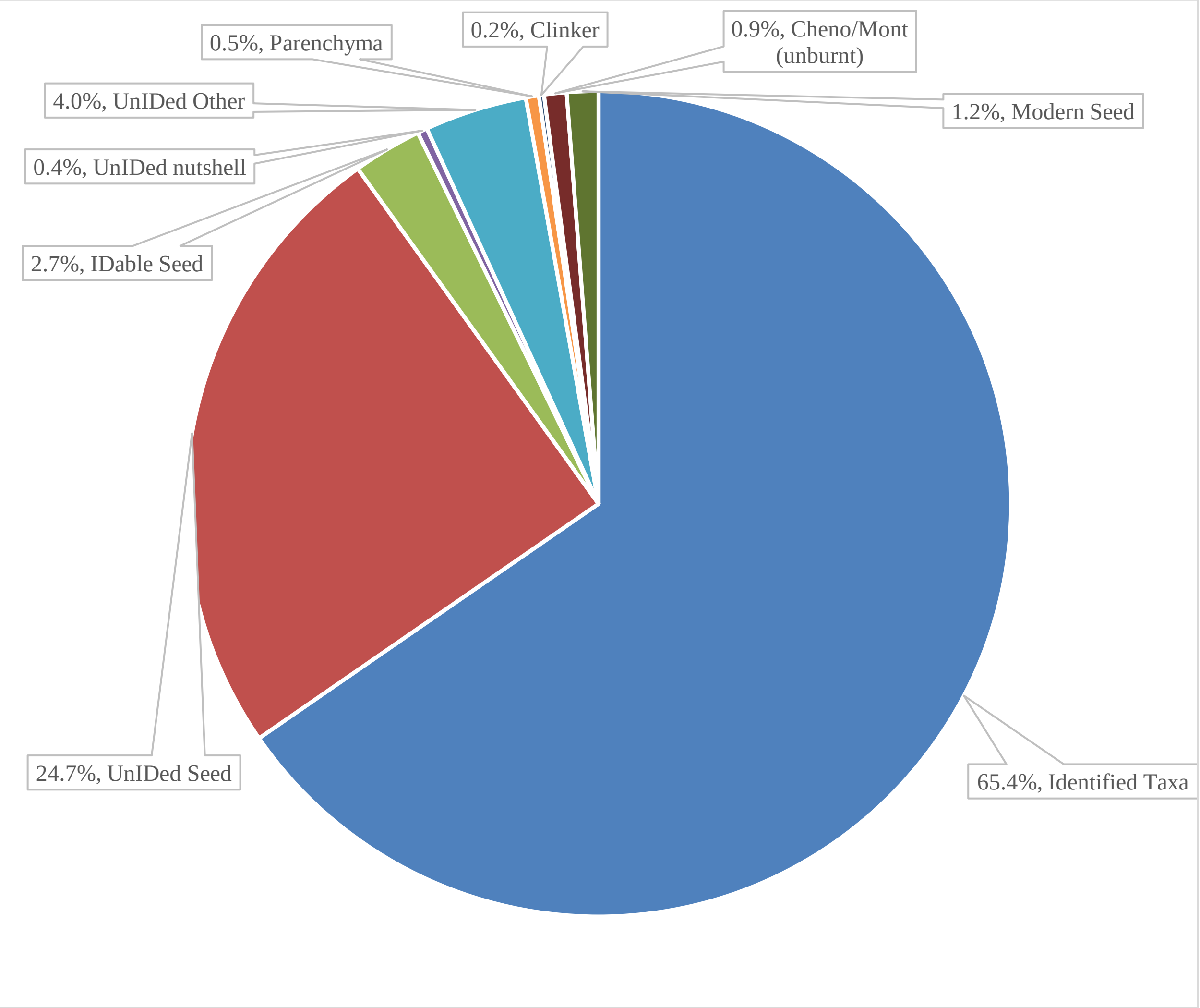
For the purposes of this study, the light fraction from 28 of the total 104 flotation samples from TAP-39 were analyzed in the McCown Paleoethnobotany Laboratory at UC Berkeley by Dr. Rob Cuthrell or by myself under the supervision of Dr. Cuthrell. These flotation samples represent contexts from EUs 1, 3, 9, and 11. Though flotation samples were collected from other EUs on site (i.e. from EUs 2, 4, 7, and 8), these samples could not be considered at the time of writing due to time and monetary constraints. The samples considered in this study were selected because they represent diverse areas of the site and are integral to the interpretation of particular cultural features in the site and to the interpretation of change in environment and foodways through time. EUs 1 and 3 represent the center and interior edge of a domestic structure. EU 9 represents the longest and oldest continuous column from which samples were collected from the site with a basal date from between 6,000-8,000 years cal BP (see Appendix B). EU 11 is a similarly old column, though the EU was not excavated to the basal deposits of the site and stopped at 80cm below surface with a radiocarbon date of about 2,000 years cal BP. The upper four levels from EU 11 were important to consider here, because this EU was placed within the general area of debris from a historic structure and could potentially offer the best data about the last occupation on this site in the late 19th to early 20th century.

In addition to the analysis of non-wood macrobotanical matrials, an anthrocological study of charred wood samples was conducted in the McCown Paleoethnobotany Lab and Microscope Lab at UC Berkeley by GeorgeAnn DeAntoni as her senior honors thesis under the supervision of Dr. Rob Cuthrell, myself, and her two advisors/readers, Professor Kent Lightfoot and Professor Christine Hastorf (DeAntoni 2015). This study explored samples from a broad range of contexts on site including EUs 1, 3, 8, 9, and 11. Though the contexts and interpretive questions we sought to answer with this study influenced the selection of samples, the main factor limiting our selection was differential preservation between older and younger radiocarbon dated samples and the availability of charred wood within these samples. That is, there were fewer pieces of charred wood, and fewer pieces still that were good enough quality to make an identification, in the older dated samples than younger samples. Samples were analyzed from level 6 of EU 1, level 4-6 of EU 3, levels 3, 5, 6, 7, 8, 9, 10, 12 of EU 8, levels 2, 3, and 7 of EU 9, and level 5 of EU 11. EU 3 and the upper levels of EU 8 had the best preserved charred wood samples and became the focus of interpretation in DeAntoni's (2015) study.

General Characteristics of the Macrobotanical Assemblage

Within the 28 samples from TAP-39 that were analyzed for this study, there was a total of 182 liters of soil. Some of these samples were so dense with materials, that they had to be split with a riffle box and subsampled anywhere between 50% in low density samples and 6.25% in very high density samples. The number of total specimens recovered from these samples was 42,686, of which 27,831 or about 65.4% of specimens were taxa that could be identified to the family or genus level (see figure 6.1). In terms of density at the entire site, there were 152.9 identifiable botanical taxa per liter of soil. However, this number over-represents most of the contexts on site, because samples from EUs 1 and 3 contained a particularly high density of botanical materials compared to all of the other EU's. The proportion of all seeds that are "identifiable" but could not be identified because of time constraints was 2.7% of the entire assemblage. The proportion of seeds that were "unidentified" was 24.7%. These seeds differ from identifiable seeds in that they did not have intact identifiable attributes and are less likely than identifiable seeds to be identified to a genus level in the future. Unidentified nutshell was 0.4% of the entire assemblage. "Unidentified other" represents charred materials that are not seeds and were not or could not be identified to the genus level. These unidentified other materials were 4.0% of the entire assemblage. Parenchymous tissue, which comprise 0.5% of the assemblage, are amorphous charred materials that represent plant tissues other than seeds or wood. "Wood" for the purposes of this study includes xylem, cambium, and phloem which are characteristics that are not present in parenchymous tissue. Clinker is charred botanical material that is derived from oily or sappy materials that become glassy in texture and appearance when burned. Clinker makes up about 0.2% of the overall macrobotanical assemblage. Uncharred "Chenopodiaceae/Montiaceae" and unburnt "modern seeds" were not included in other categories, because it is uncertain whether or not these seeds represent historical seeds or contemporary seeds that have infiltrated the site during excavation or through natural processes such as bioturbation. Chenopodiacae/Montiaceae is 0.9% of the assemblage and modern seeds are 1.2% of the assemblage.

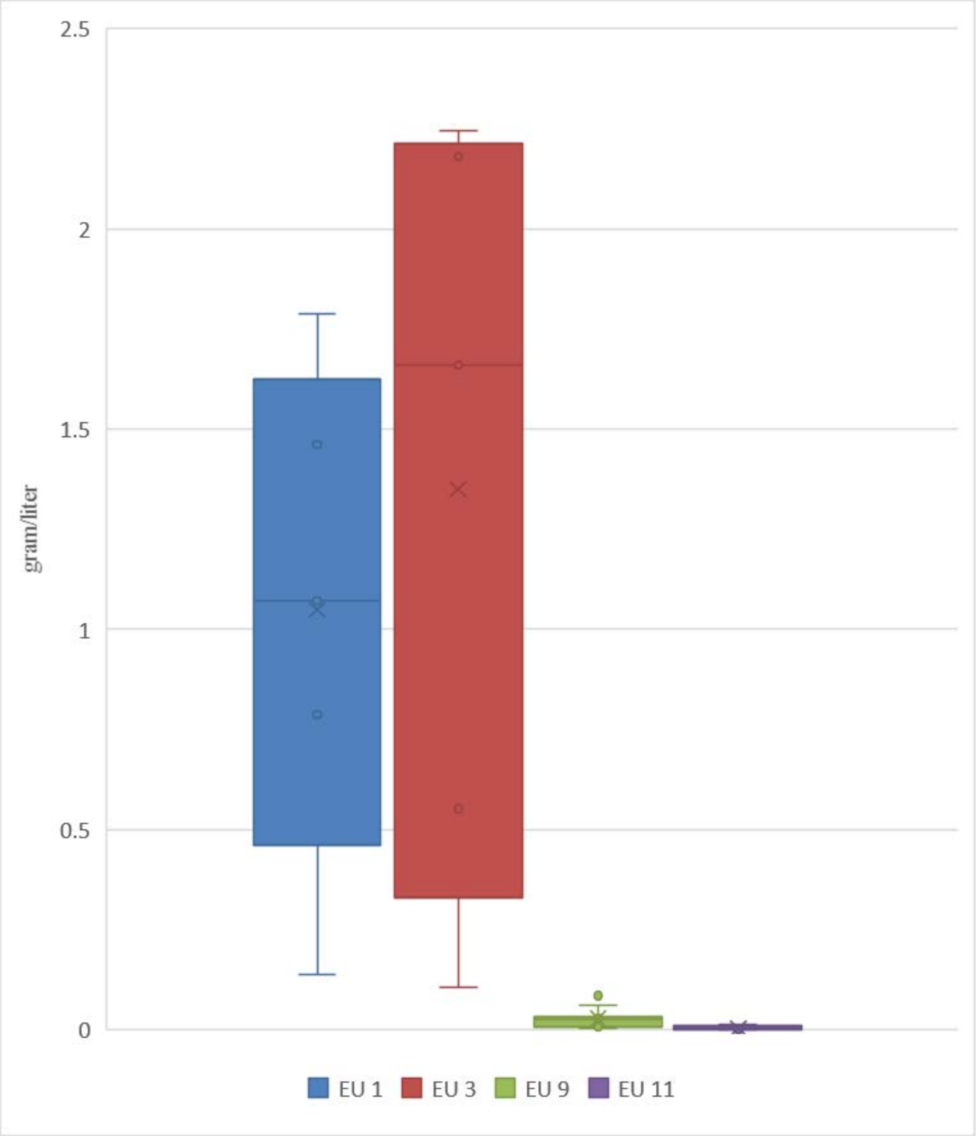
Figure 6.1. General Characteristics of the macrobotanical assemblage. Out of a total of 28 samples and182 liters of soil, the total n = 42,686 bots, and the average density = 152.9 bots/liter.



Wood Charcoal

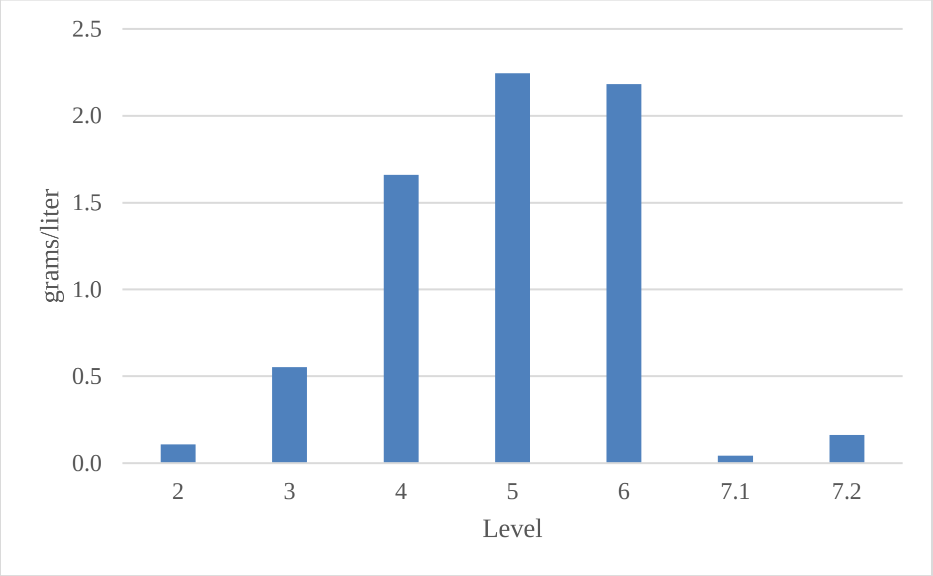
The distribution of wood charcoal is not homogenous throughout vertical and horizontal space on the site and may indicate patterns that reflect differences in the quality of preservation or differences in intentional use of wood resources in certain areas or contexts on the site (see figure 6.2). EUs 1 and 3 which are adjacent have much higher densities of wood charcoal overall (about 5.2 g/l and 7 g/l respectively) than EUs 9 and 11 (which contain about 0.33 g/l and 0.02 g/l respectively).

Figure 6.2. Charred wood densities by EU.



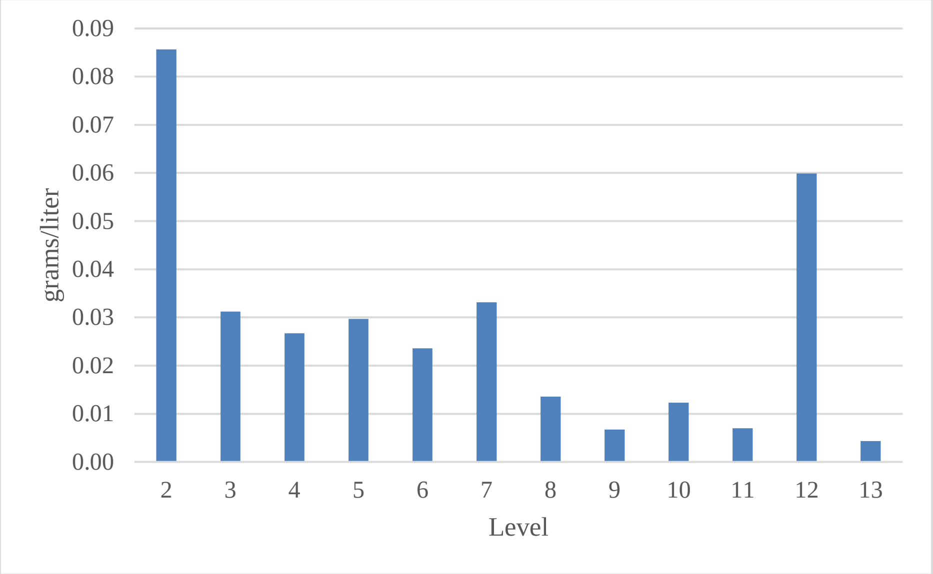
Within EU 3 (see figure 6.2), the mean density (weight in grams per liter) of wood charcoal is high (greater than 1 g/l). Levels 4, 5 and 6 are all above 1 g/l (see figure 6.3). The density of wood charcoal is moderate (between 0.5 g/l and 1 g/l) in level 3. Level 2 does not have much wood charcoal (less than 0.15 g/l) compared to these other levels in the EU. Within EU 3, the densities of wood charcoal are similarly high in levels 4, 5, and 6 of EU 1, moderate in level 3, and low in level 2. Densities of wood charcoal in levels 7.1, and 7.2, which represent arbitrary levels within a clay house floor feature, are low as well.

Figure 6.3. Charred wood densities by level within EU 3.



While EU 9 has much less wood charcoal than EUs 1 and 3, it is still useful to compare the relative densities of wood charcoal from each level within this EU (see figure 6.4). As can be seen in the graph below, levels 2 and 12 of EU 9 have uncharacteristically higher densities of wood charcoal than other levels within the EU. Levels 3-7 have consistent densities of wood charcoal between 0.023 g/l and 0.033 g/l and levels 8-11 and 13 have densities between 0.004 g/l and 0.012 g/l. Even the highest density levels from EU 9 are still lower than 0.1 g/l which are less dense than all samples from EUs 1 and 3 except for the sample from the upper level of the clay house floor (EU 3, level 7.1) which has a density of 0.04 g/l.

Figure 6.4. Charred wood densities by level within EU 9.



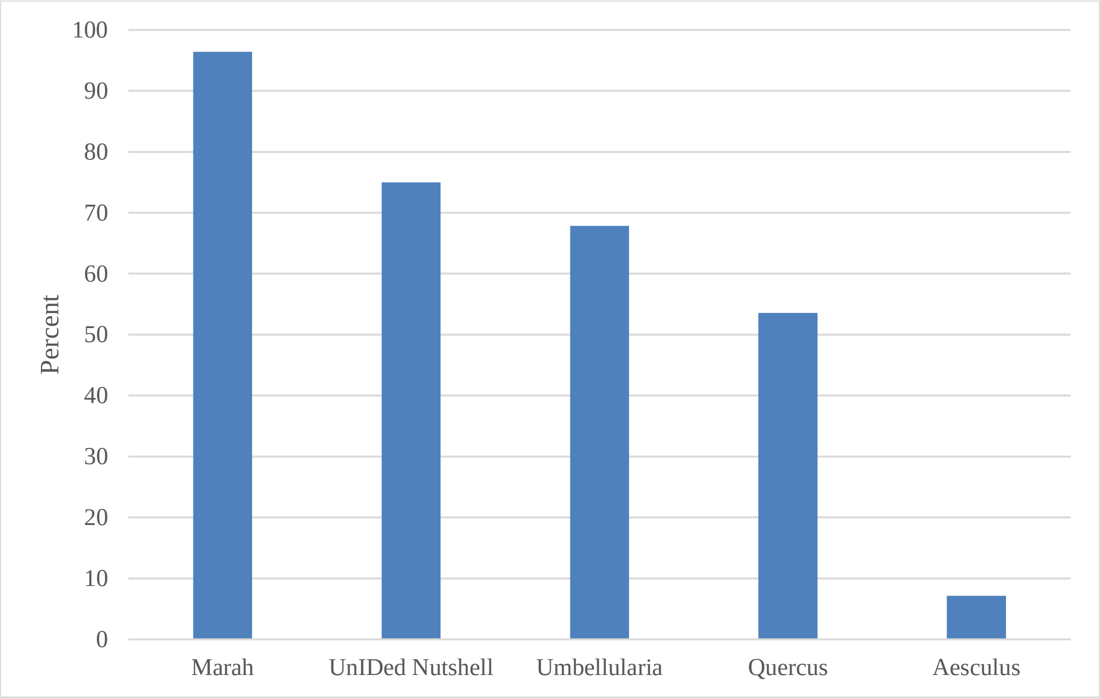
Nutshell

Nutshell was collected in the 1-2 mm, 2-4 mm and >4 mm size fractions of the light fraction samples. Each piece of nutshell was counted and weighed. Nutshell includes the shell or hull of all nut-bearing trees, such as buckeye (*Aesculus*), oak (*Quercus*), and California bay laurel (*Umbellularia*). Even though manroot (*Marah*) is technically a large seed and not a nut, it is classified with nutshell because the characteristics of its testa or seed coat are very similar to the characteristics of nutshell. The counts and weights of unidentified (UnIDed) nutshell was also recorded.

Overall, there is a patterned difference in the varieties of nutshell that were recovered in different areas of TAP-39. I will discuss these differences first in general terms using the measurement of ubiquity or presence/absence. To calculate the ubiquity or presence/absence of materials in one or more samples, each taxon receives a value of 1 for each sample where it is present (in any amount) or a value of 0 for each sample where it is not present. The total value for each taxon is divided by the total number of samples and multiplied by 100 to achieve a percent present or ubiquity for each taxon in the sample or set of samples represented (Popper 1988:60-64). After the discussion of ubiquity, I will discuss the differences between different taxa in terms of relative proportions of each taxon's density (pieces of nutshell per liter) within a single sample.

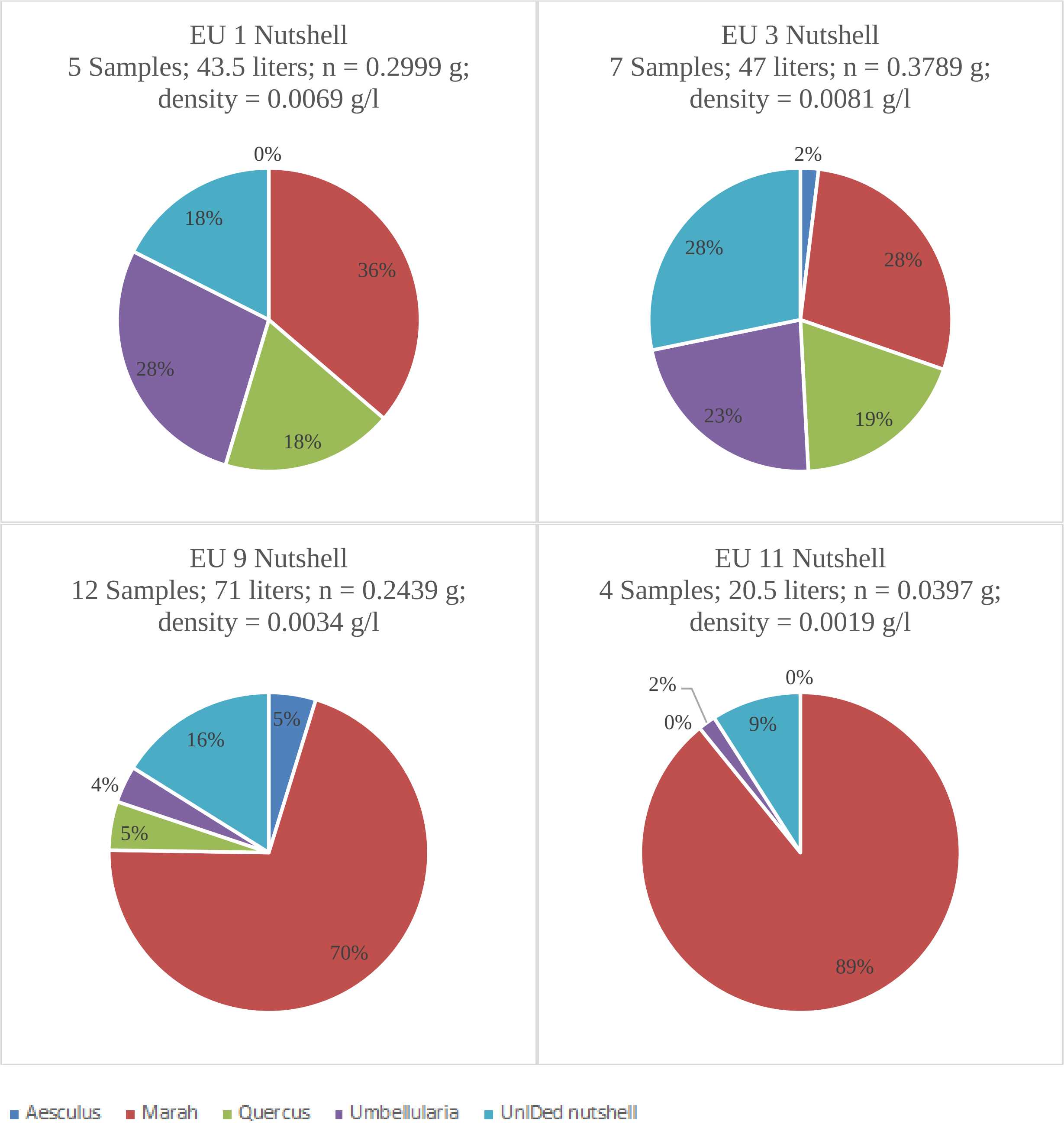
Buckeye (*Aesculus*) is only present in two flotation samples (i.e. EU 3, level 6 and EU 9, level 12) which affords it an overall ubiquity onsite of 7.1% (see figure 6.5). Manroot (*Marah*) is the most ubiquitous taxa of "nutshell" onsite, being present in 96.4% of flotation samples. Oak (*Quercus*) and California bay laurel (*Umbellularia*) are moderately ubiquitous being present in 53.6% and 63.9% of samples. Unidentified nutshell was present in 75% of samples.

Figure 6.5. Ubiquity of nutshell throughout all contexts of TAP-39.



In figure 6.6, the proportions discussed are based on the density in terms of weight (grams per liter) of each taxa of nutshell. There are striking differences in the proportions of nutshell taxa between EUs 1, 3, 9, and 11. EUs 1 and 3 have greater proportions of oak (*Quercus*) and California bay laurel (*Umbellularia*) and smaller proportions of maroot (*Marah*) than EUs 9 and 11. Oak is 18% of all nutshell in EU 1 and 19% in EU 3, whereas it is only 5% in EU 9 and 0% in EU 11. Likewise, California bay laurel is 28% in EU 1 and 23% in EU 3, whereas it is only 4% in EU 9 and 2% in EU 11. Manroot is 36% of all nutshell in EU 1 and it is 28% of all nutshell in EU 3. This contrasts with EUs 9 and 11, where manroot is 70% and 89% (respectively) of all nutshell.

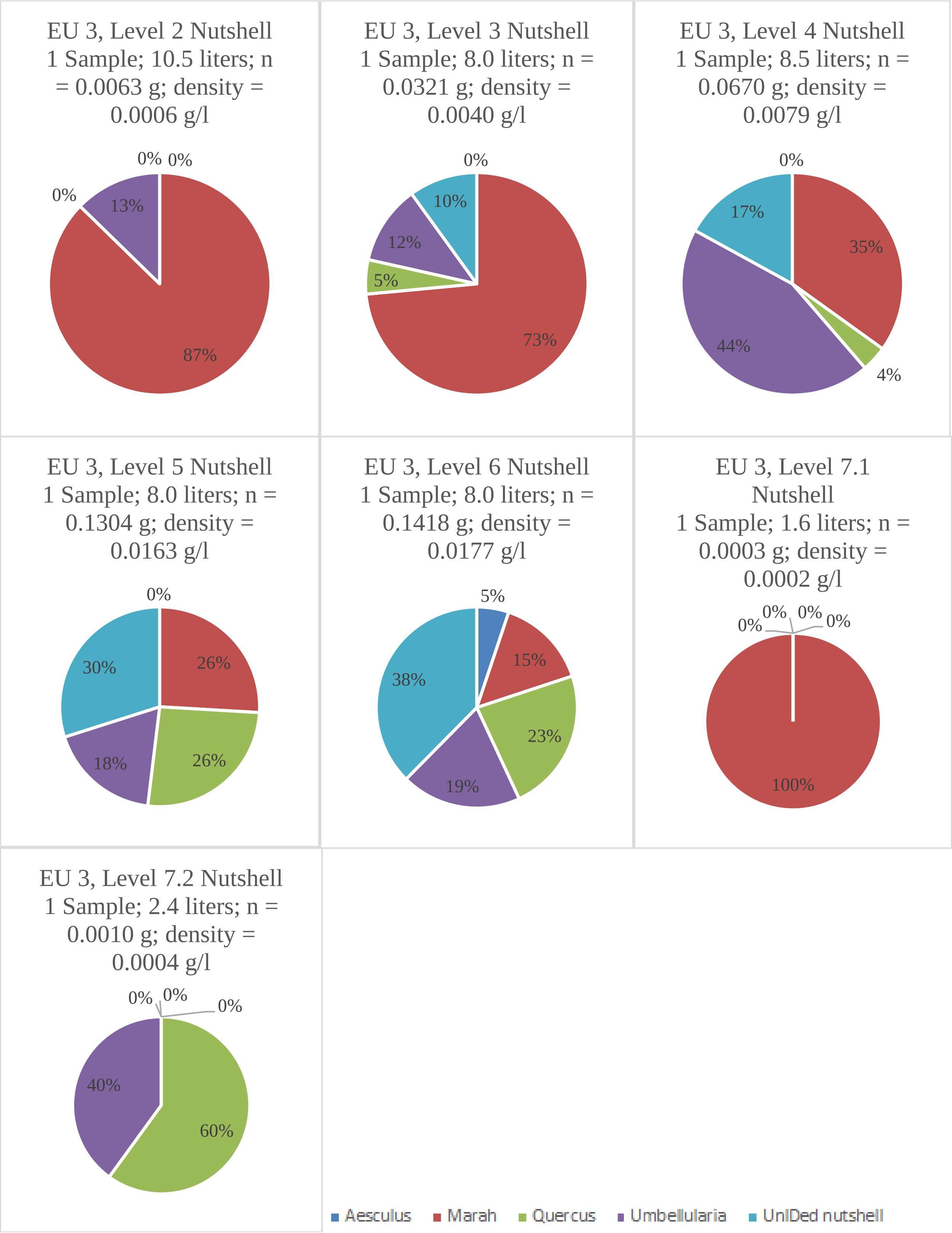
Figure 6.6. Pie charts illustrating differences in the proportional abundance of nutshell between all EUs at TAP-39.



The patterns in overall proportions of nutshell for each EU are also more or less reflected in the patterns between different levels within the EUs with a few key exceptions. In EU 3 (see figure 6.7), levels 2, 3, and 7.1, all have much higher proportions of manroot (*Marah*) than any of the other levels within this EU which are 83% in level 2, 67% in level 3, and 100% in level 7.1. Level 7.2, also differs from the rest of the levels in this EU, because it contains 0% manroot (*Marah*), which is much lower than any other level, 67% oak (*Quercus*) and 33% California bay laurel (*Umbellularia*), which are both much higher than in any other level.

These differences in proportions of nutshell correlate with stratigraphic changes in EU 3. Levels 1 and 2 consisted of lighter colored midden soil that contained more clay content than other midden below. Level 3 consisted of heavily compacted soil which transitioned into soft, dark midden soil in level 4. Levels 4, 5, and 6 consisted of soft, dark midden soil. Level 7.1 consisted of a compacted clay house floor. And level 7.2 consisted of an arbitrary second level of the house floor which was collected separately to ensure that the flotation sample from level 7.1 would not be contaminated by any over-excavation into the midden below the house floor. The pattern that emerges is higher proportions of manroot (*Marah*) in levels 1, 2 and 3 which are interpreted as overburden and compacted soils essentially capping the dark, organic-rich midden of levels 4, 5, and 6 below. Higher proportions of manroot (*Marah*) were also observed in level 7.1 of the clay house floor. Levels 4, 5, and 6, on the other hand, contain much higher proportions of oak (*Quercus*) and California bay laurel (*Umbellularia*). The soil in levels 4, 5, and 6 represent the organic, rich soil from interior and exterior activities associated with this building and construction debris from the house itself, which intentionally or unintentionally filled the interior of the house after it was retired.

Figure 6.7. Pie charts illustrating differences in the proportional abundance of nutshell between each level within EU 3.



EU 3, Level 2 Nutshell
1 Sample; 10.5 liters; n = 0.0063 g; density = 0.0006 g/l

EU 3, Level 3 Nutshell
1 Sample; 8.0 liters; n = 0.0321 g; density = 0.0040 g/l

EU 3, Level 4 Nutshell
1 Sample; 8.5 liters; n = 0.0670 g; density = 0.0079 g/l

EU 3, Level 5 Nutshell
1 Sample; 8.0 liters; n = 0.1304 g; density = 0.0163 g/l

EU 3, Level 6 Nutshell
1 Sample; 8.0 liters; n = 0.1418 g; density = 0.0177 g/l

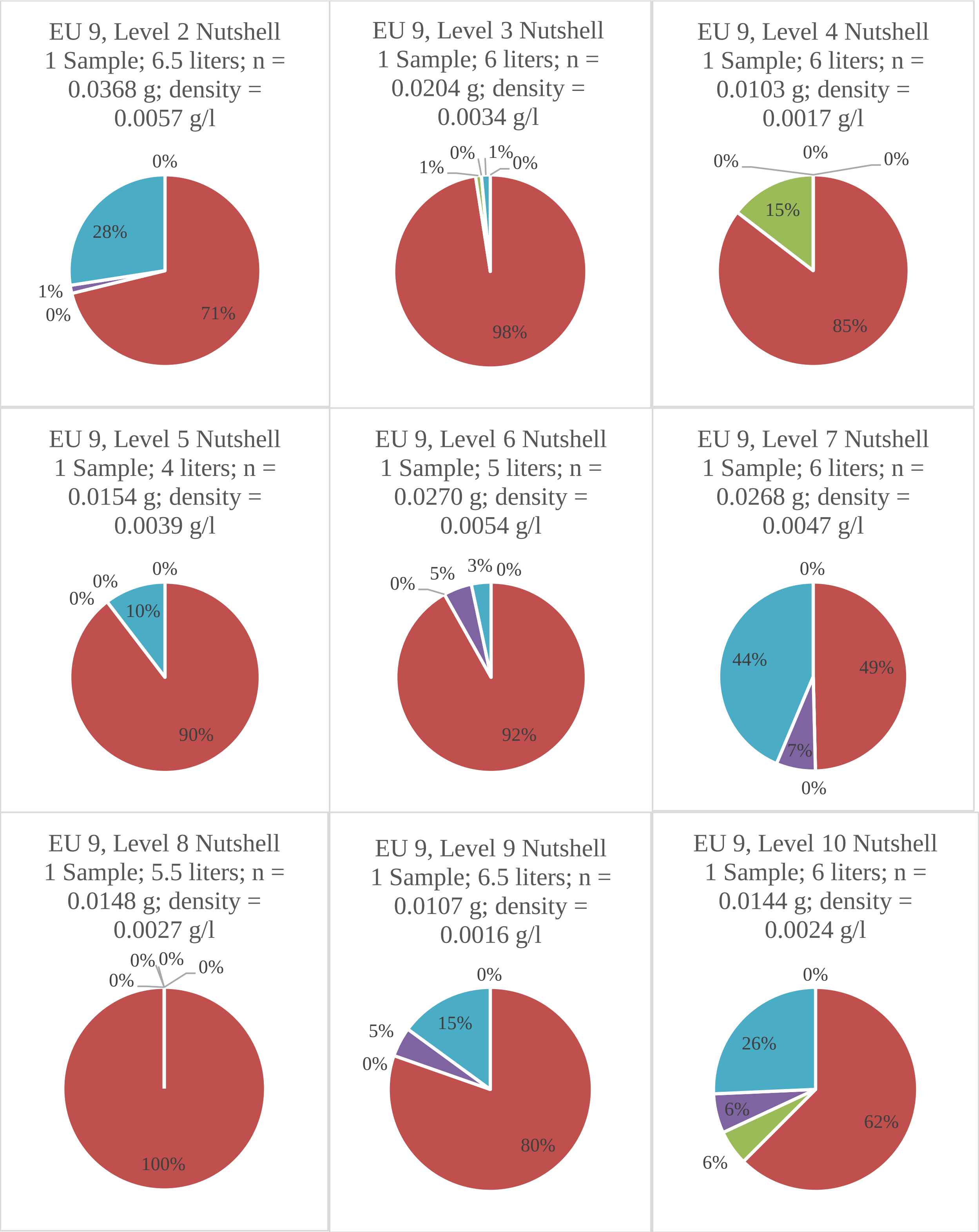
EU 3, Level 7.1 Nutshell
1 Sample; 1.6 liters; n = 0.0003 g; density = 0.0002 g/l

EU 3, Level 7.2 Nutshell
1 Sample; 2.4 liters; n = 0.0010 g; density = 0.0004 g/l

When the proportions of nutshell taxa from EU 1 and 3, representing house interior space (probably mixed with some materials from exterior space as well), are compared with units from non-discrete, “generalized midden” contexts, there are stark differences between these contexts. EU 9 was selected as a representative sample from the non-discrete or generalized midden contexts on site. That is, no discrete features (e.g. intact hearths, floors, ash lenses, etc.) or changes in stratigraphy were observed from the current ground surface to the basal deposits of the site in EU 9, and the entire unit was excavated in arbitrary 10 cm levels. It is likely that most of the midden soils from EU 9 were associated with exterior space on the site.

In every level of EU 9 except for level 12, there are higher proportional densities of manroot (*Marah*), ranging from 49% to 100%, than any other taxa of nutshell (see figure 6.8). Levels 7 and 11 have lower proportions (49% and 52% respectively) of manroot (*Marah*) than many of the other levels in EU 9, but level 7 also has a higher proportion (44%) of unidentified nutshell rather than higher proportions of oak (*Quercus*) and California bay laurel (*Umbellularia*) like in level 11 (see figure below). Level 12 is unique in EU 9, because in addition to having higher proportions of California bay laurel (*Umbellularia*) and oak (*Quercus*), level 12 also has a very high proportion of buckeye (*Aesculus*) compared with other levels. While the density of nutshell is low (0.0047 g/l) in level 12, it is consistent the densities of other levels within EU 9, and so the difference in proportions between taxa in this level may not have resulted from bad preservation compared with other levels within the unit.

Figure 6.8. Pie charts illustrating differences in the proportional abundance of nutshell between each level within EU 9.



EU 9, Level 2 Nutshell
1 Sample; 6.5 liters; n = 0.0368 g; density = 0.0057 g/l

EU 9, Level 3 Nutshell
1 Sample; 6 liters; n = 0.0204 g; density = 0.0034 g/l

EU 9, Level 4 Nutshell
1 Sample; 6 liters; n = 0.0103 g; density = 0.0017 g/l

EU 9, Level 5 Nutshell
1 Sample; 4 liters; n = 0.0154 g; density = 0.0039 g/l

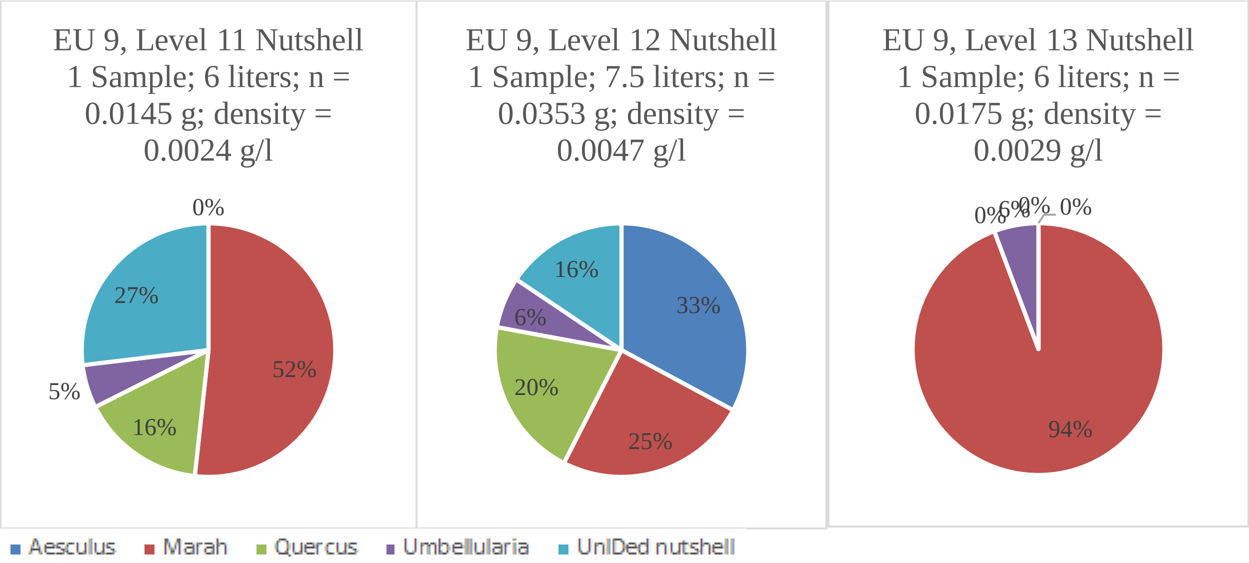
EU 9, Level 6 Nutshell
1 Sample; 5 liters; n = 0.0270 g; density = 0.0054 g/l

EU 9, Level 7 Nutshell
1 Sample; 6 liters; n = 0.0268 g; density = 0.0047 g/l

EU 9, Level 8 Nutshell
1 Sample; 5.5 liters; n = 0.0148 g; density = 0.0027 g/l

EU 9, Level 9 Nutshell
1 Sample; 6.5 liters; n = 0.0107 g; density = 0.0016 g/l

EU 9, Level 10 Nutshell
1 Sample; 6 liters; n = 0.0144 g; density = 0.0024 g/l



The pattern that emerges from EUs 1, 3, and 9 is that the contexts associated with the interior house floor feature (that is, levels 4, 5, and 6 of EUs 1 and 3) generally have higher proportional densities of food nuts (i.e. buckeye, California bay laurel, and oak) than non-discrete, generalized midden contexts. Non-discrete contexts, on the other hand, have higher proportions of non-food nuts (i.e. *Marah*) than the contexts associated with the house floor.

All of the flotation samples from TAP-39 were collected in the same manner, and so it seems as though the difference in the densities of materials is contextual rather than an error in sampling. Adding further support to these interpretations, the samples from EU 1 and 3 were collected within the first 50 cm from the surface of the site, and radiocarbon dates from botanicals within these samples all date to approximately the last 500 years (see Appendix B). Historic Period materials are also present within these samples from EU 1 and 3. Samples collected from EU 9 from these same depths (0 to 50 cm below the surface) also date to approximately the last 400 years BP, and these samples also produced Historic Period artifacts. That is, these samples are roughly contemporaneous, but different activities in the past associated with the area inside and above the house floor in EUs 1 and 3 produced a context that is materially distinct from all of the other contexts excavated at TAP-39. Whether this context within and above the house floor represents activities during the use life of the house, filling in a house pit after its use, or multiple such activities, the fact remains that there is an abundance of botanical materials within this area that does not appear in any other excavated context within this study.

Charred Seed Plants

In the following discussion of identified seed taxa, only charred seeds will be considered since these seeds represent preserved, archaeological seeds. Uncharred, archaeological seeds can also be preserved in certain conditions. However, without careful radiocarbon dating and controlled discrete contexts, it is difficult to discern uncharred, archaeological seeds from uncharred, modern seeds. The category "*Chenopodium*/*Montiaceae* unburnt" (count of 374 per liter and density of 2.1 per liter) is not included in this section, because it includes uncharred seeds. However, the uncharred category, "*Chenopodium*/*Montiaceae* burnt" is included in this section, because there is more certainty about it being archaeological rather than modern. With the amount of bioturbation at TAP-39, there is little certainty whether or not the unburnt category of *Chenopodium*/*Montiaceae* at TAP-39 represents archaeological materials. Other California sites have shown that in some contexts, uncharred *Chenopodium*/*Montiaceae* is archaeologically significant (Hammett and Lawlor 2004:340-341), and so this category is still included in the overall totals for identified taxa for the entire site.

The graph in figure 6.9 shows the ubiquity or presence/absence of all categories of charred plant taxa identified from TAP-39. Ubiquity is calculated by counting the number of samples or contexts in which each taxon is present and dividing this number by the total number of samples or contexts considered. The result is the percentage that each of these taxa are present throughout the dataset. For this study, each standard flotation sample from every excavation level analyzed (28 samples in total) was used to calculate the ubiquity of taxa at TAP-39. Grass family plants (*Poaceae*) was the only taxon category that had a ubiquity of 100%. Manroot (*Marah*), clover (*Trifolium*), and sunflower family plants (*Asteraceae*) also had high ubiquities of 96.4%, 85.7%, and 82.1% respectively. All of the top ten ubiquitous plants—grass family plants (*Poaceae*), manroot (*Marah*), clover (*Trifolium*), sunflower family plants (*Asteraceae*), California bay laurel (*Umbellularia*), bedstraw (*Galium*), phacelia (*Phacelia*), fiddleneck (*Amsinkia*), oak (*Quercus*) and goosefoot family plants (*Chenopodium*/*Montiaceae*)—had ubiquities of more than 50%.

Figure 6.9. Ubiquity of all macrobotanical taxa throughout all contexts of TAP-39.

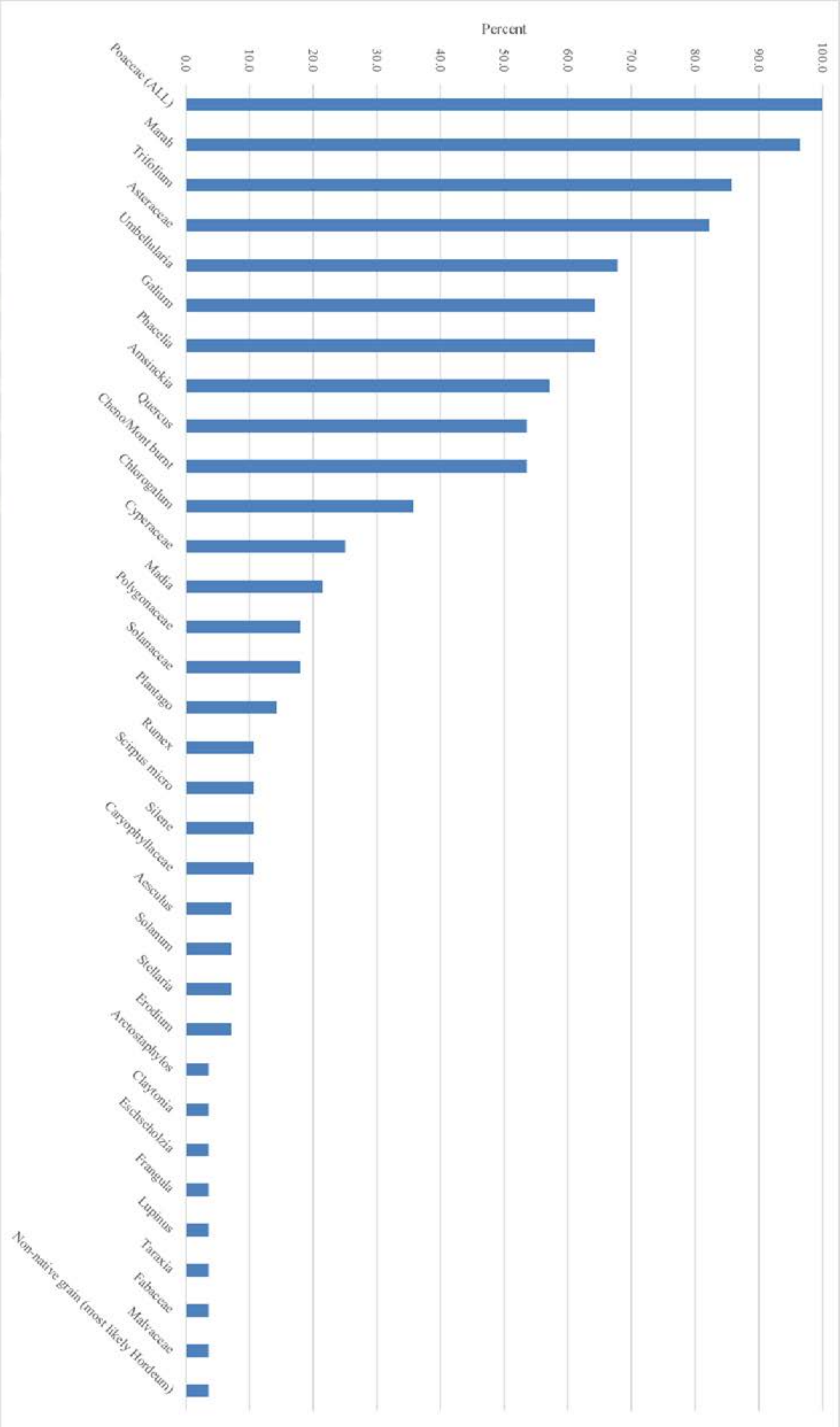


Table 6.1 summarizes all categories of charred plant taxa identified from TAP-39. The first ten taxa listed in table 6.1 constitute the top ten most common taxa at TAP-39, because they have the highest counts of seeds of all taxa at TAP-39 as well as the highest densities (count of seeds per liter). The top ten most common taxa are grass family plants (*Poaceae*), clover (*Trifolium*), goosefoot family plants (*Chenopodium*/*Montiaceae*), sunflower family plants (*Asteraceae*), manroot (*Marah*), phacelia (*Phacelia*), bedstraw (*Galium*), California bay laurel (*Umbellularia*), soaproot (*Chlorogalum*), and oak (*Quercus*). The top ten most common taxa differs from ubiquity in that the “common taxa” measurement uses an actual count or density of seeds whereas ubiquity is a measurement of the percentage of presence (number of samples in which a taxon is present divided by the total number of samples) of each taxon on site. The majority of the top ten most common plant taxa within table 6.1 also are also among the top ten highest percentages of ubiquity in figure 6.9. However, there are some differences in the order of the top ten most ubiquitous and top ten most common plants. Goosefoot family plants (*Chenopodium*/*Montiaceae*) and soaproot (*Chlorogalum*) are more common in terms of count or density, but they are less ubiquitous on site. Manroot (*Marah*) is more ubiquitous, but it is less common in terms of count or density on site. Fiddleneck (*Amsenkia*) and soaproot (*Chlorogalum*) were the only plants that were on one list but not the other. Fiddleneck (*Amsenkia*) was included in the top ten most ubiquitous plant taxa, but was not included in the top ten most common plant taxa. Soaproot (*Chlorogalum*) was included in the top ten most most common plant taxa, but was not included in the top ten most ubiquitous plant taxa.

Even though bean family plants (*Fabaceae*) were not included in the top ten most common plant taxa on site in figure 6.1, they were still very common in terms of count or density compared to their very low ubiquity (3.6%) on site (see figure 6.9). Clover (*Trifolium*), which is also a bean family plant, had a very high ubiquity (85.7%), so the very low ubiquity of *Fabaceae* may have been the result of time constraints on the identification of the one sample where this category appears (i.e. placing seeds in the family category that could eventually be identified to genus with more work, deflocculation/cleaning, etc.) and/or may have been the result of subsampling many of these samples.

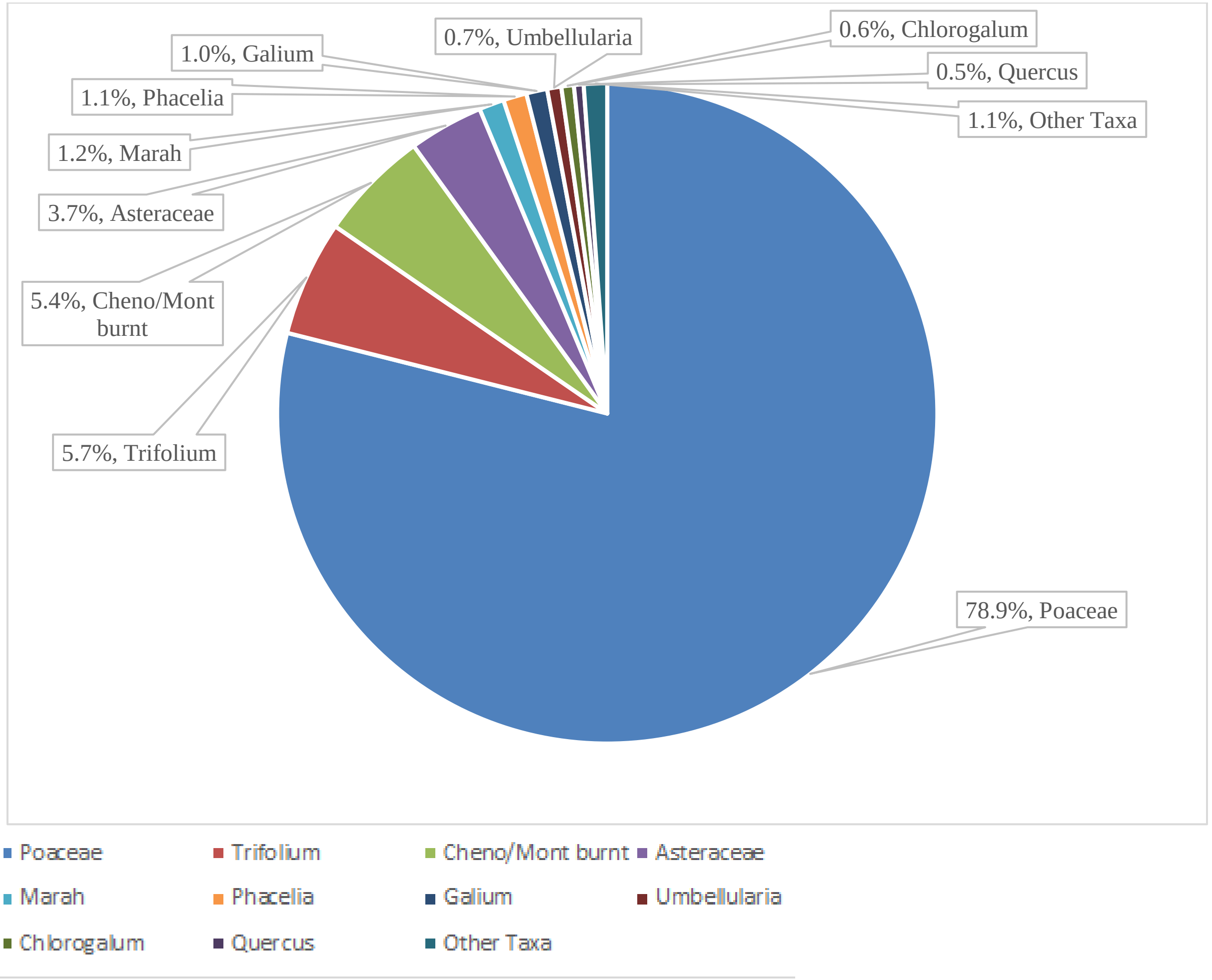
Table 6.1. Summary of identified macrobotanical taxa from TAP-39. Density is calculated as count of seeds per liter.

Scientific Name	Common Name	Type	Count	Density
Poaceae	grass family	grass	21671.0	119.1
Trifolium	clover	herb	1555.1	8.5
Cheno/Mont burnt	goosefoot family (burnt)	herb	1494.4	8.2
Asteraceae	sunflower family	herb/shrub	1002.3	5.5
Marah	manroot	herb/vine	336.0	1.8
Phacelia	phacelia	herb	315.3	1.7
Galium	bedstraw	herb	281.3	1.5
Umbellularia	California bay	tree	190.0	1.0
Chlorogalum	soaproot	geophyte	168.0	0.9
Quercus	oak	tree	130.0	0.7
Fabaceae	bean family	herb/shrub	105.0	0.6
Amsinckia	fiddleneck	herb	47.0	0.3
Madia	tarweed	herb	41.0	0.2
Cyperaceae	sedge family	sedge	23.0	0.1
Solanaceae	nightshade family	herb	12.0	0.1
Scirpus micro	panicled bulrush	sedge	11.0	0.1
Caryophyllaceae	carnation family	herb	11.0	0.1
Polygonaceae	buckwheat family	herb	10.0	0.1
Silene	catchfly	herb	8.3	0.0
Aesculus	buckeye	tree	8.0	0.0
Rumex	dock	herb	8.0	0.0
Stellaria	starwart	herb	6.0	0.0
Claytonia	miner's lettuce	herb	5.0	0.0
Plantago	plantain	herb	5.0	0.0
Arctostaphylos	manzanita	shrub	3.0	0.0
Solanum	nightshade	herb	3.0	0.0
Lupinus	lupine	shrub	2.0	0.0
Malvaceae	mallow family	herb/shrub	2.0	0.0
Eschscholzia	poppy	herb	1.0	0.0
Frangula	coffeeberry	shrub	1.0	0.0
Taraxia	primrose, suncup	herb	1.0	0.0

Overall at TAP-39, grasses (*Poaceae*) represent the largest group of identified taxa at 78.9% of all identified specimens (see figure 6.10). The next largest group is clover (*Trifolium*) at 5.7%, burnt goosefoot family (*Chenopodiaceae/Montiaceae*) at 5.4%, sunflower family (*Asteraceae*) at 3.7%, manroot (*Marah*) at 1.2%, phacelia (*Phacelia*) at 1.1%, bedstraw (*Galium*) at 1.0%, California bay laurel (*Umbellularia*) at 0.7%, soaproot (*Chlorogalum*) at 0.6%, oak (*Quercus*) 0.5%, and other taxa representing the last 1.1%. These top ten most common plants as well as the plants listed in the other category had many uses as food, tools, medicine, ceremonial offerings, and other purposes. Below is a brief description of the many different uses of the top ten most common plants at TAP-39.

The seeds of grass family plants (Poaceae) were collected, hulled, roasted, pounded, and incorporated into pinole (I. Kelly 1991:120; K. R. Smith 2014:42). The leaves of clover (*Trifolium*) were eaten as greens (I. Kelly 1991:50; 120; K. R. Smith 2014:25-26). Though the seeds in the goosefoot family (*Chenopodiaceae/Montiaceae*) category were not identified beyond the family level, these seeds represent some plants that were eaten as a food (such as miner’s lettuce or spring beauty, *Claytonia* sp. eaten as greens) and some that may have served medicinal/ceremonial purposes (such as red maids or *Calandrinia* sp.) (Hammett and Lawlor 2004:339-341). Sunflower family (*Asteraceae*) may represent weed plants that were growing around the site or were transported inadvertently to the site or these seeds could represent plants similar to tarweeds (such as *Madia* and *Hemezonia*) that were hulled, toasted, pounded, and incorporated into pinole (I. Kelly 1991:252; K. R. Smith 2014:41-43). Manroot (*Marah*) was used as a poultice for swellings, remedy for boils, and as a fish poison (I. Kelly 1991:44). The leaves of phacelia (*Phacelia*) were made into a tea (I. Kelly 1991:137). Bedstraw (*Galium*) was most likely a weed plant that was inadvertently transported onto the site (Cuthrell 2013b). The peppernuts of California bay laurel (*Umbellularia*) were hulled, roasted, pounded, and formed into balls or cakes (I. Kelly 1991:146; K. R. Smith 2014:59-61). The bulbs of soaproot (*Chlorogalum*) were roasted and eaten or could be pounded into a soap for bathing, the fibrous outer layers of the bulbs could be made into a hairbrush or mealing brush, and the leaves could be used to wrap food in preparation for cooking in an earth oven (I. Kelly 1991:148; 172; K. R. Smith 2014:49). The acorns from Oak (*Quercus*) trees were hulled, pounded, winnowed, leached of tannins, and cooked into a mush or soup depending on the consistency desired (I. Kelly 1991; K. R. Smith 2014:53-55).

Figure 6.10. Pie chart illustrating the proportional abundance of the top ten most common identified macrobotanical taxa throughout all contexts at TAP-39. Out of 28 samples and 182 liters of soil, the total n = 27,457 bots and the density = 150.9 bots/liter.[3]



Between and within the units at TAP-39, the proportions of the top ten most common plant taxa change depending on its context. For the discussion of individual units and levels, I will use EU 3 (see figure 6.11) as an example of a unit contexts inside and above the house floor and EU 9 (see figure 6.12) as a unit with non-discrete contexts. During the excavation of EU 3, levels 1 and 2 had much less material and were stratigraphically distinct from level 3, which was compact and represented the transition between the non-discrete, overburden of levels 1 and 2 and the interior deposits above the house floor. These different contexts are materially reflected in the low densities of materials such as charred wood within level 2 compared to moderate densities of charred wood in level 3 and high densities of charred wood in levels 4, 5, and 6 (see figure 6.3). The average percentages of grass family plants in EU 3 were much higher in levels 4 through 6 than in levels 2, 3, 7.1, and 7.2 within the unit. The average between levels 4 through 6 is 79.3%, whereas the average for the other levels of this unit is 71.5%. In EU 3, there are also higher

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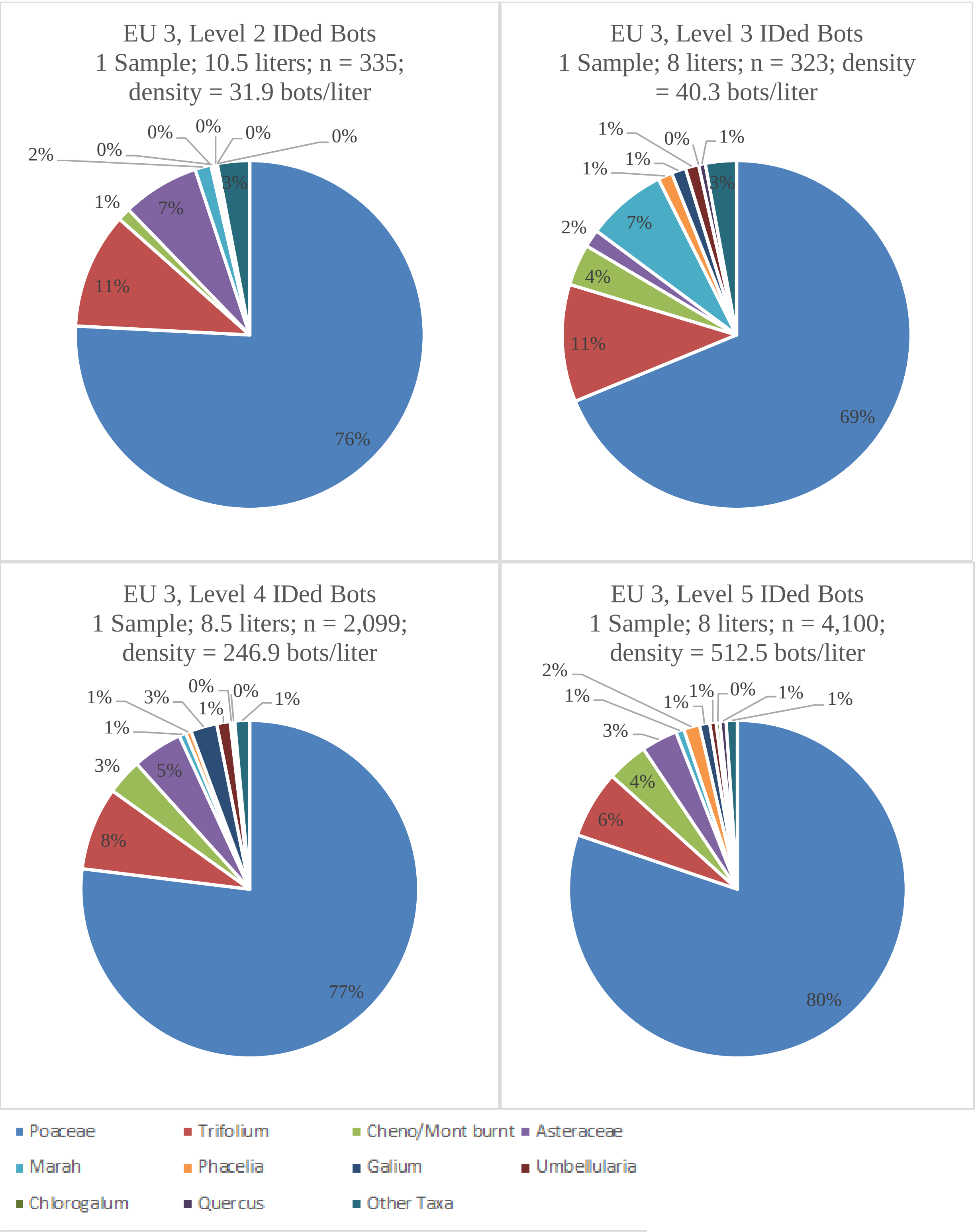
[3] The top ten most common identified taxa charts exclude unburnt Cheno/Mont (count = 374, density = 2.1 bots/liter). Unburnt Cheno/Mont is included in the total for identified taxa elsewhere unless noted.

percentages of bedstraw (Galium) between levels 4 through 6 than in levels 2, 3, 7.1, and 7.2. The average between levels 4 through 6 is 4.7%, whereas the average for the other levels of this unit is 0.5%.

Based on AMS radiocarbon dates of charred botanicals, levels 7.1 and 7.2 of EU 3 date between circa 1473-1645 cal years BP (see Appendix B). Due to rodent disturbance and the recent age of botanicals dated from the levels above the house floor, a precise sequence of radiocarbon dates for these levels cannot be established with great resolution. Based on a combination of multiple radiocarbon dates and chronologically diagnostic artifacts found throughout these levels, it appears that the levels above the house floor date to sometime between the last 500 years BP. One component of these levels is historic materials that date to the late nineteenth century.

Stratigraphically, it appears that there are a few separate components in this unit that may be reflected in the taxa of botanical materials. As is discussed in more detail in chapter 4, levels 1 and 2 are overburden on top of level 3, which is a very compact level of midden that caps the softer, darker, and organic-rich midden soils of levels 4-6 that sit on top of the house floor. Levels 4 through 6 may represent activities associated with interior or domestic space. Alternatively, levels 4 through 6 could represent fill and decomposed architectural materials from the structure that were pushed into a semi-subterranean building at the time that the building was retired from use.

Figure 6.11. Pie charts illustrating differences in the proportional abundance of the top ten identified taxa between each level within EU 3.

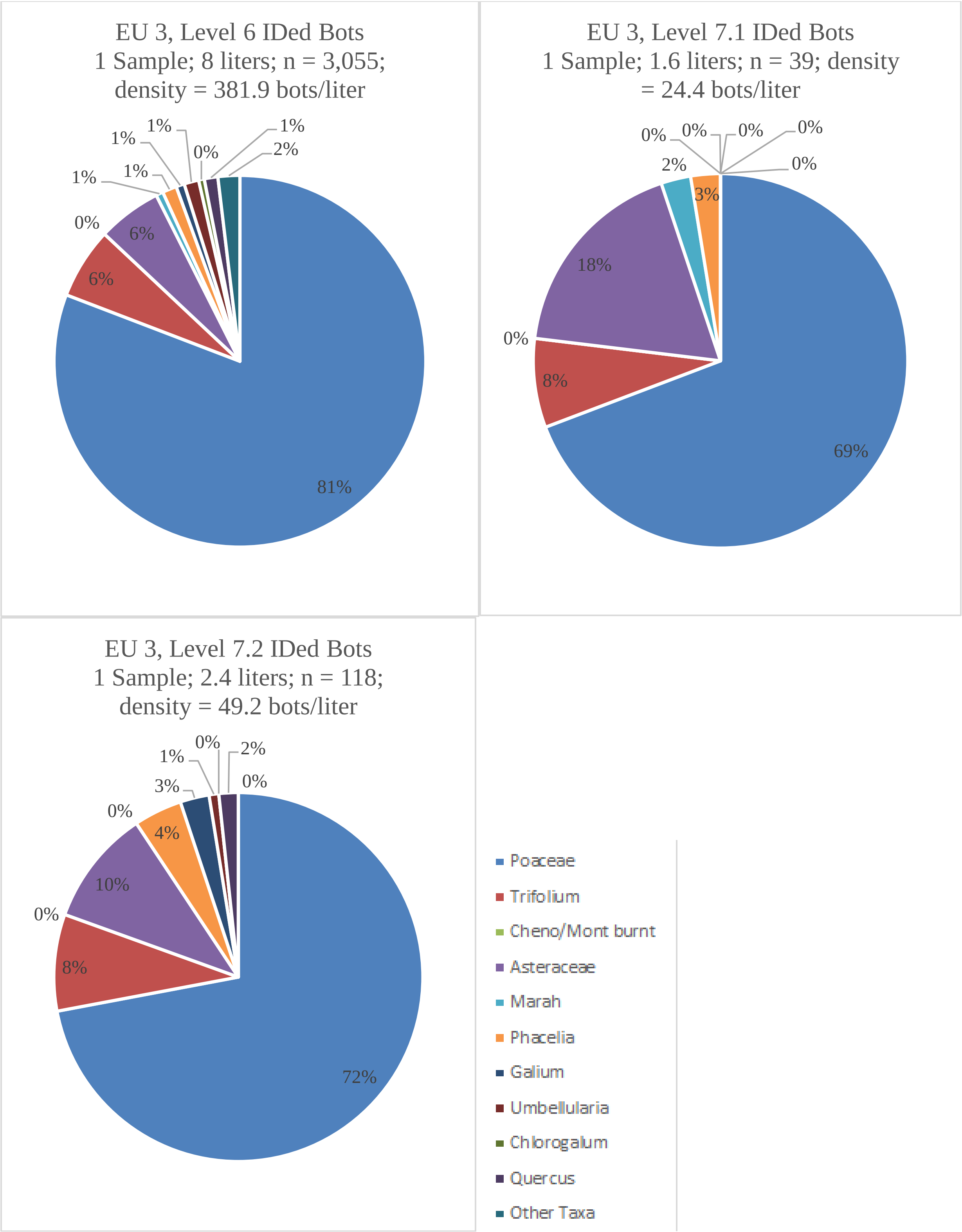


EU 3, Level 2 IDed Bots
1 Sample; 10.5 liters; n = 335; density = 31.9 bots/liter

EU 3, Level 3 IDed Bots
1 Sample; 8 liters; n = 323; density = 40.3 bots/liter

EU 3, Level 4 IDed Bots
1 Sample; 8.5 liters; n = 2,099; density = 246.9 bots/liter

EU 3, Level 5 IDed Bots
1 Sample; 8 liters; n = 4,100; density = 512.5 bots/liter

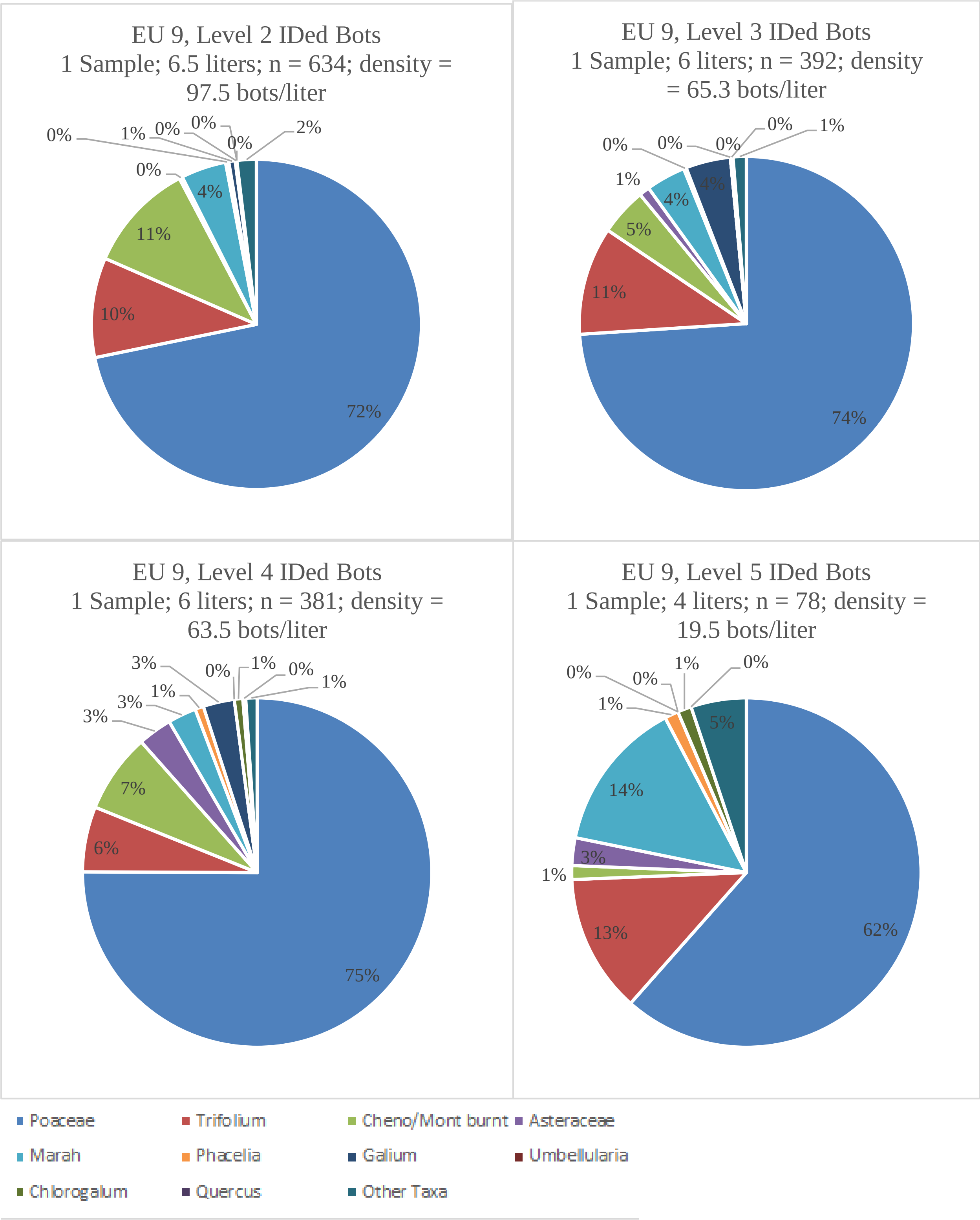


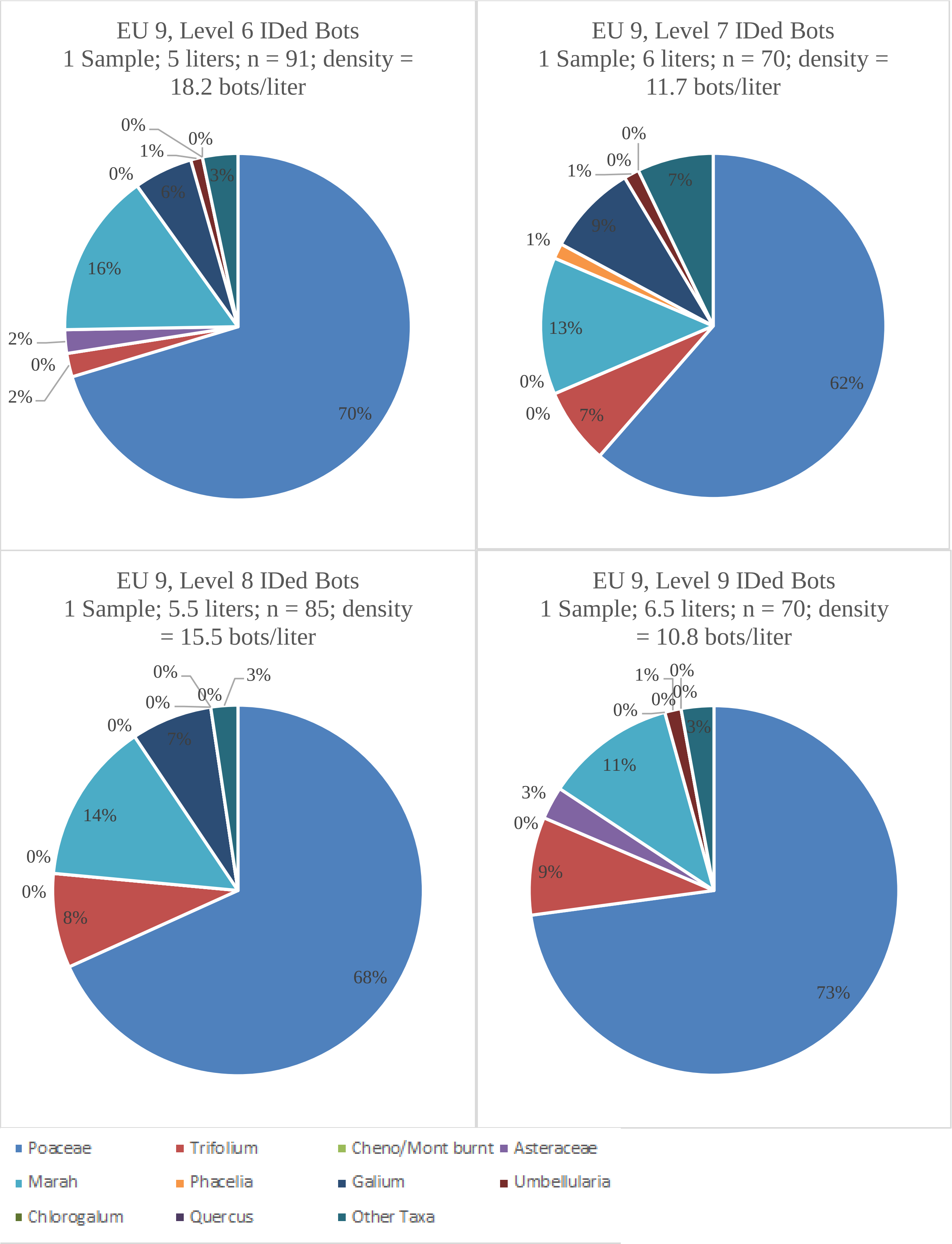
EU 9 represents non-discrete, generalized midden deposits, but there are differences in the top ten most common taxa between the levels that may indicate the presence of subtle stratigraphic changes that were not observed during excavation, because of bioturbation, narrow dimensions of the unit, and other factors. Between levels 2 through 4, the average percentage for manroot (*Marah*) is approximately 3.6% (see figure 6.12). This percentage increases to approximately 12.6% in levels 5 through 10, and increases again in levels 11 through 13 to an average of approximately 31.8%. Inversely, there is a change in the proportion of Goosefoot family plants (*Chenopodium*/*Montiaceae*) and phacelia (*Phacelia*), which had higher average percentages in levels 2 through 5 (6% and 0.7 % respectively) than in levels 6 through 13 (0.7% and 0.2% respectively).

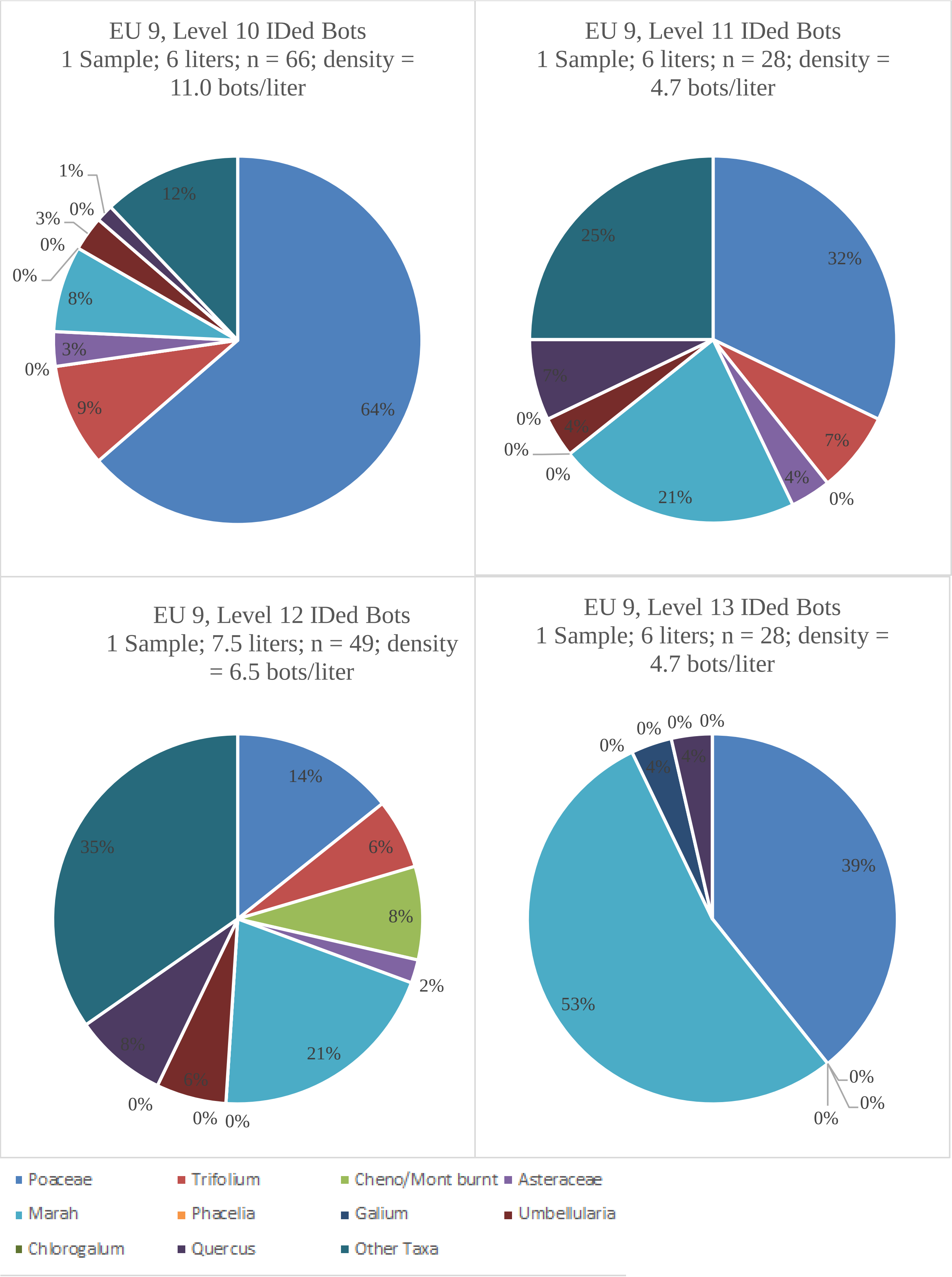
In levels 2 through 10, the average percentage of grass family plants (*Poaceae*) is approximately 68.8% (see figure 6.12). This high proportion of grass family plants (*Poaceae*) is significantly reduced in levels 11 through 13 to an average of approximately 28.6%. The category of "other taxa" also changes in level 10 through 13. The proportion changes from an average of approximately 3.1% in levels 2 through 9 to approximately 12.1% of the total plant taxa in level 10. This proportion increases again to 25.0% in level 11 and again to 34.7% in level 12, though there are no other reported taxa in level 13.

Levels 11 to 13 are the oldest deposits of the site based on radiocarbon dates of marine shell that place these levels at circa 6,000-8,000 years Cal BP (see Appendix B). The inversely related changes in the proportions of manroot (*Marah*) and grass family plants (*Poaceae*) at about level 10 of EU 9 may represent an ecological change in the Tolay Valley or a change in the intensity of collecting grass family resources. The samples collected from levels above level 11 (no date for level 10) are much younger (level 7 is circa 1680 years cal BP) than the oldest component of the site. The samples from the last three or four levels of EU 9 also produced very few seeds, which may also account for such drastic changes in the proportions of plant taxa in these levels rather than a change in the ecology or people's usage of the valley. At this age and depth within the site, the preservation may not be as good as the other more recent components of the site. Despite these drawbacks from poor preservation, these data are still very valuable, because they are among some of the oldest paleoethnobotanical materials recovered from a midden site in Central California at the time this project was carried out.

Figure 6.12. Pie charts illustrating differences in the proportional abundance of the top ten identified taxa between each level within EU 9.

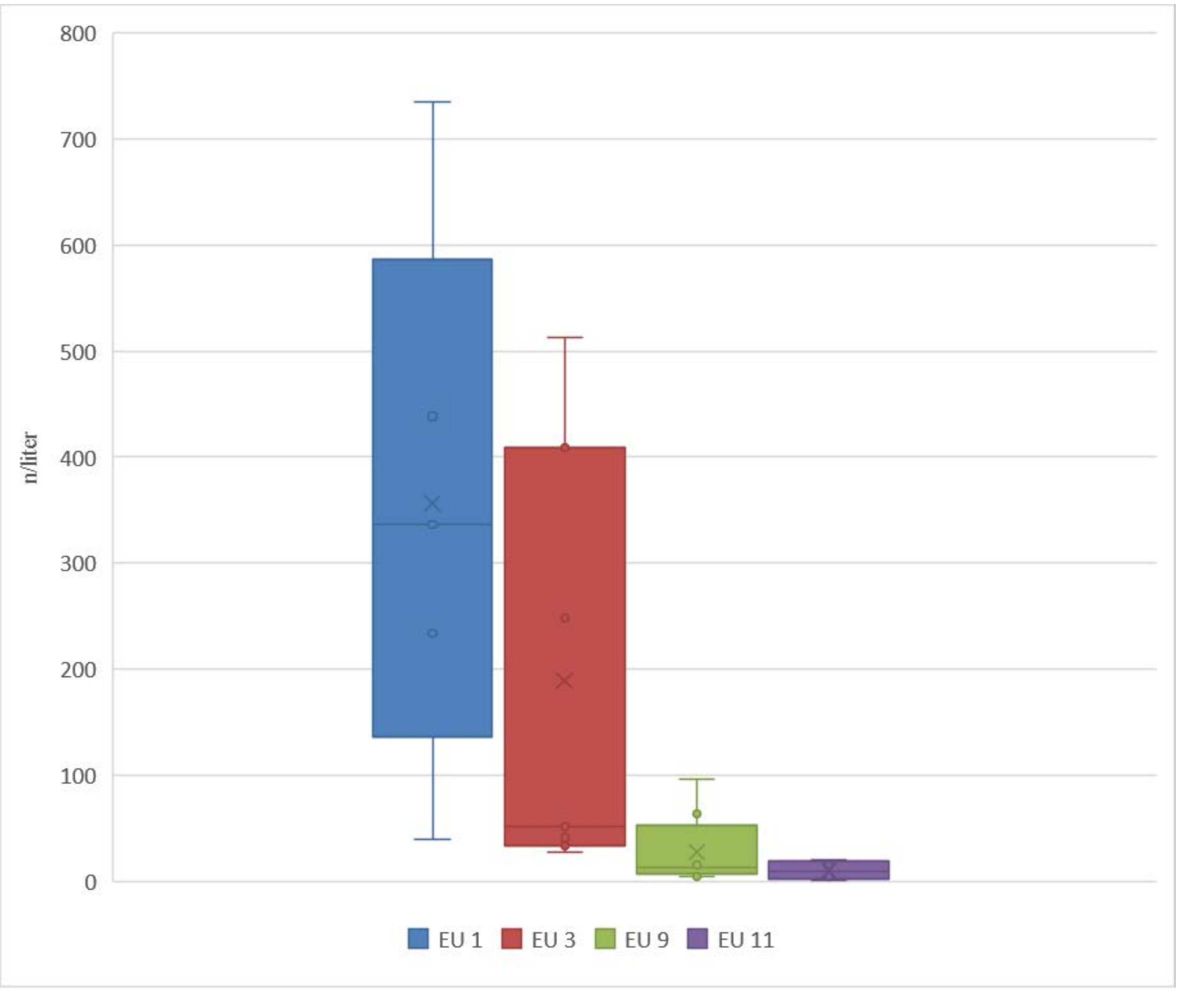



EU 9, Level 6 IDed Bots
1 Sample; 5 liters; n = 91; density = 18.2 bots/liter
0%
0%
1%
0%
3%
6%
16%
2%
0%
2%
70%
EU 9, Level 7 IDed Bots
1 Sample; 6 liters; n = 70; density = 11.7 bots/liter
0%
0%
1%
7%
9%
1%
13%
0%
0%
7%
62%
EU 9, Level 8 IDed Bots
1 Sample; 5.5 liters; n = 85; density = 15.5 bots/liter
0%
3%
0%
0%
0%
7%
14%
0%
0%
8%
68%
EU 9, Level 9 IDed Bots
1 Sample; 6.5 liters; n = 70; density = 10.8 bots/liter
1%
0%
0%
0%
0%
3%
11%
3%
0%
9%
73%
Poaceae
Trifolium
Cheno/Mont burnt
Asteraceae
Marah
Phacelia
Galium
Umbellularia
Chlorogalum
Quercus
Other Taxa


EU 9, Level 10 IDed Bots
1 Sample; 6 liters; n = 66; density = 11.0 bots/liter
1%
0%
3%
0%
0%
12%
8%
3%
0%
9%
64%
EU 9, Level 11 IDed Bots
1 Sample; 6 liters; n = 28; density = 4.7 bots/liter
25%
32%
7%
0%
4%
0%
0%
7%
4%
21%
0%
EU 9, Level 12 IDed Bots
1 Sample; 7.5 liters; n = 49; density = 6.5 bots/liter
14%
35%
6%
8%
2%
21%
8%
6%
0%
0%
0%
EU 9, Level 13 IDed Bots
1 Sample; 6 liters; n = 28; density = 4.7 bots/liter
0%
0%
0%
0%
4%
4%
39%
53%
0%
0%
0%
Poaceae
Trifolium
Cheno/Mont burnt
Asteraceae
Marah
Phacelia
Galium
Umbellularia
Chlorogalum
Quercus
Other Taxa

When EU 3 and EU 9 are compared (see figures 6.11 and 6.12), there are a few differences between the two units overall. The greatest difference between these two units is that the density of seed plants is much higher in EU 3 (219.9 bots/liter) than EU 9 (27.5 bots/liter). In EU 3, there are also very low percentages of manroot (*Marah*), and the average for all levels analyzed within this unit combined is 0.9%. Level 3 of EU 3 has the highest percentage in a single level, which is 7.4% and seems to be an outlier compared to the other levels that do not exceed 2.6%. EU 9, on the other hand, had much higher percentages of manroot (*Marah*). In all levels of EU 9 combined, the percentage of manroot (*Marah*) is 7.5% with as much as 21.4% in level 11 and as much as 53.6% in level 13. Manroot (*Marah*) was present in every level of EU 9, and the lowest percentage was 2.6% in level 4. EU 3 also has a higher proportion of grass family plants (*Poaceae*), an average of approximately 78.8%, than EU 9, which has an average of approximately 69.2%. The average proportions of the other eight top taxa only differ by a few percentage points.

Figure 6.13. Macrobotanical seed densities by unit. This box plot includes all identified and unidentified seed taxa from each EU.



Summary

Overall, the botanical data indicate that people living at TAP-39 were relying heavily on grassland resources throughout most temporal components of the site, which span thousands of years. If grasslands are not maintained, they will naturally be succeeded by shrubland, then by woodlands, and finally by dense forest vegetation types. In order to keep these grasslands open, Coast Miwok people would have actively managed this area with fire, burning the hillsides of the valley. Though this was not observed in the ethnohistoric record in the Tolay Valley, there is good precedent for it, because Father Jose Altimira who travelled through the Tolay Valley noted that the grass on the hillsides in the northeastern portion of the Sonoma Valley (just to the east of Tolay) "…had been burnt by the Indians of the neighborhood" (Altimira 1860:61). Burning was also employed elsewhere in California to achieve stable, open, and productive environments (M. K. Anderson 2005b; Blackburn and Anderson 1993; Cuthrell 2013b; Lightfoot, Cuthrell, et al. 2013; Lightfoot and Parrish 2009) Thus, active indigenous land management has been and should continue to be an integral component of the ecology of the Tolay Valley.

Other Considerations: Historic Botanical Materials

As was discussed in chapter 4, historic materials (glass, ceramics, metal, etc.) were present in EU's 1, 3, 9, and 11. The AMS (Accelerated Mass Spectrometry) radiocarbon dates (see Appendix B) from charred botanicals in the excavation levels containing these historic materials have a broad range of several hundreds of years. That is to say, there are no discrete post-contact or Historic Period contexts from which to sample historic paleoethnobotanical materials. Despite this lack of resolution in the radiocarbon dates and the ambiguity it presents for an interpretation of "historic" botanicals within the paleoethnobotanical dataset, there are a few clearly historic botanicals that merit further discussion. The presence of charred invasive species of plants in EUs 3 and 9, such as red-stemmed filaree (*Erodium*) and four non-native grain seeds demonstrate a modest historic component to the paleoethnobotanical assemblage. One of these non-native grains is domesticated barley (*Hordeum vulgare*). The other three non-native grains are most likely barley (*Hordeum vulgare*), but these seeds are too fragmentary to confirm a solid identification with high levels of confidence. Filaree (*Erodium*) is a weed plant that grew on or around the site, and this weed was most likely incorporated into the paleoethnobotanical assemblage incidentally. The barley grain seeds are domesticated food products that were most likely intentionally brought to the site from nearby ranches.

The exact timing of the introduction of invasive plant species in Central California is matter of some debate, but by the mid-1800's, invasive species were well established in the grasslands of Central Valley of California (Mensing and Byrne 1998:761). Settlers engaged in cattle ranching and agricultural activities for decades before the mid-1800's allowed invasive species to occasionally "escape" or had intentionally seeded hardy Eurasian grasses to support their livestock, producing expansive communities of these invasive species across the California landscape (Golovnin 1979; Kotzebue 1830; Lightfoot, et al. 1991; Wrangell and Kostromitonov 1974). Macrobotanical and pollen analyses of the mud bricks from adobe buildings also indicate that some of these invasive plants such as *Erodium cicutarium* were introduced and well established prior to the establishment of the Spanish missions in Alta California (Hendry 1931; Mensing and Byrne 1998).

Maria Copa Frias, a Coast Miwok women who was interviewed in 1932 by Isabel Kelly (1991:146), mentioned that the Spanish brought wheat, corn, and other plants that Coast Miwok people mixed with seeds from native plants in *pinole*. Maria Copa also mentioned specifically that *Avena* sp. or wild oats were also used for *pinole* (I. Kelly 1991:148). These sorts of seeds were processed and eaten in traditional cuisine by Coast Miwok and neighboring Pomo peoples from the early nineteenth century up to the modern day. Kashia Pomo people have a word for *Avena fatua* and *Avena sativa*, both invasive oats (Goodrich, et al. 1980), and similar *Avena* (either var. *fatua* or *barbata*) seeds are embedded in an early nineteenth century Kashia Pomo seed beater basket (item # 570-109) from the Kunstkamera Museum in Saint Petersburg, Russia (that I personally observed on a research trip to Russia in 2014). Lawrence Dawson of UC Berkeley's Anthropology department documented other instances of invasive seeds embedded in nineteenth century *walahin* baskets or parching trays from the greater Monterey/Carmel area (Dawson 1955-1992). More recently, Kathleen Smith (2014:42-43), a Coast Miwuk and Dry Creek Pomo artist and author, writes from her own experience that she and others in her family have bought raw grains from health food stores, toasted them on the stovetop, and ground them with a coffee grinder to make *pinole*.

In the 1830's and 1840's, Coast Miwok laborers working and living nearby the Petaluma Adobe to the north of the Tolay Valley made use of both domesticated and wild taxa of plants and animals (Silliman 2000, 2004). Though there are no historic accounts of where these laborers were going to gather wild resources during this time, a slightly later account is available from J. B. Lewis that describes California Indian subsistence provisioning regimens along the Petaluma River and in the Tolay Valley from the 1850's to the 1870's (Moorehead 1910:109). Lewis also suggests that these California Indians were from a tribe living near Petaluma who had suffered from a contagious disease some time before he had arrived, possibly indicating that these people were the California Indian laborers who had worked at the Petaluma Adobe and had lived through the smallpox epidemic of 1838 (Moorehead 1910). If this is correct, it could offer some potential options for interpreting the paucity of clearly historic (domesticated or invasive) botanical materials at TAP-39 in comparison to the Coast Miwok laborer site near the Petaluma Adobe. One option could have been that access to domesticated foods was limited, and these provisioning trips were necessary for Coast Miwok laborers of this time to procure enough food to survive. An alternative may be that the time spent away from the centers of colonial power (that is, the mission quadrangles, the rancho adobes, etc.) was when Coast Miwok people could more freely re-engage with and take refuge in Coast Miwok cultural practices, foods, and places (Panich and Schneider 2014; Schneider 2010, 2015).

Although willow (*Salix* sp.) and other similarly-sized sticks and roots of plants used for basketry would not have been burned and represented by the paleoethnobotanical dataset, it may be possible to infer that they were being collected in the Tolay Valley during the Historic Period. In order to process these materials in preparation for basket weaving, the outer bark is scraped off. The perfect tool for this is a small pocket knife (which is used by many weavers today) or a concave shaped scraper. Though the use of the historic aqua glass scraper (see figure 4.8.A.) found on the surface of TAP-39 cannot be definitely confirmed, the small size and concave shape of its knapped edges imply that this tool was used to scrape round or circular objects with a diameter of approximately 10 mm. It is possible that this scraper from TAP-39 was used to process these kinds of resources for basketry in the Historic Period, and these baskets could have been used to gather, process, and store a variety of foods.

Faunal Analysis Results

Methods of Faunal Analysis

The faunal materials from TAP-39 that were analyzed and are presented here were collected from surface contexts within blocks 14, 15, 20, and 21, and all Excavation Unit (EU) contexts during the 2013 and 2014 fieldwork during the Tolay Archaeology Project. All materials unless otherwise noted were dry screened through 1/8 inch mesh or sorted and separated in the lab from the > 4 mm and 2-4 mm size fractions of flotation samples. These materials were then delivered to Michael Stoyka and Whitney McClellan, faunal analysts of the Anthropological Studies Center at Sonoma State University, for a complete analysis. All materials were preliminarily checked for sensitive materials that may have been missed in field identifications before the preparation of faunal materials began. These sensitive materials were set aside separate from the rest of the faunal materials. Non-sensitive materials were gently washed in water and tools or modified bones were gently, dry brushed to remove soil residue.

The analysis of faunal materials included observations such as approximate animal size category, species class, taxa, bone element, bone sub element, segment of bone present, and siding. Taphonomic factors were also recorded including discoloration from burning, calcination, gnawing, weathering, butchering cuts, and other anthropogenic modifications. The categories and naming conventions for attributes listed in the faunal analysis derives from the Bone and Butchering Analysis System (BABAS) by Sherri Gust (1996). Gust’s (1996) system uses Ingles (1965) and Peterson (1990) as references for taxonomic identifications and Behrensmeyer (1978) as a reference for taphonomic identifications. A Number of Individual Specimens or NISP was recorded for each catalogue number or sub-catalogue “artifact” number (for individual groups or items that were unique from the greater lot or context that was given a single catalogue number).

General Characteristics of the Faunal Assemblage

There is a robust and diverse dataset of faunal materials from excavated and surface collected units at TAP-39. The Number of Identified Specimens or NISP for faunal materials at TAP-39 is 9,174 (see figure 6.14). The majority of these faunal materials are bird (44.9%) and indeterminate (39.0%). There are far fewer mammal (10.6%) and fish (5.3%) materials in the total faunal assemblage. A very small amount of amphibian (0.1%) and reptile (0.1%) were also identified. In the assemblage, there are 76 worked bones or tools. These include highly polished long bones of mostly mammal and some bird. There are also antler tine pressure flakers, pins or needles, awls, and incised ear tubes or adornment items.

Figure 6.14. Pie chart illustrating the differences in proportional abundance of all faunal classes (including indeterminate) present in all (surface collected and excavated) contexts at TAP-39. The total n = 9,174 faunal materials.

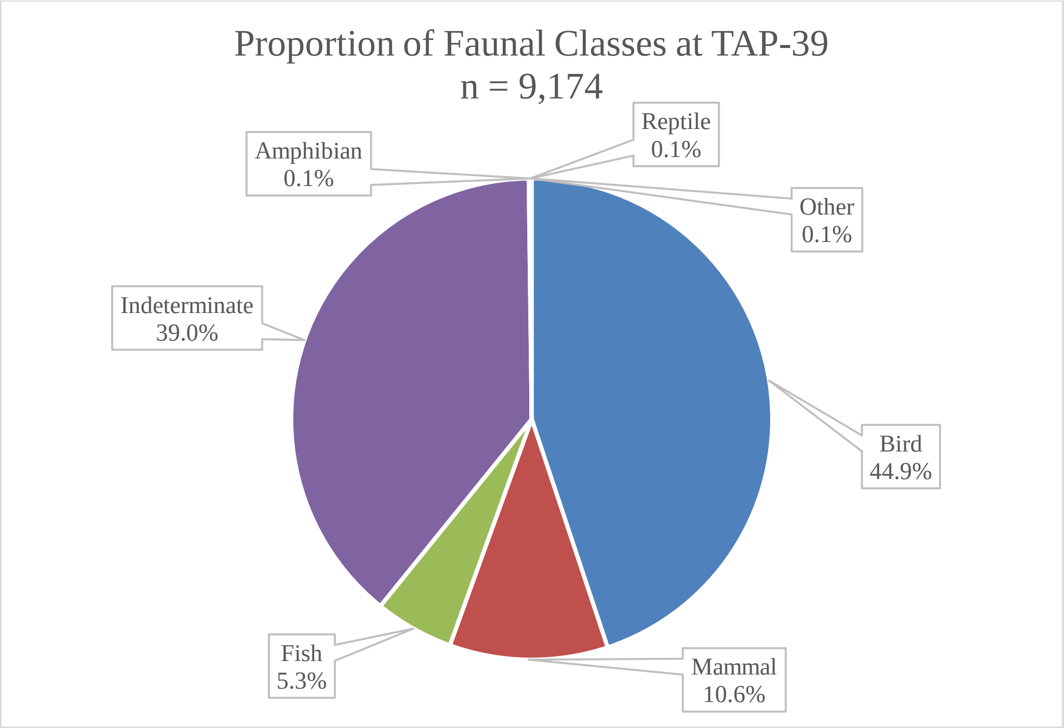


Table 6.2 summarizes all of the taxa of faunal materials identified below the class level. Only 450 items out of the total 9,174 items, approximately 4.9%, within the entire faunal assemblage were identifiable to a more specific level than taxonomic class. Of all the identifiable items to more specific levels than class, fish were most proportionally abundant, representing 60.2% of the assemblage. Mammals were also highly abundant, representing 35.8% of the identifiable assemblage. Birds and reptiles were not proportionally abundant, representing 3.1% and 0.9% of the identifiable assemblage respectively. The disparity between the high proportional abundance of indeterminate bird materials and extremely low proportional abundance of bird materials that could be identified more specifically than class may reflect the delicacy of bird bones, the amount of processing that these bones went through in food preparation, or taphonomic processes that resulted in these bones fragmenting at a higher rate than more robust mammal bones. Fish bones are also very fragile, but most of the identified items in the fish class are vertebrae which are small, compact and more robust than other bones in fish. The low proportional abundance of both reptiles and amphibians in the class and identifiable items to levels more specific than class indicate that these classes of animals were not a substantial food or tool source for people living at TAP-39.

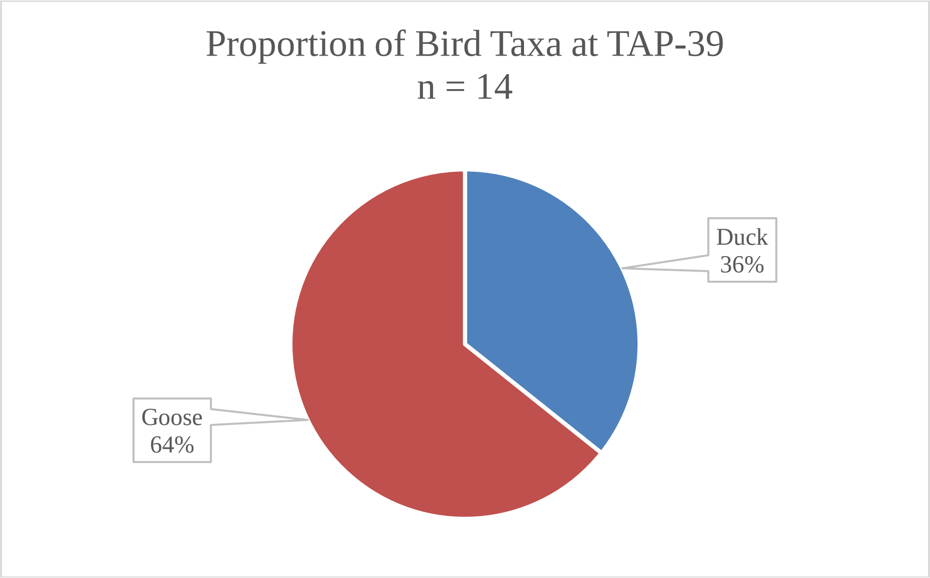
Table 6.2. Summary of identified faunal taxa from TAP-39.

Scientific Name	**Common Name**	**NISP**	**Percentage**
Birds:		14	3.1
Anas sp.	Duck	5	1.1
Anseridae sp.	Goose	9	2.0
Mammals:		161	35.8
Carnivora	Carnivore	1	0.2
Cervidae	Deer	33	7.3
Lepus californicus	Rabbit	3	0.7
Microtus californicus	Vole	7	1.6
Peromyscus truei	Mouse	1	0.2
Rodentia	Rodent	57	12.7
Scapanus latimanus	Mole	1	0.2
Thomomys	Gopher	58	12.9
Fish:		271	60.2
Acipenser transmontanus	Sturgeon	53	11.8
Brachyura	Crab	1	0.2
*Lavinia exilicauda**	Hitch*	204	45.3
Myliobatus californicus	Bat Ray	13	2.9
Reptiles:		4	0.9
Serpentes	Snake	4	0.9
TOTAL		450	100.0

*Though small minnow fish in this assemblage were identified by Stoyka as Sacramento Hitch (*Lavinia exilicauda*), an analysis conducted by Kenneth Gobalet on a small portion of these same samples revealed that these fish may in fact be Sacramento Splittail (*Pogonichthys macrolepidotus*).

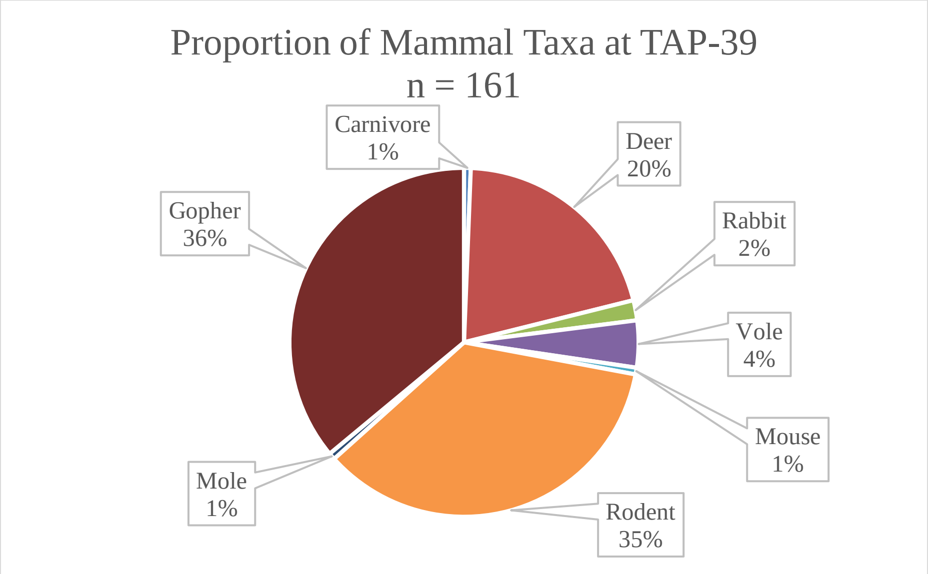
The most proportionally abundant class of faunal materials was bird, but only two types of birds were identified within this highly fragmented assemblage. The two types of birds in the assemblage are ducks (*Anas* sp.) and geese (*Anseridae* sp.), both waterfowl. The presence of waterfowl in the faunal assemblage is consistent with today's migratory birds found in the Tolay Valley. The location of the Tolay Valley within the Pacific Flyway make it a perfect place for waterfowl who could have taken refuge at the expansive mile-long Tolay Lake (Verheyen, et al. 2017:62).

Figure 6.15. Pie chart illustrating the differences in proportional abundance of bird taxa present in all (surface collected and excavated) contexts at TAP-39. The total n = 14 identified bird taxa.



At TAP-39, the most proportionally abundant mammal taxa are rodents (*Rodentia*), which include voles (*Microtus californicus*), pinyon mice (*Peromyscus truei*), indeterminate rodents (*Rodentia*), and gophers (*Thomomys*). All of these taxa of rodents (*Rodentia*) combined comprise a total of 76% of all mammals within the assemblage. Ruminants from the family *Cervidae*, most likely deer (*Odocoileus* sp.) in this assemblage, also comprise a large proportion (20%) of the mammals represented at TAP-39. Other mammals present but not proportionally abundant are jack rabbit (*Lepus californicus*), which comprise 2% of all mammals within the assemblage, moles (*Scapanus latimanus*), which comprise 1% of all mammals within the assemblage, and carnivores (*Carnivora*), which comprise 1% of all mammals within the assemblage.

Figure 6.16. Pie chart illustrating the differences in proportional abundance of mammal taxa present in all (surface collected and excavated) contexts at TAP-39. The total n = 161 identified mammal taxa.



The fishes present at TAP-39 are sturgeon (*Acipenser transmontanus*), crab (*Brachyura*), Sacramento hitch (*Lavinia exilicauda*), and Bat Ray (*Myliobatus californicus*). Sacramento hitch (*Lavinia exilicauda*)[4] are the most proportionally abundant taxa of fish, representing 75.3% of the fish assemblage. Sturgeon (*Acipenser transmontanus*) also have a moderate proportional abundance, representing 19.6% of the fish assemblage. Bat Ray (*Myliobatus californicus*) and crab (*Brachyura*) have low proportional abundances, representing 4.8% and 0.4% of the fish assemblage respectively.

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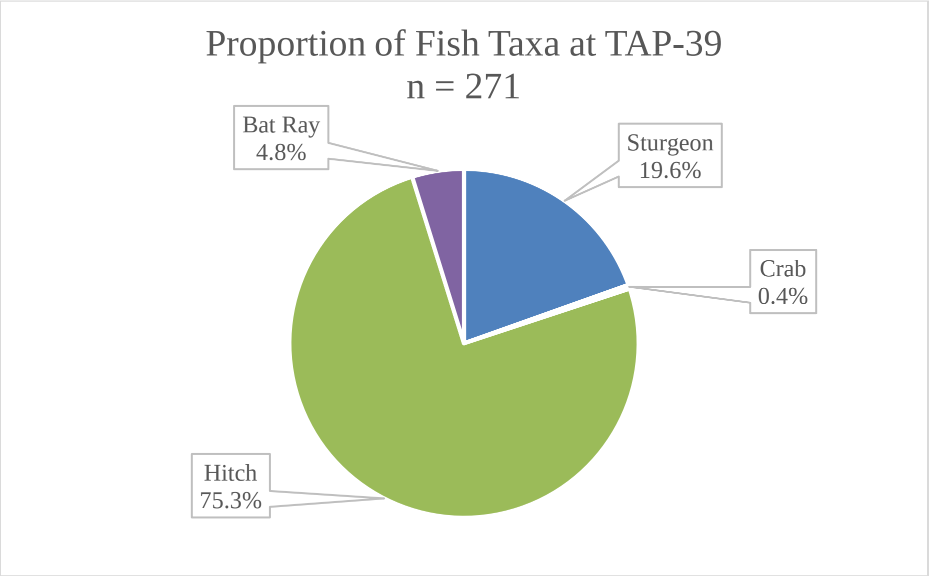
[4] On July 26, 2017, Kenneth Gobalet, who happened to be visiting the California Archaeology Lab at UC Berkeley, graciously analyzed the fish vertebrae from the 2-4 mm size fraction of flotation samples from EU 3 levels 5 and 6 and also reanalyzed all of the fish from dry screened materials in EU 1 levels 5 and 6. According to Gobalet, the fish identified as Sacramento Hitch (*Lavinia exilicauda*) should actually be identified as Sacramento Splittail (*Pogonichthys macrolepidotus*). The difference is that splittail fish have two rows of teeth on the pharyngeal element, whereas the hitch only has one row. The element in the faunal database from EU 3 levels 5 and 6 that is identified as *Lavinia exilicauda* "maxilla/teeth," according to Gobalet, is consistently misidentified and should actually be identified as a pharyngeal element. Hitch have teeth on their maxilla, whereas splittail do not, which might have contributed to why these pharyngeal elements were misidentified as the maxillae of hitch. The identification of these fish as splittail, which are much more resilient to salt and brackish water environments than hitch, also makes sense given the ecology of the Petaluma/Tolay area. The local rivers and sloughs that were home to these fish around the Tolay Valley were much more brackish than the fresh water systems further inland from San Pablo Bay. Additionally from the EU 3 level 5 flotation sample, the lower penultimate vertebra of one herring (*Clupea pallasii*) was identified. One *clupeidae* was also identified, which could be either sardine (*Sardinops sagax*) or herring (*Clupea pallasii*). All of the vertebrae from EU 3 level 6 were *cyprinidae* and most likely Sacramento Splittail (*Pogonichthys macrolepidotus*).

Figure 6.17. Pie chart illustrating the differences in proportional abundance of fish taxa present in all (surface collected and excavated) contexts at TAP-39. The total n = 271 identified fish taxa.



Maria Copa Frias and Tom Smith, two Coast Miwok people interviewed by Isabel Kelly (1991:139-143) in 1932, describe the fishing practices and preparation of these fishes as fresh or dried foods. Maria Copa Frias describes sturgeon being caught from the east shore near the mouth of a lagoon (slough) just north of Novato, which was the extensive wetland, sough and creek system that constituted the Petaluma River (I. Kelly 1991:66; 143; 226). The east shore of the Petaluma River near the mouth would be the side of the river closest to the Tolay Valley, most likely near the end of the hills near Sear’s Point. This information is significant, because it offers a much later account that corroborates earlier accounts by J. B. Lewis that Coast Miwok people fished for sturgeon somewhere in the vicinity of the Petaluma River or sloughs of San Pablo Bay to the west or south of the Tolay Valley (Moorehead 1910:109).

Faunal Results in the Historic Period at TAP-39 and Petaluma Adobe

Returning to the comparison between the Petaluma Adobe and TAP-39 assemblages, there are some key differences in the faunal materials represented at each site. While there are both wild collected/hunted animal taxa at sites near the Petaluma Adobe, there is an abundance of domesticated animal taxa at these sites. The TAP-39 assemblage presents a contrast to the Petaluma Adobe in that there is only one saw-cut lower limb bone from a cow (*Bos taurus*) that was found on the surface of TAP-39. In terms of wild collected/hunted resources, sturgeon (*Acipencer transmontanus*) and salmon (*Oncorhvnchus* sp.) are represented by only 3 dermal ossicles and 1 vertebra, respectively, in Silliman’s (2000:270, 288) Petaluma Adobe assemblage. Although it cannot be determined what proportion of the sturgeon (*Acipenser transmontanus*) at TAP-39 dates to the Historic Period (making a true comparison difficult), sturgeon (*Acipenser transmontanus*) is the most proportionally abundant large fish (20% of the identifiable assemblage) at TAP-39 overall.

This paucity of sturgeon (*Acipenser transmontanus*) at sites nearby the Petaluma Adobe is especially curious given that J. B. Lewis witnessed California Indian people in the 1850's travelling through his property from the north to fish on the east bank of the Petaluma River and travel back through the Tolay Valley (Moorehead 1910:109). One explanation for why sturgeon do not appear at the sites near the Petaluma Adobe may be that the preparation of filleting and drying sturgeon removed the parts of the fish that would have preserved. The fish could have also been eaten before returning. Hunting and fishing for wild game may have been important to California Indians in the Historic Period for a number of reasons. As was stated before, these trips down south to the Tolay Valley may have represented a time to shed European accoutrements and foods and a time to reconnect with indigenous practices, resources, and significant places or seek refuge outside of the shadow of colonial institutions (Panich and Schneider 2014; Schneider 2010, 2015). These trips may have also represented times of scarcity when there was little or no European/American foods available or no money to purchase European goods (Schneider 2010).

Conclusion

Though there is some variation in the proportions of plant and animal taxa across TAP-39, the assemblage of botanical and faunal materials indicate that the majority of resources used by the people living at this site were grassland resources. Grasses (*Poaceae*) and clover (*Trifolium*) are ubiquitous and very common throughout the contexts at TAP-39. In addition, the vast numbers of rodents (*Rodentia*) as opposed to deer (*Odocoileus*) or other mammals indicates that the habitat in the valley was an open grassland. Within the assemblage, only jack rabbits (*Lepus californicus*) are found at TAP-39 rather than brush rabbits (*Sylvilagus bachmani*). Jack rabbits (*Lepus californicus*) are adapted to open grasslands and prairies rather than the chaparral environments that provide cover for brush rabbits (*Sylvilagus bachmani*).

The persistence of great numbers of grassland/shrubland-adapted plants and animals in the Tolay Valley for over hundreds if not thousands of years in the eco-archaeological data indicate that these lands were routinely managed with controlled burns set by the Alaguali tribe of Coast Miwok people. Jose Altimira noted burned or blackened hillsides when he passed through the North Bay Area in 1823 which also corroborates this argument (Altimira 1860:61). In order to keep grasslands open and halt the encroachment of larger shrubs and trees, controlled burning or some other intensive land management strategy is necessary (Cuthrell 2013a, 2013b; Lightfoot, Cuthrell, et al. 2013; Lightfoot and Parrish 2009). Thus, there is substantial evidence that shows that Alaguali people actively and routinely managed the Tolay Valley in order to maintain it as an open and habitable landscape since time immemorial. The re-introduction of these traditional management practices will be crucial in future restoration efforts to enhance the indigenous plants and animals in the valley.

The botanical and faunal materials from TAP-39 also indicate that Coast Miwok people maintained connections to the Tolay Valley in historic times. There were a few non-native grains, most likely all barley (*Hordeum vulgare*), and invasive filaree weed plants (*Erodium*). There was also one saw-cut cow (*Bos taurus*) bone in the assemblage. Though there were few introduced taxa of botanical and faunal materials at TAP-39, these traces may indicate a connection between this site and others where California Indian laborers worked in the area. J. B.

Lewis's account of California Indian people from the Petaluma tribe travelling south across his property to hunt, fish, and gather native food resources before stopping at Tolay Lake for ceremonial purposes attests to these connections (Moorehead 1910:109). These trips may reflect Coast Miwok peoples' commitment to engaging with indigenous practices, resources, places of significance and/or a lack of enough European goods needed to survive while laboring on ranches. The paucity of sturgeon (*Acipenser transmontanus*) at the historic California Indian habitation sites near the Petaluma Adobe and the accounts from J. B. Lewis of California Indian people fishing for sturgeon before visiting the Tolay Valley may indicate that Coast Miwok laborers from the Petaluma Adobe acquired, processed, and brought these resources back with them when they left the Tolay Valley.

Chapter 7

A History of Tolay: Indigenous Refusal of Settler Colonialism in 19th Century Central California

Archaeological investigations of the historic period in the homelands of the Federated Indians of Graton Rancheria (i.e. Marin and Southern Sonoma Counties of California) have primarily focused on major colonial institutions and events such as the landing of Sir Francis Drake or daily activities within Spanish missions and Mexican ranchos. This Euro-centric focus devoid of discussions of "hinterland" sites has led to the overrepresentation of settler colonial narratives in which Indigenous people acculturate and/or disappear from the landscape. However, oral tribal knowledge, historic accounts, and renewed investigations of archaeological sites in the Tolay Valley show that Coast Miwok people innovatively navigated colonial politics and economics in order to provide for their families and maintain ties to Indigenous institutions, conventions, and places. In this chapter, I will discuss how (ab)use of Indigenous labor, alterations of major landforms and waterways for agriculture, introductions of Euro-American plants, animals and material culture, and acts of early amateur artifact collecting posed particular hardships for Coast Miwok people throughout the 19th Century. Despite these hardships necessitating great change in traditional lifeways, Coast Miwok people remained immersed in and connected to a broader Indigenous world in which colonial places and institutions were only one part. Coast Miwok peoples refused to wholly accept settler boundaries, ownership, and ways of using the Tolay Valley by trespassing on private property to hold ceremony and collect traditional resources. These actions are reflected in the material archaeological traces and historical accounts from the mid to late 1800's and attest to the continuity of these people and these traditional practices from pre-mission times (circa pre-1817) into the American Period (circa post-1850s). More recently, the persistence of Coast Miwok engagement with the Tolay Valley has been reaffirmed by a contemporary co-management agreement between the Federated Indians of Graton Rancheria and the Sonoma County Parks Department to preserve and develop this valley as protected parklands.

Introduction

By the 1870s, Coast Miwok peoples of California's Marin and Southern Sonoma Counties had experienced over half of a century of land dispossession, labor exploitation and violence through Spanish, Mexican, and early American settler colonialism. Settler claims to indigenous land, labor, and natural resources materialized in diverse ways throughout California's history, and each spatiotemporal context for these claims had implications for how indigenous people strategically navigated these situations (Gosden 2004; Wolfe 2013). Though settlers forced Coast Miwoks to change many aspects of their traditional lifeways, Coast Miwoks also had some amount of choice and agency in engaging with certain practices, places and things. Archaeologists studying Spanish missions and Mexican ranchos in California have found both change and persistence of indigenous practices evident in European-manufactured goods refashioned into indigenous tool forms and in the reoccupation of culturally significant places by California Indians as places of refuge (Panich and Schneider 2014; Schneider 2015; Silliman

2009). In these colonial contexts, change and persistence can be thought of as part of the same process rather than dichotomous and mutually exclusive categories of analysis (Silliman 2005:66; 2009).

It is exactly these paradoxes of change as persistence versus persistence as change that I would like to weigh in my analysis of responses to a catastrophe that reverberated throughout the Coast Miwok and Pomo world in the 1870s. This catastrophe involved the draining of Tolay Lake, a well-known Indian doctoring site that California Indians actively used up to the time it was drained. This lake was drained to increase the amount of land available for the agricultural exploits of a German-born, American settler named William Bihler. The waters of this lake contained the implements of doctoring practices called charmstones and the sicknesses from thousands of years of patients. When the water was released from the lake, so were the sicknesses released into the world. As a result, California Indians distanced themselves from this place until the mid- to late-twentieth century when Coast Miwok people revisited Tolay to silently monitor collections of artifacts from the Cardoza family. As the landowners at this time, they displayed artifacts collected from their property during their annual fall festivals. In the year 2006, the Sonoma County Regional Parks Department (SCRPD) purchased the property that encompasses a great deal of land in the Tolay Valley including the dry lakebed where Tolay Lake had formerly existed. The descendants of Coast Miwok and Southern Pomo peoples from this area, i.e. the Federated Indians of Graton Rancheria (FIGR), were involved early on in conversations with SCRPD, and helped finance the acquisition of this park. Since this acquisition, FIGR has been intimately involved in the planning, development, and restoration of Tolay as co-managed parkland. Tolay has a history that is still very much unfolding as is being written, and it is characterized by a continuity of Coast Miwok engagement with this significant place albeit shifting views on how to appropriately and safely engage with it after it was physically altered by settlers.

To understand the departure of Coast Miwok peoples from Tolay Lake when it was drained in the 1870s and the return of Coast Miwok peoples in efforts to revitalize this place after more than a century of separation from it merits a discussion of territoriality in the context of settler colonialism and indigenous refusals of settler claims to territory. This chapter will focus on settler colonialism, because the majority of the data and discussion will refer to the American Period in contrast to the Spanish and Mexican Periods. However, forms of colonialism other than settler colonialism will be discussed when talking about these earlier periods. In discussing the themes of change and persistence, territoriality, and refusal, I will present an analysis of historic and archaeological data from the Tolay Valley to illustrate how Coast Miwok people changed and adapted to cope with times of adversity while still maintaining and reaffirming their cultural identities and refusing to take on settler ideologies about land and how to engage with it.

Colonialism and Settler Colonialism in Central California, 1776-1873

Although the very first interactions between Europeans and Native Americans on the coast of California were short-term episodes of contact between peoples from very different cultures, subsequent incursions into California by Spanish, Mexican, Russian, American, and other foreign peoples are part of a long settler occupation of indigenous lands that continues into the present day. Many of the early studies in the archaeology of colonialism focused primarily on these first instances of culture contact rather than on long-term entanglements and have portrayed colonial histories as unidirectional acculturation of indigenous peoples into settler societies (Silliman 2009:59-62). More recently, archaeologists studying colonialism in North America have begun to recognize the long-term nature of these interactions between indigenous and non-indigenous peoples of the Americas and the unequal distribution of power and processes of racialization in these relationships that separate modern colonialism from other forms of cultural entanglement (Cusick 1998; Gosden 2004; Silliman 2005, 2009).

Developments in the archaeology of colonialism towards viewing these interactions as long-term entanglements is complementary to how scholars of settler colonial studies conceive of these structures. Stephen Silliman (Silliman 2005:62), an archaeologist studying colonialism in California and Connecticut, states that "Colonialism is not about an event but, rather about processes of cultural entanglement, whether voluntary or not, in a broader world economy and system of labor, religious conversion, exploitation, material value, settlement, and sometimes imperialism." This statement is complementary to how Patrick Wolfe (Wolfe 1999; 2006:390) conceives of settler colonialism as "a structure rather than an event."

Eve Tuck and Wayne Yang (Tuck and Yang 2012:5) further define the distinction between settler colonialism and other forms of colonialism in that "settlers come with the intention of making a new home on the land, a homemaking that insists on settler sovereignty over all things in their new domain." Settlers cement their claims to indigenous land and make a place their home by simultaneously removing indigenous peoples and exploiting chattel slave labor which establishes a triad of settler-native-slave (Tuck and Yang 2012:6). In many regions of North America, the entangled colonial triad of settler-native-slave is composed of mutually exclusive categories that are racially structured as white settlers, red/brown natives, and black slaves. However, in places such as California, Mexico, the U.S. Southwest and Canada, settlers used indigenous people as chattel slaves or cheap labor in the absence of another labor force (Neeganagwedgin 2012; Resendez 2016; Tuck and Yang 2012:6).

In California, Spanish colonialism through the process of missionization of indigenous peoples focused on conversion of indigenous peoples to Christianity and the exploitation of these converts. Even though there was population decline and poor conditions for California Indians in the Missions, "…without Indians alive, working, and undergoing a process of civilization, the conquest had lost its object and could even be deemed a failure. In this regard, the views of California missionaries and those elsewhere in the Spanish Borderlands differed sharply from those of contemporary Anglo-Americans during and after the colonial period" (Hackel 2005:122). Drawing on records spanning the entire Spanish Period in Central California between the establishment of the first mission in the San Francisco Bay Area in 1776 and the secularization of the missions when Mexico received its independence from Spain in 1834, Spanish missionaries baptized 2,828 Coast Miwok people, most of whom were moved to mission quadrangles to perform labor (Milliken 2009:5). This removal left much of Marin and Southern Sonoma Counties depopulated except for small groups who managed to escape the clutches of the mission fathers or individuals who received permission to leave the missions (Milliken 2009).

After Mexico gained its independence from Spain in 1821 and secularized the missions in 1834, religious conversions of the indigenous population were deemphasized and the exploitation of California Indian labor became a primary facet supporting Mexican economic activities in California. Secularization also brought about claims to “surplus” mission lands that were originally promised to California Indians, and millions of acres of land grants were awarded to Mexican citizens (Hackel 2005:388). To support the seizure of land and to ensure a constant supply of laborers for ranching operations, military leaders such as Mariano Vallejo executed slave raiding operations which often involved separating children from parents and men from women. These acts hindered biological reproduction and the transfer of cultural knowledge from one generation to the next and contributed to the genocide of California Indians (Madley 2016:63). Though the Spanish and Mexicans in California had very different priorities than American settlers after the United States annexed California as a state in 1846, the structures and policies of these early periods set precedents for American settler colonialism and interactions with California Indians.

Hixon (2013:1) states that “American history is the most sweeping, most violent, and most significant example of settler colonialism in world history.” The early American Period in California from 1846 to 1873 was one of the most harrowing examples of this history of violence. Vagrancy laws maintained California Indian peonage to land-owning settlers who exploited their unfair or unfree labor, and state funded militia participated in “expeditions against the Indians” that directly contributed to increased violence towards California Indians and declines in the California Indian population (Johnston-Dodds 2002; Madley 2016). Recent scholarship shows that individual acts of violence as well as California State and United States Federal governmental policies impacting the livelihood of California Indians during this period were acts of genocide (Field 1993; Lindsay 2012) that also satisfy the criteria for being classified as genocide as it is defined by the United Nations Convention on the Prevention and Punishment of the Crime of Genocide Geneva Convention’s definition for genocide (Madley 2016). Governmental policy making in California’s early legislature also denied California Indians the right to reservation lands afforded to most other tribes in the United States by convincing the federal government not to ratify the 18 treaties with California Indian tribes due to the perceived future conflicts these rights to land would bring about between miners and California Indians. Thus, American settlers, much more so than Spanish or Mexican settlers before them, focused their efforts on removing and exterminating California Indians, even though they were at times needed for labor.

Territoriality, Hinterlands, and Refusal of Settler Conceptions of Space

Applied to the early American Period of California (circa 1846-1873), settler colonialism is particularly apt for describing the structural backdrop for interactions between California Indians and non-indigenous settlers. As Patrick Wolfe (2006:387-388) notes, settler colonialism is not invariably genocidal but it is inherently eliminatory, the primary motive for which “…is not race (or religion, ethnicity, grade of civilization, etc.) but access to territory. Territoriality is settler colonialism’s specific, irreducible element.” What changes when scholars consider that territoriality or access to the territory of indigenous peoples, not labor, violence, racism, and genocide are settler colonialism’s defining characteristics? And how does the analysis of these histories change when scholars take into account how indigenous peoples conceive of the broader landscape of their homeland rather than how colonialism draws this territory on a map?

Recent contributions to the archaeology of colonialism have reoriented the focus of investigation from colonial centers to the areas beyond colonial influence to investigate how indigenous peoples used hinterland sites such as refuge sites, villages, hunting and gathering areas, ancient sites, and other meaningful places “to navigate their own traditions and the colonial world thrust upon them” (Schneider 2015). This shift to studying sites in the hinterlands of colonial institutions is part of an effort to address the inadequacies in studies across the Spanish Borderlands and reconsider how borders, frontiers and homelands are defined and experienced (Lightfoot, et al. 1998; Panich and Schneider 2014; Silliman 2004, 2005, 2009). Many of these studies highlight indigenous agency and resistance despite hardship and coercive or oppressive colonial forces structuring indigenous peoples’ environments.

Tsim Schneider (2015:696) acknowledges that there are many forms of resistance to colonialism and these forms should not be understood simply as a colonial domination and gain versus indigenous resistance and loss. Failure to see other possibilities for indigenous responses to colonial encounters obfuscates human agency and hinders the ability of archaeologists to understand “some sites as places of ongoing commemoration and significance” (Schneider 2015:697). In his resistance-memory-refuge framework, Schneider (2015:697) reiterates the importance of places on the landscape where people do not visit or return to after long periods of “abandonment.” Certain places on the landscape such as Mount Tamalpais (N.B. *tamal pais* meaning Coast or West Mountain in the Marin dialect of Coast Miwok language) are places that Coast Miwok and other California Indian peoples approach cautiously or do not visit at all because they are sacred. Some of these places have stories and knowledge attached to them and serve as cosmological and ontological texts for local indigenous peoples that aid in structuring and making sense of the world (Sarris 2003). These are the places that boundaries cannot encapsulate, the intangibles that cannot be bought or sold, the persisting connections that refuse any other way of being in the world.

Indigenous places do not exist within or outside of a colonial center or a hinterland, and they are not crosscut by borders that limit their potency; they exist instead of these colonial constructs. “Existing instead of” is a refusal to acknowledge—or rather a counter-refusal of—terra-nullius and settler understandings and ways of being in the world. This is not to say that the act of refusing wishes away the settler’s stone walls and physically bounded space or violent reprisals for not adhering to settler constraints on indigenous lifeways. There are serious material implications for refusing settler claims, but indigenous people refuse them all the same because refusal is generative and makes space for indigenous futurity in which decolonization or the return of stolen land is physically possible and is not only a metaphor (Tuck and Yang 2012). Indigenous refusals do not acquiesce to settler moves to innocence or concessions in exchange for land, because this would compromise the goal of decolonization.

In some cases, California Indians were coerced to resist settler violence as in the cases of Captain Jack and Modoc warriors opposing the United States Army and militia from California and Oregon in Northeast California in 1873 and Satiyomi opposition to Captains Salvador and Mariano Vallejo and Mexican soldiers in the Napa Valley in the 1830’s and 1840’s (Heizer

1953:229-231; Madley 2016:337). These acts, like the x-marks on the 18 unratified California treaties, were provocations to material aggression and responses to settler threats on the lives and sovereignty of California Indian tribes. In contrast to resistance whether forced or willful, however, refusals of affiliations, identities, and relationships stake "claims to the sociality that underlies all relationships, including political ones. In that sense…refusal [is] genealogically linked to resistance, but not…one and the same" (McGranahan 2016b:320). Refusal is generative, social and affiliative, and willful (McGranahan 2016b:322-323). Resistance overestimates the place of the state, whereas refusal "points to the presumptive falsity of contractual thinking" (Simpson 2016:330) and reconfigures social and political relations as an aspirational move toward change that is altogether configured differently (McGranahan 2016b:323).

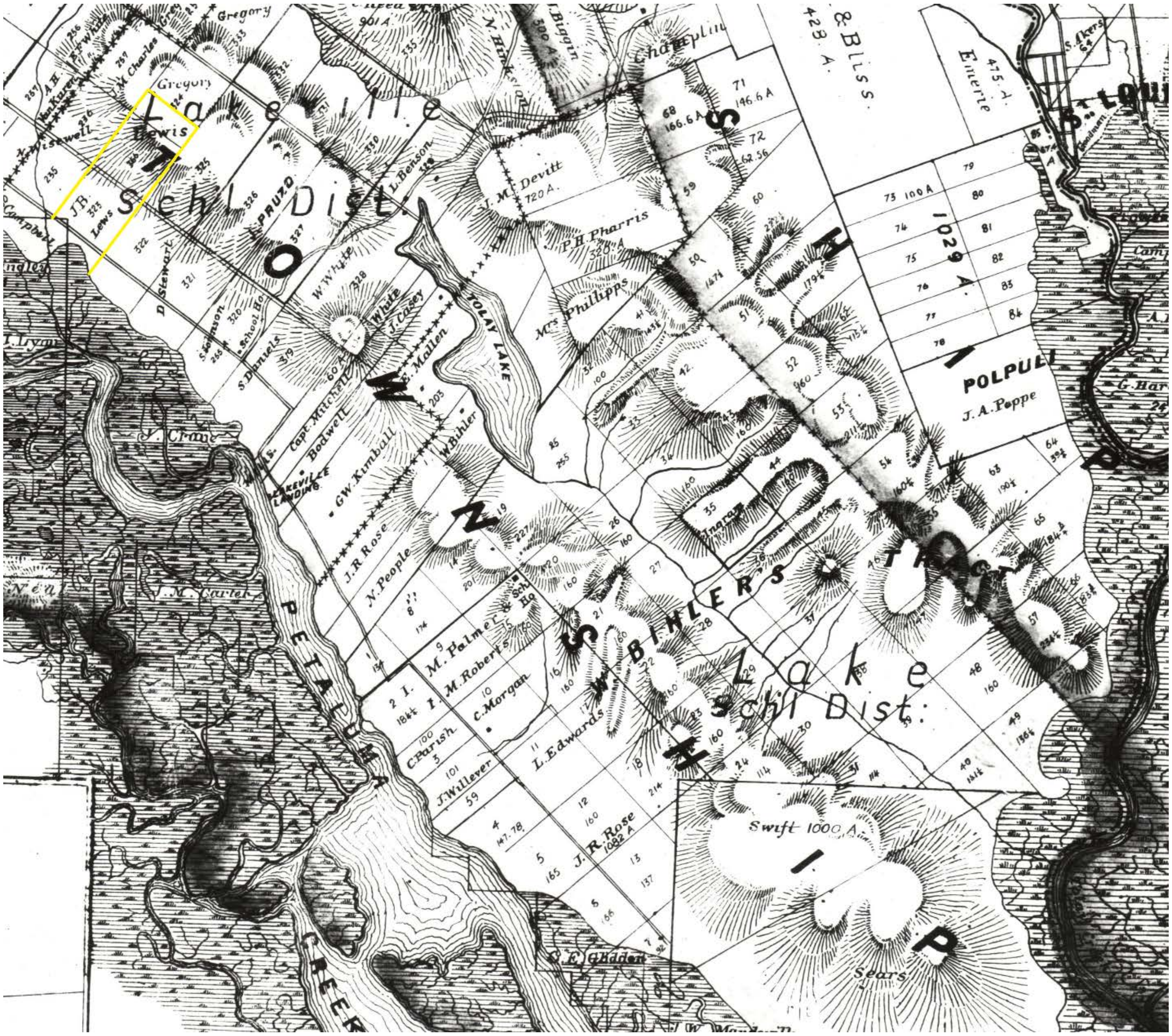
The Persistence of Indigenous Practices in the Tolay Valley

Tolay Lake is one in a chain of lakes that stretch from San Pablo Bay to Parson's Meadows above Santa Rosa. Each one of these lakes serves a specific ceremonial purpose for indigenous peoples of the region and has stories associated with them (Sarris 2011:3-4). Tolay Lake is the last lake in this series before reaching San Pablo Bay and its purpose was to retain the sicknesses that doctors extracted from their patients. The doctors used implements called charmstones that served as the receptacles for the sicknesses and needed to be drowned so that these sicknesses would not escape into the world. Charmstones were fashioned mainly from basalt, granite or steatite raw materials and made smooth by grinding them against harder rocks until they took one of a variety of forms, the most common being plummet or spindle shapes of about 10 to 20 cm in length (Elsasser and Rhode 1996).

No place in Central California has contained more charmstones than Tolay Lake. A total of nearly 2,000 from the lake are known to be housed in the private collections of the Cardoza family and in the public collections of the Smithsonian Institution's National Museum of Natural History and the National Museum of the American Indian, the Pheobe A. Hearst Museum of Anthropology at UC Berkeley, and the California Academy of Sciences in San Francisco. Many more charmstones have also been collected from the lake by visitors to the valley, and Cherney (Cherney 1984:75) estimates that there may have been as many as 15,000 charmstones removed from Tolay since the nineteenth century.

Despite the removal of Coast Miwok peoples from their traditional homelands including the Tolay Valley by 1822, many Coast Miwoks among other California Indian people, were brought back out into Sonoma and Marin Counties to provide labor for Mexican Ranchos (Milliken 2009; Silliman 2004). One such rancho was Mariano Vallejo's Rancho Petaluma which was established in 1834 and encompassed 66,600 acres of land including the entirety of the Tolay Valley. The reasons why California Indian people participated in ranch labor were often complex and varied involving one or more of the following: 1. the passage of laws that required Native people to perform labor; 2. indebtedness of Native people to landowners; 3. the use of force and violence against Native people to make them work; 4. labor assistance in exchange for military protection; and 5. opportunities for trade and social interactions facilitated by labor (Silliman 2004:28-30). Considering that opportunities for social interactions were in some cases facilitated by labor, some former mission Indians may have volunteered to work on Vallejo's rancho because it offered Coast Miwoks who had a connection to that place or were living in the valley before missionization a chance to reconnect with Tolay as a place of refuge from their lives of labor on missions or other ranchos. This situation is especially likely given that by 1834, the original inhabitants of the Tolay Valley had only been separated from Tolay for a maximum of 23 years if they were among the first from this valley to be baptized in 1811 or a minimum of 16 years if they were among the very last to be baptized in 1818. Some Coast Miwoks may have even received permission to visit Tolay while still laboring in the missions between 1811 and 1834.

Figure 7.1. Section from A. B. Bower's Map of Sonoma County, California, circa 1867, showing the Tolay Valley. Tolay Lake is still a major land feature in the Tolay Valley at this time. American settler property lines are visible, and J. B. Lewis's Property is outlined in yellow.



Attesting to the continuity of Coast Miwok connections to Tolay in the mid- to late-1800's, J. B. Lewis, an American settler who lived just to the Northwest of the Tolay Valley observed:

> "When I came here in the early [eighteen] fifties, there used [to be] large numbers of Indians [that would] go by my ranch in the fall, down to the creek to catch sturgeon and dry them, and they always went back by the way of the lagoon and stayed a day or two and had some kind of a pow-wow. After the lagoon was drained, they never came back." Mr. Lewis, on arrival in California, heard that a numerous tribe living near Petaluma was practically exterminated by some contagious disease. He believed that the Indians returning annually to hold ceremonies at the lagoon belonged to this tribe." (Moorehead 1910:109)

Considering Lewis's observations in the 1850's, oral tribal knowledge about practices associated with Tolay Lake, and Catherine Bell's (1992:89) concept of ritualization as a practice that differentiates itself from other practices, Tolay can be considered a ritualized landscape and the activities that Lewis describes as a "powwow" can be considered ritualized, sacred, or ceremonial practices. The practice of holding a "powwow" or ceremony at the lake is differentiated from other subsistence practices within Lewis's own description of going to the lake to "stay," a place with charmstones and "never any fish" (J. B. Lewis 1900:3), as opposed to the activity of going to acquire fish and other resources elsewhere in the valley and bringing them back out of the valley without staying.

Lewis's statements also imply that the regimes of Coast Miwok subsistence procurement that ranged through his property to either the Petaluma River or to San Pablo Bay for sturgeon and other resources in the surrounding landscape as well as ritualized activities at Tolay Lake were routine and seasonal (i.e. taking place throughout the 1850's and 1860's during the fall). Even if these Coast Miwok people only stayed in the Tolay Valley for short periods of time, the routine nature of their activities would produce material traces. These traces have been identified at two sites in the valley, one at the north end of the valley (TAP-41) investigated by George Phebus (1965, 1990a) in the 1960's and the other in the south end of the valley (TAP-39) investigated by myself in 2013 and 2014.

Archaeological materials at both TAP-41 and TAP-39 sites include pre-contact and postcontact materials such as midden soils, fire cracked rock, lithic debitage, faunal bone, shellfish, charred botanicals, metal nails, ceramics, and bottle glass. While many of the artifacts cannot be dated with precision to exclusively either the Spanish Period from 1776 to 1821, the Mexican Period from 1821 to 1846, or the American Period from 1846 to the 1920's, there are a few notable objects that offer clues about a more precise range within one of these periods or a sense for Coast Miwok use of these sites generally speaking throughout these periods, circa 1776 to the 1920's. One such object at TAP-41 is a fragment of shell-edged earthenware with blue painting that dates to between the 1840's and the 1860's. Phebus (1965) also reported that some historic artifacts from this site were found in situ in excavated contexts within midden of TAP-41 which led him to believe that this was evidence for California Indian use and occupation of the site in historic times.

The historic occupation at the southern site, TAP-39, seems to date a little later into the American Period than TAP-41. There is a champagne finish and neck of a mouth blown bottle collected on the surface of this site that dates somewhere between 1880 and 1920 (figure 4.8. D). Also, a surface-collected, liquor bottle base with an emblem produced by the San Francisco &

Pacific Glass Works dates to between 1876 and 1902. California Indian use of this site in historic times is suggested by a piece of aqua glass reworked into a scraper with three concave working surfaces similar to those for scraping the bark off of long, narrow sticks of willow or dogbane for basket weaving or cordage (figure 4.8. A). Another flaked glass object found at the site was a brown glass, bottle bottom reworked into a burin etcher or perforator tool (figure 4.8. C). Unfortunately, these two flaked glass objects do not have any chronologically diagnostic markings. TAP-39 also contained a concentration of machine-cut nails and flat glass in the northwest portion of the site that seem to indicate some kind of a structure probably without a subsurface foundation as geophysics and excavation did not identify traces of any such historic features. The presence of flaked glass and what it suggests of other historic materials at TAP-39 including the possibility of a building or structure is that Coast Miwok people used at least some of these new European-manufactured goods for traditional purposes and reaffirmed their connections to places of significance and refuge as well as actively supplemented their diets, toolsets, and lives with indigenous resources from the valley and beyond as their ancestors had since time immemorial.

Boundaries, Persistence, and Refusal

In order to claim territory, demarcate property and control cattle, Euro-American settlers erected physical stone fence lines throughout Marin and Sonoma Counties and in so doing refused to acknowledge indigenous spaces and places. Later examples (after circa 1880's) of these walls were probably built by Chinese laborers (Chan 1986:242), but many of the earlier walls like those on Tomales Point (Wing, et al. 2015) and possibly some in the Tolay Valley (E. T. Jones 2009) were constructed by California Indian people though not directly attributed to the labor of any particular group in the archaeological assessment reports. A number of stone walls still meander across the hills of the Tolay Valley demarcating space that matches property lines on historic maps from 1867, 1877, and 1898 (Bowers 1867; Reynolds & Proctor 1898; Thos. H. Thompson & Co. 1877).

But Coast Miwok people refused to acknowledge these physical colonial boundaries that kept them from engaging with the Tolay Valley as a place of significance and place of refuge. Even despite risks such as enslavement and hard labor if caught "idle" on the lands claimed by Euro-American settlers as defined in the vagrant laws in the 1860s, California Indians would have risked life and limb to persist in their homelands and physical violence and enslavement were not always enough to stop indigenous people from engaging with their territory. This is not to say that California Indian people were borderless or had no sense of boundaries. Indigenous borders were the ones that were meaningful to Coast Miwoks and settler borders were not. Refusing settler control and use of space by hopping a fence or two reaffirmed that Coast Miwok territory was Coast Miwok territory even if settlers grew grapes on the hillsides, herded cattle in the valleys, built houses, barns, and distilleries on sacred sites all in the self-interest of their own settler claims and gains. Refusing to see settler boundaries within Coast Miwok territory then and now keeps the possibilities open for a greater futurity for Coast Miwok people and Tolay.

Catastrophic Change and Refusal: An Indigenous Reworking of Relationships to Tolay

Returning to J. B. Lewis's observations of Coast Miwok people's engagement with Tolay Lake during the mid-nineteenth century, he notes that "After the lagoon was drained, they never came back" (Moorehead 1910:109). When did this event occur and what did it mean for California Indians as well as settlers in this area? In the mid-nineteenth century, the land within the Tolay Valley was sold to William Bihler. Bihler used the land to raise horses and grow potatoes, grapes and other crops. Like Vallejo before him, Bihler probably also used California Indians as seasonal laborers in addition to a few Chinese laborers who are recorded in census records and newspaper articles as working in his household and in his fields (Daily Alta California 1884; United States Federal Census 1860, 1870).

William Bihler was also responsible for removing a barrier at the southern end of the Tolay Lake and expelling all of its waters down the valley to San Pablo Bay. Bihler drained the lake in order to expand the amount of land available in the valley bottom for agriculture and viticulture. According to the superintendent of the property, this event took place in 1870 (Elsasser 1955:30; Meredith 1900:282; Thompson 1877:52). Even though the lake was drained in 1870, it is still represented on maps of Sonoma County as a body of water until 1898 when it is shown as a wetlands (Bowers 1867; Reynolds & Proctor 1898; Thos. H. Thompson & Co. 1877). The maps may have lagged in updating the image of a drained lake because later surveyors may have used the maps of previous surveyors as references for their updated renderings. Or perhaps another explanation is that Tolay Lake filled with water seasonally until the Creek was channelized in the early 1900s as is seen on the 1914 USGS 15 minute map (USGS 1914).

Regardless of whether there was some portion of the lake left filling and drying up seasonally after 1870, the act of draining the lake was a catastrophic event for Coast Miwok and other California Indian people in the area. The water had protected people from all of the charmstones and sicknesses from thousands of years of doctoring, and when the lake was drained, these sicknesses were released into the world. On the surface the draining of Tolay looks like a zero sum game, a complete loss, a complete destruction, a conquest. But these understandings of this situation frame it as one of dominance and resistance where the resistance has failed. It is true that California Indian people were horrified by the denigration of such a sacred place. It is also true that the initial reaction to "never come back" to Tolay was an effort to preserve health and wellbeing in a potentially hazardous situation. But these reactions also understood the event of draining Tolay through indigenous ontology and being in the world that dictated that California Indians should physically distance themselves from Tolay and change how future generations of California Indians engage with this place. This did not mean that the place would be conceived of as off limits forever, but it did merit caution, distance and time before returning in contemporary times. Leaving Tolay was an instance of change as persistence where redefining the bounds of what was safe for California Indians was an act that sought to protect and preserve California Indian lives. Staying and persisting at Tolay would have brought negative changes to the health of those did not leave.

Temporary Native Absence and Chinese Labor at Tolay

For William Bihler, the refusal of Native American people to work in his fields meant a greater reliance on Chinese laborers who were coming to Napa and Sonoma Counties in much larger numbers in the 1870's from California's mines (Chan 1986; United States Federal Census 1850, 1860, 1870, 1880). Census records (see table 7.1) from this time show that while there were some California Indians present in the Vallejo Township[5] of Sonoma County in 1860, in 1870 and thereafter very few California Indians were living in the township. Chinese laborers on the other hand show the reverse pattern of no Chinese people in the Vallejo Township before 1870 and increasing numbers of Chinese laborers in 1870 and even more in 1880. These Chinese laborers were not aware of the indigenous taboos about the drained lakebed area and the dangers that the sicknesses in the charmstones threatened. Even though the lakebed itself was taboo to visit just after it was drained, Coast Miwok people continued to visit other sites in the Tolay Valley and continued to tell stories about the lake (Sarris 2011). Stories about the Tolay Valley and Tolay Lake have been maintained in the oral traditions of the Federated Indians of Graton Rancheria into the present day.

Table 7.1. Numbers of California Indians and Chinese Immigrants Recorded in the Census for the Vallejo Township, Sonoma County, California. *The 1850 and 1852 censuses do not differentiate between townships that the county is later divided into and so the numbers represent all of what is documented for Sonoma County on this census record rather than only the Vallejo township as with others. These years are represented to show that there was an absence of Chinese people in Sonoma County before 1860 and no Chinese people in the Vallejo Township in 1860.

Year	California Indian	Chinese
1850*	Absence	Absence
1852*	Presence	Absence
1860	6	0
1870	0	20
1880	2	59

The histories and experiences of Chinese immigrants in California are very important in exploring the intricacies of how settler colonialism operated in rural Central California in the early American Period. However, the issues at stake for California Indians and Chinese and other immigrants are incommensurate, because the issues for the former group are the return of land and recognition of sovereignty, whereas the issues for the latter groups is equal rights to settlers who claim indigenous land. That being said, many Chinese laborers suffered abuses at the hands of white settlers, and one short example merits space in this narrative about settler colonialism in the Tolay Valley.

Just a few years before William Bihler sold his property to James G. Fair in the late 1880s (K. Johnson and Eastman 1995), another disturbing event occurred in the fields of Bihler's farm. On

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[5] The Vallejo Township is an area bounded by San Pablo Bay to the south, the western edge of the Sonoma Mountains to the east, Copland and Crane Creeks to the north (where the present-day cities of Cotati and Rohnert Park are located), and the Petaluma River to the west.

October 16, 1884, there was a dispute between Bihler's foreman, Charles Fresh, and fifteen Chinese laborers who were picking grapes in the fields (Daily Alta California 1884). Charles Fresh insisted that the picking had to be done in a certain way which the laborers disregarded. In response, Charles Fresh threatened to terminate the employment of the laborers and remove them from the property. Feeling defenseless, the laborers picked up grape sticks and refused to stand down. Rather than reason with the laborers, Charles Fresh pulled out a gun and shot two of the men. The other laborers beat Charles Fresh with their sticks in an effort to protect themselves after which some neighboring white landowners chased them off. All of the Chinese laborers were arrested and put in jail, whereas there was no punishment for the white foreman, Charles Fresh, who wounded and possibly murdered two men in cold blood. This story is a striking illustration of how racist tensions were growing between Americans and Chinese immigrants, and how poor working conditions for these people were on the early "gentleman farms" of Sonoma County.

In the second half of the twentieth century, some Coast Miwok people revisited the Tolay Valley during the Cardoza family's fall festivals, and continued to monitor the status of old village sites, sacred places and tribal cultural resources in the valley, even though there were few laws at the time giving California Indians the right to protect and preserve these cultural resources. In 2005, the Sonoma County Regional Parks Department purchased the Cardoza family's land in the Tolay Valley to establish Tolay Lake Regional Park. The Federated Indians of Graton Rancheria took this as an opportunity to work in collaboration with the Sonoma County Parks Department to develop plans for co-managing the Tolay Valley as a park. Ongoing tribal involvement in the development and management of the park reaffirms once again that Tolay is a very significant place to current tribal citizens, some of whom are direct descendants of people who lived in the Tolay Valley region before contact with Western colonial nations.

Conclusion

Tolay Lake is a sacred place to Coast Miwok and other California Indian people that originally served as a place where doctors healed the sick. Coast Miwok people reaffirmed their connections to this place throughout the Spanish, Mexican, and American Periods as a place of significance and a place of refuge. Coast Miwok people did not engage in active resistance at Tolay or attack settlers to resist their claims to land in the Tolay Valley. Rather, through a process of refusing to acknowledge settler claims to territory and conceptions of how they used the space, Coast Miwok people lived in an indigenous world *instead of* rather than within or outside of the bounds of colonialism. The act of refusing settler territoriality reaffirms indigenous affiliations with family and territory and maintains the futurity and hopefulness for what Tolay and other places in Coast Miwok territory are and can be.

The draining of Tolay Lake was a catastrophic event in a longer legacy of settler colonialism that continues to the present day, but this event should not be viewed as a complete loss, a conquest, or a failed resistance. Even though Coast Miwok people had to distance themselves from Tolay after 1870 in order to maintain their wellbeing, Coast Miwok people and other California Indians curated stories about the lake and what happened there. That is to say that no matter how the landscape itself is changed and how Coast Miwok people have to adapt and change their own practices for the wellbeing of their families, connections to sacred places and to territory or homelands are never severed. Refusal offers a framework for thinking about indigenous places and futurity instead of colonial ones. These spaces are healing and hopeful.

Today, through the work of tribal council, committees and individual citizens of the Federated Indians of Graton Rancheria, Coast Miwok and Southern Pomo people are making plans in collaboration with Sonoma County Regional Parks Department to co-manage, restore, and protect Tolay as parkland. Though not full decolonization and return of land, it is a starting place, a place to begin to heal for future generations to come.

Chapter 8

Conclusion: Refusal, Relationships and California Indian Futurities in Archaeological Research

“While Indian people donned Victorian clothing and lived seemingly Christian lives, their Bole Maru leaders inculcated an impassioned Indian nationalism in the homes and roundhouses. They deemed everything associated with the white world taboo; they forbade interactions with whites except for necessary work-related situations…The Pomo and Coast Miwok always have been generally private, averse to open exchange with persons outside their respective tribal communities. The Bole Maru, with its emphasis on local individual dreamers, reinforced the stringent localism of the pre-contact cultures. Secrecy as an aspect of pre-contact culture became an asset for the resistance and reorganization.”

— from Greg Sarris (1996:34-35)

Indigenous peoples from around the globe have been watching settlers in our lands and monitoring the impacts of settler actions on these lands and resources for hundreds of years. In the words of a Kashaya Pomo elder as retold by Greg Sarris (1996:28):

> “The invaders are miracles, miraculous. [The Pomo word for this is *pala-cha*.] They think they can kill and plunder and get away with it’. The word reminds us of who they are, and of course of who we are…But the miracles ain’t really miracles or special. Look around, it has all come back on them, on everything. Look at the world, the pollution, the sick people. Still they act like miracles…”

When we look at the world today, the manifestations of these “miracles” surround us. For example, the suppression of cultural landscape burning produces ‘wilderness’ areas that are more susceptible to large-scale wildfires; the creation of dams and reservoirs, the draining of lakes and the infilling of bays have contributed to loss of habitat for many species of plants and animals; and the construction of oil pipelines to transport fossil fuels have contaminated our most precious resource, clean water. These impacts have exacerbated changes in our environment and global climate to an extreme that we have never known in our recorded histories.

In this time of uncertainty, many indigenous peoples, especially those nations located on coastlines and islands, are now the first peoples who are experiencing these changes and struggle to preserve the safety of their families and homelands. We as scholars of all disciplines need to be aware that research in the coming years may not be the only intervention that is needed (Simpson 2007:78; Tuck and Yang 2014a:241). The need for direct humanitarian action may be more immediate, and we should direct our efforts in working with indigenous peoples accordingly.

In the introduction to this dissertation, I asserted that the incorporation of multiple epistemologies and ontologies in archaeology through developing community-based and desire-oriented studies and management of cultural heritage can benefit indigenous communities and produce richer understandings of the past. This is similar to the agenda that McNiven (2016) sets for Indigenous archaeology, which he addresses by encountering the past and historicizing the present in a two-way relationship with indigenous communities. What I have come to realize at the end of my dissertation research is that ethnographic refusal, as theorized by Audra Simpson (2007, 2014, 2016), Eve Tuck and Wayne Yang (2014a, 2014b), and others (e.g., McGranahan 2016a; McGranahan 2016b; Ortner 1995; Sobo 2016; Weiss 2016), is a key component in deciding how to ethically proceed when engaging in community-based research. In archaeology, refusal is not a concept that has been explicitly articulated, but many indigenous communities and archaeologists working collaboratively often implicitly employ refusals in their agreements about how research is conducted and disseminated. During any stage of research, refusals can occur on multiple levels and offer moments of education and understanding if scholars can learn to recognize and acknowledge that something is being refused (e.g., Simpson 2007, 2014). These moments are generative waypoints in the research and offer new hopeful directions that lead to unexpected knowledge rather than road blocks and resistance to the knowledge that was initially sought (Tuck and Yang 2014b:812).

The findings of this dissertation project are significant, because they helped shape my writing of a historical and cultural affiliation document for agency planning purposes and educating the public, as well as providing an historical narrative of the Tolay Valley that has been disseminated to tribal youth for education hikes in the Tolay Lake Regional Park. The research conducted for this project also supported the historical narrative that was incorporated into the master plan for Tolay Lake Regional Park (Verheyen, et al. 2017). And this dissertation provides information about the varieties of plants and animals living in the valley before colonization that supports future environmental restoration and land management within the valley.

Whereas the information presented in this dissertation has been reviewed by my tribe to assess how it represents tribal history, resources, and people, uncontextualized information or raw data in the public domain could be used by anyone to misrepresent the tribe’s history, undoing my diligent efforts to protect my tribe’s rights to our tangible and intangible heritage. This is an intentional refusal to provide uncontextualized tribal heritage data in any publicly accessible form or database. For example, site locations are especially sensitive because of looting, so no GPS or standard site name information is presented in the dissertation. Instead, this sort of information can be accessed with permission from FIGR. Therefore, if particular datasets did not address the main questions and goals of the project, I did not include them in the body of the dissertation or as an appendix to it. The analyses of data not presented in this dissertation may become important for future publications, but the utility of publishing this information will be at the discretion of tribal officials of the Federated Indians of Graton Rancheria.

During this dissertation project, I worked closely with tribal citizens, elders, committees, and office staff to generate and refine the questions, methods, and interpretations for this study of the Tolay Valley. The low-impact methodology (described in more detail in chapter 4 and 5), including Ground Penetrating Radar (GPR), magnetometry, surface collection, and terrestrial LiDAR topographic mapping allowed me to identify features that would not have been possible if excavation and augering were the primary modes of identifying features and components of the site. These features and components included surface level depressions (possible house pits), subsurface clay structure floors, patterned concentrations of materials, such as groundstone near the drainage, that implied activity areas. An expansion of the number of surface collection units across TAP-39 also revealed patterns in the spatial distribution of historic materials that suggested a structure (possibly a domicile) was present on the site during the Historic Period. This historic structure was probably inhabited or used by Coast Miwok people, because knapped or reworked glass was also found in this area of the site.

As described in greater detail in chapter 6, limited excavation at TAP-39 indicates the persistence of great numbers of grassland/shrubland-adapted plants and animals in the Tolay Valley for over hundreds if not thousands of years in the eco-archaeological data indicate that these lands were routinely managed with controlled burns set by Coast Miwok people. Grasses (*Poaceae*) and clover (*Trifolium*) are ubiquitous and very common throughout the contexts at TAP-39. In addition, the vast numbers of rodents (*Rodentia*) as opposed to deer (*Odocoileus*) or other mammals indicate that the habitat in the valley was an open grassland. Within the assemblage, only jack rabbits (*Lepus californicus*) are found at TAP-39 rather than brush rabbits (*Sylvilagus bachmani*). Jack rabbits (*Lepus californicus*) are adapted to open grasslands and prairies rather than the chaparral environments that provide cover for brush rabbits (*Sylvilagus bachmani*).

As described in further detail in chapter 7, Coast Miwok people reaffirmed their connections to the Tolay Valley throughout the Spanish, Mexican, and American Periods as a place of significance and as a place of refuge by visiting ancestral home sites and ceremonial areas such as Tolay Lake where doctors healed sick patients with charmstones. Coast Miwok people did not engage in open resistance or attack settlers in the Tolay Valley, especially in the early American Period when laws and courts in California allowed settlers to abuse California Indian people with impunity in order to use their labor for economic gain or eliminate them (Madley 2016). Rather than physically resisting settler acts, such as the draining of Tolay Lake, or staying to plow the dry, charmstone-filled lakebed for the settlers' fields, Coast Miwok people refused to acknowledge settler ways of engaging with land and distanced themselves from Tolay Lake after 1870.

Even though Coast Miwok people distanced themselves from Tolay Lake in 1870, stories about Tolay Lake were maintained in Coast Miwok families, and some Coast Miwok people may have still visited other ancestral sites within the valley where knapped glass and glass dating to the late 1800's can be found. Through these refusals of settler values and claims to territory, Coast Miwok people reaffirmed their connections to Coast Miwok (rather than settler) epistemologies and places. Tolay Lake continues to be a very significant place for Coast Miwok people today, and the Federated Indians of Graton Rancheria have actively been involved in co-writing the master plan for and donating money to protect the Tolay Valley as a public park.

Though archaeological sampling of the sites in Tolay Valley can tell us about indigenous histories and past environments, there is a tension between the benefits of this kind of knowledge production and the cost of doing archaeological research to extract data from these sites. If a site were an elderly relative, would it be appropriate to subject them to every kind of lab test and invasive surgery before they pass for the sake of an interesting question? Or would it be more appropriate to continually care for them without invasive study, because they, as a whole being, are more important to their family than test results?

Indigenous peoples as the next of kin for sites and ancestors are the ones who should answer these questions. From this stance, I refuse archaeology that operates from top-down modes of research that produce knowledge for the sake of knowing without regard for indigenous concerns. This refusal engenders possibility and futurity in the relationships it builds with others who are willing to work from a place outside of the rigid, epistemological confines of a singular Western science. This refusal provides a space for indigenous peoples, archaeologists, and indigenous archaeologists to find common values and work from these values to develop protections for indigenous cultural heritage and produce robust knowledge about this heritage that reflects and respects multiple epistemologies.

In other words, what has made the Tolay Archaeology Project successful is not one or another low-impact method. What makes this project successful is engagement with indigenous peoples and building relationships that last with tribal nations. Through this collaborative process, we are not able to ask all the questions that intrigue us. But we can ask the questions that will benefit rather than harm indigenous peoples. In partnering with indigenous peoples to address these questions, we can learn from the collective knowledge of these peoples, the land, and the archaeological sites in ways that are not possible through modes of research that do not engage with indigenous peoples. By working collaboratively in all aspects of research to ask questions that are relevant to indigenous peoples, we will produce knowledge that we need to know, not knowledge that we want to know. That is to say, we will produce knowledge that matters, and we will act more like human beings than miracles.

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Appendix A

Tolay Archaeology Project / California Archaeology Lab Confidentiality Agreement

The confidentiality agreement developed for the Tolay Archaeology Project (TAP) was a way of reaffirming for every project participant their commitment to the community-engaged values of the project, in this case specifically, the values of confidentiality and protection of sensitive information. This agreement was signed by every field school and lab participant, other UCB personnel including my dissertation committee advisors, visitors to the site, consultants who performed special analyses on materials from the project, and anyone else who had interactions with the physical archaeological sites or archaeological materials and information generated by this project. This reaffirmation of values through the confidentiality agreement was important for setting the tone in the project that participants are granted the privilege of working with these sites and material heritage, and these sites and materials should be treated with respect according to the protocols and terms agreed upon by the Federated Indians of Graton Rancheria. That is, the research undertaken in this project is not to be used for purposes other than tribally approved initiatives, research, presentations, publications, etc. in order to ensure that the products of this research resonate with the desires of the tribe rather than disproportionately provide researchers with personal gains and rank advancements with little reciprocation or benefit to the tribe.

UNIVERSITY OF CALIFORNIA, BERKELEY

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PARTICIPANT FORM

Participant's Name ______________________________ Date ______________

Affiliation ____

Address ______________________________ City ______________

State ____ Zip ________ Telephone ____________ Fax ____________ Email ______________

Project and/or Purpose ____

AGREEMENT OF CONFIDENTIALITY

I, the undersigned, have been granted permission to participate in research undertaken by the University of California, Berkeley's California Archaeology Lab and to access cultural resource site data held at the California Archaeology Lab for the project or purpose noted above. I fully understand the confidential nature of the information contained in archaeological site records and reports, the data collected at archaeological sites and Traditional Cultural Properties (TCPs), and the locations of these resources. Archaeological and Traditional Cultural Property (TCP) locations are generally considered confidential and public access to such information is restricted by law (including: Section 304 of the National Historic Preservation Act; Section 9(a) of the Archaeological Resources Protection Act; Executive Order 13007; Section 6254.10 of the California State Government Code). I agree to respect that confidentiality. I will ensure that specific site location information is not distributed in public documents of any kind or made available to unauthorized individuals within or without my institution or agency. I also understand that prior written consent of the California Archaeology Lab and all other research partners, collaborators, and descendent communities is required for any exceptions to the above stipulations. Furthermore, I agree to obtain prior written consent of the California Archaeology Lab and all other research partners, collaborators and descendent communities in order to publish, present in public or otherwise share any data or interpretations that were generated by this research. I understand that failure to comply with the above is grounds for denial of subsequent access to archaeological site data and future research and employment opportunities.

Signature ______________________ Date ____________

Approved ______________________ Date ____________

Please return completed forms in person or by mail prior to participation in this research.
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Appendix B

Accelerated Mass Spectrometry (AMS) Radiocarbon Dating Results

Accelerated Mass Spectrometry (AMS) radiocarbon dating was performed at three laboratories. The Center for Accelerated Mass Spectrometry at the Lawrence Livermore National Laboratory (CAMS LLNL), Beta Analytic, and the W. M. Keck Carbon Cycle Accelerator Mass Spectrometry Laboratory at the University of California, Irvine. The samples sent to CAMS LLNL underwent a Acid/Base/Acid pre-treatment completed by Rob Cuthrell and myself, after which all other phases of sample preparation and analysis were completed by CAMS LLNL staff. The samples sent to Beta Analytic were entirely prepared and analyzed by Beta Analytic staff. The samples sent to the Keck lab at UCI underwent preparation (involving Acid/Base/Acid pre-treatment, combustion, graphitization, and mounting) by myself under the supervision of John Southon and his staff. These samples were then analyzed with the AMS by John Southon and his staff.

Sample Name	Material	Unit	Level	Depth (cm)	14C age	±	2-sig cal
TCRAMS-009	Charred Botanical	2	5	41.5-51	440	30	1425-1470 CE
TCRAMS-023	Charred Botanical	2	5	41.5-51	395	15	1445-1495; 1602-1613 CE
TCRAMS-024	Charred Botanical	2	10	91-100.5	3735	15	2200-2157; 2155-2126; 2089-2045 BCE
TCRAMS-004	Charred Botanical	3	3	16-22	Modern		Post-1950 CE
TCRAMS-019	Charred Botanical	3	3	16-22	165	15	1668-1688; 1730-1782; 1797-1809; 1926-1948; Post-1950 CE
TCRAMS-005	Charred Botanical	3	4	22-32	220	30	1645-1680; 1735-1800; 1935-Post-1950 CE
TCRAMS-001	Charred Botanical	3	6	49-51	125	30	1677-1766; 1800-1940 CE (MI)
TCRAMS-002	Uncharred Grape	3	6	43-51	>Modern		Post-1950 CE
TCRAMS-006	Charred Botanical	3	6	43-51	1500	30	475-485; 535-620 CE
TCRAMS-021	Charred Botanical	3	6	43-51	320	15	1496-1506; 1512-1601; 1616-1642 CE
TCRAMS-017	Charred Botanical	1	6	48-55	1315	15	660-710; 746-763 CE

TCRAMS-003	Charred Botanical	3	7.1	51 (House Floor)	325	35	1473-1645 CE (SI)
TCRAMS-007	Charred Botanical	3	7.1	51 (House Floor)	440	30	1425-1470 CE
TCRAMS-022	Uncharred Mussel	3	7.1	51 (House Floor)	885	15	1434-1949 CE
TCRAMS-025	Charred Botanical	4	6	20-29	210	15	1652-1677; 1765-1772; 1776-1800; 1940-Post-1950 CE
TCRAMS-008	Charred Botanical	4	7	29-39.5	120	30	1670-1780; 1800-1940; Post-1950 CE
TCRAMS-026	Charred Botanical	4	7	29-39.5	370	15	1452-1521; 1577-1583; 1591-1620 CE
TCRAMS-018	Charred Botanical	7	4	31-41	975	15	1019-1048; 1088-1123; 1138-1149 CE
TCRAMS-020	Charred Botanical	7	10	89-98.5	900	15	1044-1100; 1119-1143; 1146-1188; 1199-1202 CE
TCRAMS-041	Uncharred Mussel	7	13	120-140	4660	15	3077-1986 BCE
TCRAMS-016	Charred Botanical	7	14	140-160	4470	30	3340-3080; 3070-3025 BCE
TCRAMS-010	Charred Botanical	8	3	21-30	150	30	1665-1785; 1795-1890; 1905-Post-1950 CE
TCRAMS-027	Charred Botanical	8	5	40-50	365	15	1455-1521; 1575-1585; 1590-1623 CE
TCRAMS-011	Charred Botanical	8	6	50-60.5	120	30	1670-1780; 1800-1940; Post-1950 CE
TCRAMS-028	Charred Botanical	8	7	60.5-70	910	15	1041-1106; 1117-1165 CE
TCRAMS-029	Charred Botanical	8	8	70-80	405	30	1434-1521; 1576-1584; 1590-1622 CE
TCRAMS-012	Charred Botanical	8	9	80-90	500	30	1405-1445 CE
TCRAMS-030	Charred Botanical	8	9	80-90	365	15	1455-1521; 1575-1585; 1590-1623 CE
TCRAMS-031	Charred Botanical	8	10	90-100	245	15	1644-1665; 1785-1795 CE
TCRAMS-013	Charred Botanical	8	12	110-121	310	30	1485-1650 CE

TCRAMS-032	Charred Botanical	9	2	10-21	200	15	1657-1681; 1739-1745; 1762-1802; 1937-Post-1950 CE
TCRAMS-034	Charred Botanical	9	5	38.5-49	150	15	1669-1695; 1726-1780; 1798-1814; 1836-1844; 1850-1869; 1872-1876; 1917-1944; Post-1950
TCRAMS-035	Charred Botanical	9	7	61.5-70	1680	15	334-405 CE
TCRAMS-036	Charred Botanical	9	9	79-88.5	240	15	1645-1666; 1784-1796 CE
TCRAMS-037	Charred Botanical	9	11	100-108.5	6485	15	5485-5464; 5445-5418; 5409-5382 BCE
TCRAMS-038	Uncharred Mussel	9	12	110-121	6190	15	4820-3924 BCE
TCRAMS-014	Charred Botanical	9	14	130.5-150	7530	30	6445-6375 BCE
TCRAMS-039	Charred Botanical	11	3	20-30	545	35	1310-1360; 1387-1437 CE
TCRAMS-040	Charred Botanical	11	5	40-49.5	1505	15	540-601 CE
TCRAMS-015	Charred Botanical	11	8	70-79	2210	30	375-195 BCE