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WHERE THE ANCESTORS SLEEP: RADIOCARBON DATING OF BIOAPATITE FROM LA CONSENTIDA, OAXACA

Robert Mitchell

WHERE THE ANCESTORS SLEEP: RADIOCARBON DATING OF BIOAPATITE FROM LA CONSENTIDA, OAXACA

A Thesis

Presented to the

Faculty of

California State University,

San Bernardino

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in

Applied Archaeology

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by

Robert Edwin Mitchell

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Approved by:

Guy David Hepp, Committee Chair, Anthropology

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ABSTRACT

This study aims to refine the chronology of the burial sequence at the Early Formative Period (2000–1000 BCE) site of La Consentida in Oaxaca, Mexico. Previously, the chronology of mortuary spaces at La Consentida was supported by nine radiocarbon dates (2020–1510 *cal* BCE) from secure contexts, including charcoal, carbonized material from pottery, and two human bone samples processed together using R_combine to establish a single direct date for human remains at the site. This thesis study dated bioapatite from nine sets of adult human remains found in the two known mortuary contexts at La Consentida and two carbon-rich sediment samples found with a ritual deposit. Calibration and prescreening methods are suggested to correct the enamel dates, which tend to underestimate age. Securing the dates of these interred individuals enabled exploration of the mortuary space as it related to the creation and maintenance of group identity and collective memory during the initial Early Formative Period in coastal Oaxaca. More broadly, the mortuary data from La Consentida are compared to the immediate region of coastal Oaxaca and The Oaxaca Valley. The patterns discovered are discussed concerning how La Consentida fits into local and regional mortuary practices.

ACKNOWLEDGEMENTS

I am indebted to many people for their assistance and support during the undertaking of this thesis, and they are acknowledged here in no particular order. I sincerely thank Dr. Guy Hepp, my thesis advisor, who allowed me to conduct my research using material collected during his dissertation. His criticism, feedback, and patience were irreplaceable. I count myself lucky to have him as a mentor and friend. I want to thank my parents, Lynda and John Mitchell, for their support and never losing faith in their wayward son. I would also like to thank my In-Laws, Gary and Michelle Meyer, for their support during this undertaking despite showing up in their lives as a scruffy-looking stray their daughter brought home. Finally, and most importantly, I want to acknowledge and thank my partner, Kelsey Meyer, for her incalculable contributions. Without her, none of this would have been possible.

DEDICATION

For Robert Theodore McClain

Beloved Grandfather

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CHAPTER ONE:

INTRODUCTION

Mortuary practices and identity are intricately intertwined in more ways than marking group affiliation or territories. Identity has been a major research focus in Mortuary archaeology and Bioarchaeology, as seen in the rise of osteobiographies in the academic literature (Castro et al. 2017; Mayes and Barber 2008). However, we know that the dead do not bury themselves; the community of which they are a part must perform their rites of passage indelibly, imprinting their beliefs, customs, and memories onto the bodies of group members, both alive and dead.

At La Consentida, this recreation of memory and identity can be seen in the repeated use of the mortuary spaces uncovered so far at the site (Hepp et al. 2017). The evidence includes frequent truncating of older burials, a ritual cache associated with a burial space (perhaps alluding to the watery underworld, demonstrating the people's connections with the larger cosmological sphere within Mesoamerica), and consistent use of mortuary spaces throughout the site's occupation. These practices would have been utilized in the same way psychologists have discovered human cognitive memory operates via accessing the memories of previous events. The events are recalled and relived, and a memory of the initial memory is stored (Bridge and Paller 2012). In essence, remembering your previous memory of an event destroys it and leaves in its place a memory of a memory. Anthropologically, mortuary practices and physical

spaces that bound them would provide access to community memory and re-creation.

While I do not claim that La Consentida is the first community with practices deployed for maintaining community identity in Mesoamerica, I believe the data presented here paints a picture of one of the earliest examples of a dedicated space removed from dwellings for interning community members (Cervantes Pérez et al. 2017; Hepp et al. 2017; Whalen 1983)This would provide a physical manifestation or type of storage for access to memories held collectively at any time as part of the site's occupants' daily practices. The following paragraphs will lay the groundwork for the following chapters, introducing my hypotheses, the background literature used to inform my queries, the methods of data collection and analyses, the results of those analyses, and further discussion contextualizing my results.

The following paragraphs will introduce my general research question and the hypotheses guiding this study. The general question I address with this study is: Is the chronology of burial space use at La Consentida using absolute dating of specific individuals consistent with the established previously established chronology? Further, what do the dates and the compiled mortuary data tell us about La Consentida's use of the mortuary spaces in the broader context of Oaxaca during the Early Formative Period?

Research Questions

The first of my specific research queries to address the general research question is: Do the radiocarbon dates from the bioapatite samples support the previously established occupational chronology at La Consentida? Do the dates reported here correlate with the previously analyzed charcoal and shell dates from secure contexts? Secondly, do the dates from the interments provide more precision or accuracy in the timing of the use of mortuary spaces than previously dated material? The first step in answering this question was to select materials for sampling and date them by accelerator mass spectrometry (AMS).

The second research question I set out to answer was: do the interments support the presence of a communal burial ground and associated practices at La Consentida? To answer this question, I examined the absolute dates provided by AMS with one another and their frequency through time. I compiled the available mortuary data from La Consentida, including burial type, orientation, and sex distribution, alongside data from other mortuary contexts throughout Oaxaca.

Finally, my third research question was whether the mortuary data indicated a communal mortuary space during the Early Formative Period. Specifically, do the data support the interpretation that this charged space acted as a touchstone for community members to maintain collective memory?

In Chapter 2, Background, I lay out the necessary foundations for the study, including information on mortuary archaeological theory to interpret the

generated results and Oaxaca, Mexico's cultural and physical background. I also provide a summary of previous work carried out in coastal Oaxaca. In Chapter 3, Materials and Methods, I address the selection of samples for dating and their treatment. I present the mortuary data analyzed in this study in Chapter 4, Materials and Methods, and Chapter 5, Discussion and Conclusion. Finally, the data are summarized and synthesized in Chapter 5, Discussion and Conclusion.

CHAPTER TWO:

BACKGROUND

Oaxaca and the Lower Río Verde Valley

This chapter outlines the background needed to understand the research conducted throughout this study. The physical geography and location of La Consentida and previous archaeological research conducted in Oaxaca and on the coast specifically are required to place this study in context with the existing literature. The theoretical perspectives through which the study is conducted are explored extensively as collective memory, identity, and landscape are intimately entwined. Finally, a rationale for selecting enamel bioapatite dating is given.

Figure 1: Key Archaic and Formative Period sites of Mesoamerica. Reproduced from Hepp 2019b

Physical Geography of Oaxaca

The mountain ranges of the Sierra Madre Oriental and the Sierra Madre del Sur characterize the geography of Oaxaca. Valleys have been carved throughout these ranges by a combination of fluvial and tectonic forces. These arms of the Valley of Oaxaca provided the necessary environment for settling pre-conquest Oaxaca. They set the stage for the rise of village sites such as San José Mogote during the Early to Middle Formative Periods and urban sites like Monte Albán during the Middle to Terminal Classic Periods (Joyce 2010). La Consentida is located approximately 6.5 km from the coast in the Lower Río

Verde Valley. During its occupation, the site was positioned near an open bay, which later became estuaries fed by the Río Verde, one of the largest rivers on the Pacific coast of the Americas. The Río Verde has a broad floodplain that provides some of the most productive agricultural lands in the state.

Previous Archaeological Work in the Lower Río Verde Valley

The earliest known archaeological sites of the Río Verde Valley date to the Early Formative Period (2000–1000 BCE). According to paleoecological reconstructions, the earliest evidence of human occupation is older, dating to approximately 2750 cal. BCE (Goman et al. 2010). Arthur Joyce and his colleagues instituted the Río Verde Formative Project (RVFP) in 1986 to carry out archaeological and geomorphological research to address the dearth of archaeological data about the Lower Río Verde region (Joyce 1991a). The region has since been the research focus of Dr. Joyce and his colleagues, including large-scale and test excavations, non-systematic surface reconnaissance, and full-scale surveys covering 228.69 km^2. Archaeofaunal, archaeobotanical, human bone chemistry and dental wear studies have elucidated subsistence practices, while paleoenvironmental studies have documented paleoecological and geomorphic change in the drainage basin and coastal areas of the Verde (Goman et al. 2010; Hedgepeth-Balkin 2020; Joyce 1991a).

LCAP. Archaeologists rediscovered La Consentida in the 1980s as part of the Río Verde Formative Project, which included surface collection and test excavations (Joyce 1991a). This project led to the establishment of a ceramic

chronology for the Region during the Formative Period. However, at the time, La Consentida was interpreted as a Middle Formative Period (1000–400 BCE) site. The La Consentida Archaeological Project (LCAP) began in 2008 (Hepp 2015, 2019a). The site covers 4.5 ha and is dominated by Platform 1, an earthwork feature measuring approximately 300 x 100 x 5 m. The LCAP studies of earthen architecture, middens, and mortuary contexts were designed to explore mobility, subsistence, and social organization transitions. Hepp concludes that La Consentida was likely founded by a semi-mobile population that established the site as one of several seasonally occupied domestic and gathering locales throughout the region. It was permanently settled before site abandonment (Hepp 2015). In support of the increasing sedentism of the population at La Consentida, Hepp and colleagues demonstrated via the relationship between the rising presence of groundstone implements and dental pathologies that maize consumption remained relatively constant. In contrast, the method of consumption appears to have changed. Maize consumption was measured according to stable isotopic data and the presence of ceramic bottles and granite metates. The increased dental attrition and coarse-grained granite groundstone implements indicate how this community's maize was consumed and a hypothesized shift towards sedentism with task-specific tools (Hepp et al. 2017).

Burials yielding fifteen sets of human remains were discovered during excavations in the 2009 and 2012 field seasons (Hepp 2015; Hepp et al. 2017, 2020a). Observations recorded in the field included burial orientation, associated

artifacts, features, and identifiable characteristics. The burials were removed in blocks for further laboratory work, which included producing a skeletal inventory identifying diagnostic markers of age and sex, and paleopathology. These methods included rating the skull and os-coxae characteristics for sex determination and estimating age at death by rating epiphyseal fusion of the postcranial skeleton where possible or cranial suture closure where it was not. Subadults were aged by deciduous and permanent teeth (Hepp et al. 2020b). These analyses determined that the known skeletal collection from La Consentida consists of eleven adults or sub-adults and four children, of which four individuals are females or probable females, six males or probable males, and five individuals, including the children, are of indeterminate sex.

The La Consentida burials occurred in two non-residential areas at the northern edge of Platform 1, a monumental earthen architectural feature (Hepp et al. 2017). Eight of the individuals were buried in a prone position. Nine were oriented east-west, while three burials trended northeast-southwest. Most burials contained ceramic vessels, stone tools, figurines, instruments, animal bones, ground stone, and ceramic and stone beads. However, the artifacts positively identified as burial goods were modest. The research team recorded pathologies for these remains, including dental attrition, caries, linear enamel hypoplasia, Periodontal disease, abscesses, signs of osteophytosis, degenerative joint disease, periostitis, squatting facets, and taphonomy. The human remains were examined for cultural modifications, such as dental inlays; however, none were

found. The researchers formed an approximate burial chronology by comparing radiocarbon dates from adjacent contexts and direct dates for a single set of remains to stratigraphic sequences within the burial space (Buikstra and Ubelaker 1994; Hepp et al. 2017; Hepp 2019a). I draw the primary data from these Interments for comparison and interpretation. Before these data can be interpreted, a brief overview of Oaxaca's geography, archaeology, and the primary theoretical orientations that inform this study is required.

Mortuary Theory

One of the earliest contributions to the study of mortuary archaeology, in which an interpretation of a mortuary feature supports the presence of social phenomenon, was written in 1868 by John Lubbock. Lubbock was the first to find that burial treatment varied with facets of the social being, such as age, sex, and social status (Lubbock 1868). Additionally, Lubbock described burial treatments along the stages of religious belief constructed by Tylor (Bartel 1982). Lubbock attributed burial goods or artifacts found with the deceased as evidence of the societal belief in an afterlife and that these grave goods, whether broken or whole, were evidence of the societal belief in the presence of a material existence post-mortem (Bartel 1982). Perhaps the most interesting contribution to the budding field of mortuary archaeology was the statistical analysis of British Tumuli. Bartel described this study as the most interesting of Lubbock's works that pertain to mortuary archaeology, in which Lubbock provided the frequencies of grave type, body orientation, method of corpse disposal, and grave goods as

well as relative monumentality and individuals buried within the monuments (1982). This correlation of monumentality and wealth in the form of time investment and labor is still a common practice and can be likened to Tainter's use of energy expenditure in his study on prehistoric social systems (Bartel 1982; Tainter 1978).

The French sociologists Hertz and Van Gennep were not well-known to the English-speaking world until the 1960s. So, their work was not influential in Americanist archaeology at the time of their writing at the beginning of the twentieth century. These authors shifted the paradigm of examining religious beliefs and related phenomena in a vacuum into examining them in the context of their social system. Hertz studied the mortuary practices of Indonesian peoples, primarily those of the Dayak, and focused on the practice of double burial (Bartel 1982; Davies 2005, 2005). Hertz's writing is concerned with treating not only the biological body of the deceased but also that of the social being and society in transition. Central to Hertz's work was the thought that there is a need for society to deal with the nature of the seemingly everlasting social systems and the transitory nature of the individual members who make up that society. In Hertz's view, mortuary rites are conceived to change the status of the dead as they transition from the realm of the living into the realm of the ancestors. The funerary rites here are viewed as being as much for the living as they are for the dead, acting as rites of separation and reintegration on behalf of both parties. Hertz focused primarily on double burial, wherein the corpse goes through two

stages, a wet and dry stage (Davies 2005; Hertz 2013). During the wet, or first stage of decomposition, the identity of the dead is removed from its social status in life. In the dry stage of decomposition, this being reburial in Hertz's case, a new identity is conferred for use in the realm of the hereafter. The deceased is removed from the web of social ties by removing the physical body onto which the social being is grafted from society until decomposition has occurred. Only then can the social being be temporarily excused from the community to be among the ancestors. Thus, society perpetuates itself in the realm of the living into the realm of the dead.

Van Gennep's writing at the time of Hertz and publishing only a few years later reinforced many of the points Hertz put forward by postulating the existence of cross-cultural rites of passage (Bartel 1982). These rites were those of separation, transition, and incorporation. Life could be defined as a series of transitory Periods starting at birth and ending with death. For Van Gennep, death was both a rite of transition from one state to or plane to another. Separation occurs when the corpse is removed from society during the wet stage as the family is removed from the normal flow of daily life. Finally, the integration or incorporation into the realm of the ancestors for the deceased, as well as for the family, reintegrating with society after w.

In the first half of the twentieth century, Kroeber (1927), an archaeologist, found an incredible amount of mortuary variability between and within groups of California Native Americans. Kroeber examined the amount of mortuary

variability across different cultures and geographic areas ranging from the African and South American continents and parts of Asia. He found similar results and concluded that mortuary rights were incredibly variable between and within groups. This made Kroeber view funerary rites and customs as a component of culture more akin to a fashion that could come in and out of style through inter-group contact and transmission or independent invention.

The main thrust of Kroeber's work, however, is that these "fashions" were only a component of culture at one end of a spectrum of cultural traits. These cultural traits ranged from "Core" traits such as social structure and subsistence base to those fashions that were short-lived and wholly disconnected from the traits of the core. In his 1921 paper, Kroeber mentioned that despite the wide variability in mortuary customs, there were instances of long-term stability in mortuary practice. For example, some ancient Egyptian burial practices remained remarkably consistent for about four thousand years.

Lewis Binford's 1971 article has been referred to as the beginning of mortuary archaeology (Robben 2017). Binford (1971) wrote that despite burials being one of the most common excavated features, little had been done to explain variable burial phenomena. He noted that until this point, archaeology had been more interested in examining and describing the abstract categories of burial practices such as double burials, burial cairns, or the burial practices of a society. Binford used Kroeber as the archetype of previous archaeological work on mortuary analysis from the culture-historical perspective. Binford set out to

test Kroeber's postulations that mortuary customs are unstable and that they vary independently of those "core" cultural units, which pertain to biological or social imperatives (Binford 1971).

Binford set out to test the hypothesis that there was some relationship between mortuary variability, as in the degree of variation in funerary rites within a society, and that society's level of social complexity (Binford 1971; Parker Pearson 1999). To do this, Binford used the Human Relations Area Files (HRAF) to collect data on differences in the status of the deceased and the level of social complexity. Among the ethnographic material he consulted, numerous accounts of burials were available, which outlined which social dimensions were recognized in the formal mortuary practices of the society examined. These included age, sex, social position, sub-group affiliation, cause of death, and location of death. Binford used a given community's subsistence base to determine the level of social complexity while admitting that it was a crude index of social complexity (Binford 1971).

Binford's investigation of the material from HRAF found tangible correlations between his variables. First, there was no significant degree of variability in the facets of the social persona represented in death rituals between hunters and gatherers, shifting agriculturalists, and pastoralists. Additionally, the data supported the idea that settled agriculturalists more often took the dimensions of the social persona into account while symbolizing the status of the deceased in funerary rituals. Among the attributes that varied with social

complexity and were distinguished by the disposal of the body were sex, age, type of grave, and placement and positioning of the grave (Binford 1971). This varying burial treatment indicates that specific facets of the social persona are important enough within a given society worth marking in mortuary ritual. These facets of the social persona increase as social complexity increases, possibly due to increasing social ties and roles. Lastly, these findings are at odds and seem to refute Kroeber's notion that funerary rites are separate from "core" components of culture.

Arthur Saxe wrote on the social dimensions of mortuary practices. He posited eight hypotheses, each finding varying support from the data he collected during his cross-cultural study. According to Parker Pearson (1999), these hypotheses are an exercise in logic and have various issues in that they rely entirely, as did Binford's, on the observations of ethnographers. One of the hypotheses that has led to fruitful research and new directions of site interpretations is Saxe's hypothesis eight, which essentially states that communal burial grounds are used to maintain group ownership of the land and resources through their ancestral occupation (Saxe 1971). Lynne Goldstein (1981) tested hypothesis eight through analysis of Mississippian burial grounds and found partial support for the hypothesis. Parker Pearson (1999) remarked that Goldstein's study shows that the absence of a formal disposal area for the dead indicates little about social structure. The existence of the disposal area does, however, inform us about the presence of a corporate group and ancestor

veneration. Parker Pearson noted that Saxe's hypothesis eight is the one that continues to be discussed in the archaeological literature despite issues of the reductionist view of ancestral relationships. Furthermore, hypothesis eight does not help us understand why cemeteries are used to legitimize ancestral ties to the land (Parker Pearson 1999). Saxe's hypothesis eight is helpful to us in interpreting what may or may not be labeled a cemetery in that it assists in sifting out burial areas that are not corporately maintained.

Another New Archaeology school member, Joseph Tainter, continued with Binford and Saxe's work in the processualist investigation of mortuary archaeology. Tainter undertook a cross-cultural survey examining the relationship between social status and differential treatment of the dead, seeking quantifiable data to support his hypotheses relating to hierarchies. Tainter found that aspects of funerary treatment were associated with social rank. These aspects included the complexity of body treatment, construction, and placement of the corpse's final resting place, the duration of a mortuary ritual, material contributions, and human sacrifice (Tainter 1978). Tainter calculated that every individual in society had at their disposal the energy output of everyone below them in the hierarchy at increasing ratios depending on how far above the others the individual was. He used this model to calculate the energy expenditure in creating mortuary Interments as a proxy for the deceased's rank in society. This proposition is similar to Tylor's (1982) work on tumuli, as resources are required to build elaborate tomb structures correlated to the interred individual status.

What seems to be missing from the work of these authors and of many processualist archaeologists is the distinct lack of interest in or reference to the religious-philosophical reasoning behind the mortuary ritual, of which burial and placement within a culturally acceptable space constitute a considerable component. Christopher Carr (1995) undertook a sizeable cross-cultural survey, again using HRAF, which aimed to test several of the premises put forward by Tainter and Binford and raise issues with the materialist-ecological approach applied in their writings and that of their successors. One of Carr's most important findings was that philosophical-religious beliefs were at least as likely as social and organizational factors, if not more so, to determine intrasocietal variation in mortuary practices. Carr noted that mortuary practices are carried out as they relate to personal intentions, social strategies, attitudes, beliefs, and world views and that organizational factors remain significant contributors to the variation observed in any society but are expressed through the filter of religious-philosophical beliefs (Carr 1995). One of Carr's examples to demonstrate this point was burial orientation following cardinal directions as practiced by the Inuit and orientation of the body laid to rest in the direction of one of two afterlives. The most useful variables in reconstructing philosophical-religious beliefs were body orientation, body position, and spatial arrangement of grave furniture. In contrast, the variables most useful for reconstructing social organization were the internal organization of cemeteries, energy expended on corpse disposal, number of socially recognized burial types, number of people in a grave, and the

number of grave goods. Finally, Carr found good support for Hertz's assertion that mourners believe the state of the body to be the final state of the soul, and as such, the state of the soul can be manipulated by way of the treatment of the corpse. According to Carr, this notion is influenced directly by philosophical-religious beliefs, allowing archaeologists to reconstruct past worldviews and beliefs. Importantly, this paper gives context for thinking about the cemetery or communal burial space beyond simply a means of satisfying biological imperatives and territory marking.

Cemeteries, as places, are a component of what archaeologists have come to term landscapes. Landscapes have been widely examined in terms of ecological exploitation, demographics, political power, and areas of refuge. Recent landscape studies have also examined the socio-symbolic facets of landscapes. The last has been used to highlight non-economic perspectives on human-land relations (Knapp and Ashmore 1999). According to Knapp and Ashmore, landscapes (and, by extension, cemeteries) as places or components of the environment in which people live can be ideational landscapes that help illustrate moral messages, recount mythic histories, and record genealogies (1999). Landscapes are integral to constructing and maintaining memory, identity, social order, and transformation. The cemetery or communal burial space embodies a landscape that accomplishes each of these aspects. The cemetery is a landscape of memory that cements social and individual memories in contexts as specific as family units or even modern nation-states. The

cemetery is a landscape of identity as people collectively maintain the space in ritual, symbolic, or ceremonial terms. The cemetery, in turn, creates and conveys sociocultural identity. Cemeteries are a landscape of social order; this point has been explored from a mortuary archaeological perspective since the early days of Anglophone archaeology, as mentioned previously (Alekshin et al. 1983; Bartel 1982). Buikstra and Charles noted that from landscape perspectives, cemeteries place the dead and the ancestors in specific spaces, marking their roles in the social and natural order (as cited in Knapp and Ashmore 1999). Exploration of social orders in mortuary analysis is common, as explored earlier in this paper, especially under the New Archaeology. Cemeteries, then, according to Knapp and Ashmore, Tainter, and Saxe, may be seen as multifunctional in that they simultaneously establish and reaffirm group rights to resources both “real and Imagined” in terms of material resources and more intangible resources such as identity. They create and maintain community identities, reaffirm social orders as the capstone to the cyclical order of the human lifespan, and demonstrate social continuity over long Periods.

Cemeteries are more than disposal areas for a community’s dead; they contain and maintain a vast quantity of social and cultural knowledge. I wish to explore some thoughts on the role of the cemetery and its archaeological footprint. Cemeteries offer a place for the dead to be subsumed under the banner of the ancestors and move into the land of the dead while simultaneously creating social identity, maintaining social order, and imbuing the landscape with

social memory (Chesson 2001; Halbwachs 1950). Hertz (2013) argued that mortuary treatments were a tool for reconciling the fleeting nature of human life and the seemingly immortal nature of the society to which they belonged. Kroeber (1927) lent some credence to this notion by the social order of the Egyptians, and their mortuary customs persisted for many thousands of years. Burial spaces are used in the final rite of passage as proposed by Van Gennep (as cited in Bartel 1982) and, by association, may be considered liminal spaces or places of transition; as such, these places, as meaning-laden and potentially dangerous spaces, need careful navigation, either through specialist intervention as in the manner of the Àqi among the Chumash or through strict adherence to ritual practice and reproduction of the social order. The archaeological residues of such practices should be the only material culture in areas where communal burial practices occur.

Mortuary Practice

Mortuary practices in Oaxaca occurred in the earliest part of the pre-Hispanic occupation. These rites focused on mortuary ritual and burial through time, became increasingly elaborate, and encompassed elites and commoners (Blomster 2011). According to Blomster (2011), as populations throughout Oaxaca became more sedentary and dependent on agriculture, the concentration of burials within and under settlements increased. This pattern likely relates to developing concepts of community and territory, as identified elsewhere in the ancient world (Blomster 2011; Parker Pearson 1999).

Necessary for the discussion of Mesoamerican landscapes and peoples' relationship with them is the transition to sedentism. The traditional view, as outlined above, sees agriculture as the driving force behind sedentism. However, as multiple authors argue (Joyce and Goman 2012; Lesure 2009; Neff et al. 2006), a new picture is emerging in coastal Mesoamerican contexts. For example, in the Soconusco region of Southern Mexico and Guatemala, estuarine resources likely played a critical role in establishing sedentism before complete dependence on agriculture (Clark and Blake 1994). These authors questioned the sequence of the paradigmatic transition to sedentism in Mesoamerica as a direct result of the adoption of agriculture. Instead, they argue, sedentism arose through a complex mosaic involving changes in social relations between people and the landscape with which they interacted (Rosenswig 2015). While sedentism is not the primary focus of this thesis, ideas tied to sedentism, including landscape, community, and identity, are important for this discussion, especially for a community on the cusp of such a dramatic social transformation (Hepp 2019b).

Formal disposal areas for the deceased, or communal mortuary spaces, are often cited as evidence of corporate groups establishing control of resources through demonstrating familial ties to buried ancestors (Goldstein 1981; Parker Pearson 1999; Saxe 1971). However, burials and other mortuary treatments may be part of a larger strategy involving a society's symbolic connection with the landscape, ancestors, and the living (Carr 1995; Knapp and Ashmore 1999). The

acts involved in carrying out mortuary rituals, including, but not limited to, the disposal of the physical body, reproduce messages of cosmological importance within communities. Thus, cosmology and landscape are intimately entwined. They form socio-symbolic meanings observable in Mesoamerica's vibrant creation stories.

One such creation story, that of the Mixtecs, describes the origins of agriculture via the resolution of the “War with Heaven,” where gods and nobles fought against rock and rain deities. During the resolution of this conflict, a covenant was established that allowed the people to practice agriculture, which caused the deities pain by tilling the soil and consuming maize, the daughter of the earth and rain. This covenant requires that humans sacrifice their bodies at death by being placed in the ground where they are assimilated (Joyce and Goman 2012; Monaghan 1990). This recounting provides insight into the mortuary practices of the Mixtecs and other people of Mesoamerica.

At La Consentida, a ritual cache (Figure 2) was discovered in association with the mortuary space excavated in Op. LC12 A. This cache contained the complete skeleton of a venomous reptile, a ceramic bird ocarina, a shark tooth, pottery sherds, and other mineral and faunal remains (Hepp et al. 2017). It is postulated that this cache has celestial and astronomical connotations due to the reptile and bird imagery since birds are seen as the facilitators of communication with other planes and reptiles as having connections with the “watery underworld” (Hepp 2022; Hepp et al. 2014; Taube 2010). Additionally,

archaeologists have suggested that sharp shark teeth may have been used in blood-letting ceremonies (Flannery 1976). This cache may also represent an early reference to the Mesoamerican quincunx, the four cardinal directions, and perhaps even relates to the primarily east-west and northeast-southwest orientation of the graves.

The mortuary information discussed above suggests, I argue, a connection between burial practices at La Consentida and the establishment of community identity, as discussed recently for Early Formative Period highland Oaxaca by Cervantes Pérez and colleagues as well as others working in the later Formative Period (Barber et al. 2013; Cervantes Pérez et al. 2017). If the chronology of the burials and these burial contexts occurred in an orderly, prescribed manner, La Consentida might offer some of the oldest evidence of these phenomena in Mesoamerica. Still more intriguing, the burial areas and the steps taken by the people who created them may demonstrate memory and identity formation through time as the community transitioned from a semi-mobile to a sedentary population.

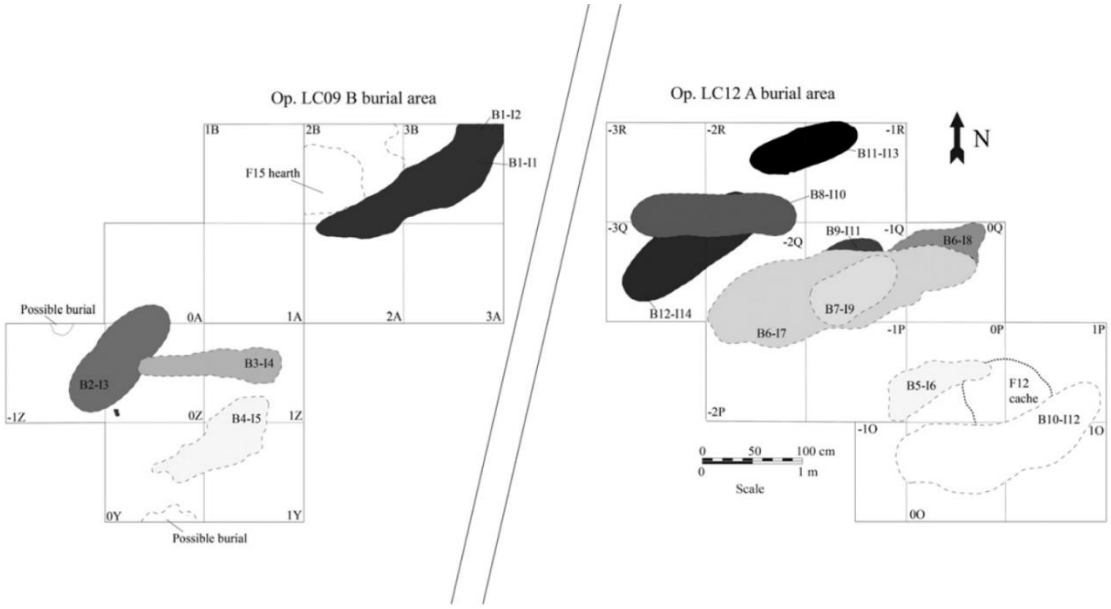


Figure 2. Plan Map of Mortuary Spaces at La Consentida Showing Graves in Relative Chronological Order with Darker Shapes Indicating Earlier Burials. The Cache is Visible in Op. LC12 A. Image from Hepp et al. 2017.

Radiocarbon Dating Enamel Bioapatite

Typically, the bone's organic or protein fraction is the radiocarbon dating target. Bone collagen can quickly degrade, especially in warm environments and where water is present (Hedges 2002). Water in the depositional environment causes collagen to leach from bone and dentine into the surrounding matrix, degrading possible samples or rendering them entirely unfit for analysis. The mineral component of bone and enamel, bioapatite, survives in many depositional environments where collagen or dentine may degrade to such a point that they become questionable data sources. Tooth enamel and long bone mineral phases can provide information on dietary and residential mobility

patterns via stable isotope analysis (Gregoricka et al. 2014; Hepp et al. 2017; Katzenberg 2008). Enamel has produced more reliable results than bone apatite due to its lower porosity, smaller surface area, larger crystallites, and higher insolubility due to lower carbonate content. However, this durability enables the preservation of stable isotope signatures while radiocarbon ages are found to be younger than expected (Lee-Thorp 2002; Wood et al. 2016).

Tooth enamel comprises an organic phase and a mineral phase. The organic phase contributes only a small fraction of tooth enamel, and the inorganic phase contributes the remainder. This inorganic phase is formed of crystallites of bioapatite and arranged into micrometer (μm) sized prisms or rods (Cui and Ge 2007). These bioapatite crystallites are used to create various structures within the tooth enamel, while an interprismatic matrix of crystallites is arranged between rods. These crystallites of bioapatite are composed of hydroxyapatite $Ca_{10}(PO_4)_6(OH)_2$ (Lee-Thorp 2002).

CHAPTER THREE:

MATERIALS AND METHODS

In this chapter, I summarize the materials used for this study to generate the absolute chronologies of the burials at La Consentida. Due to the constraints on dating the collagen fraction of the human remains at la Consentida, I opted to use AMS radiocarbon dating of the bioapatite fraction of the tooth enamel from nine of the fifteen individuals recovered from the site thus far. I use these nine dates in combination with two additional dates from two charcoal samples as part of this thesis. Additionally, the existing direct date taken from long bone collagen from individual B12-I14(Burial 12 Individual 14) and dates from shell midden contexts are examined. All samples exceeded DirectAMS guidelines for a minimum mass of 300 mg for sample submission. Three of the enamel samples come from the Op. LC09B burial area of the site, the remaining six derive from Op. LC12A.

Burials from La Consentida

The burials sampled for dating from LC09B constitute three individuals. The individuals will here be referred to as their updated burial and individual numbers while retaining their burial field designation in Table 1. Burial 1 Individual 1 (B1-I1) was estimated to be between 35–50 years of age and was excavated from approximately 122–152 centimeters below the surface. This individual was dated using enamel from their lower right third molar (LRM3). B3-

I4, an adult of unspecified age, was excavated from approximately 120–135 centimeters below the surface and dated using the enamel from the lower left third molar (LLM3). The final sample from burial area LC09B is B4-I5, was excavated approximately 95–110 centimeters below the surface and was dated using a ULM3 (Third Upper Left Molar).

There are five burials containing six individuals sampled for dating from Op. LC12A. B5-I6 was excavated from approximately 60–95 centimeters below the ground surface and dated using enamel from either URM 1 or 2. B6-I7 was approximately 60–95 centimeters below the ground surface and dated using enamel from LRM3. B6-I8 was excavated from 75–95 centimeters below the ground surface and was dated using enamel from LLM2. B8-I10 was excavated 90–124 centimeters below the ground surface and dated using enamel from LLM3. B10-I12 was excavated 32–60 centimeters below the ground surface and dated using enamel from LRM2. Finally, B12-I14 was excavated from 141–151 centimeters below the ground surface and dated using enamel from LLM3.

Table 1 LCAP Enamel Samples.

Burial and Individual	Burial Orientation	Position	Sex	Age	Primary/Secondary	Single/Multiple	Enamel Sampled
Burial 1, Individual 1	NE	Extended, Prone	Male	35-50	Primary	Multiple	y
Burial 3, Individual 4	E	Extended, Left side	Female	18+	Primary	Single	y
Burial 4, Individual 5	NE	Extended Prone	Unknown	Unknown	Primary	Single	y
Burial 5, Individual 6	SW	Unknown	Female (Probable)	25-30	Primary	Single	y
Burial 6, Individual 7	SW	Extended, Prone	Male	20-35	Primary	Multiple	y
Burial 6, Individual 8	NE	Extended, Supine	Male (Probable)	Unknown	Primary	Double	y
Burial 8, Individual 10	E	Extended, Prone	Male	15-18	Primary	Single	y
Burial 10, Individual 12	NW (Probable)	Extended, Prone (Probable)	Female (Probable)	20-35	Primary	Single	y
Burial 12, Individual 14	SW	Extended, Prone	Female	45-50	Primary	Single	y
Burial 1, Individual 2	S	Unknown	Unknown	1 - 2	Primary	Multiple	n
Burial 2, Individual 3	SW	Extended, Prone	Male	40-50	Primary	Single	n
Burial 7, Individual 9	SW	Unknown	Male	20-35	Primary	Single	n
Burial 9, Individual 11	SW	Extended, Prone	Unknown	3 - 4	Primary	Single	n
Burial 11, Individual 13	NE	Extended, Supine	Unknown	2 - 4	Primary	Single	n

Two carbon-rich sediment samples were submitted to DirectAMS for radiocarbon dating. While these two samples are not from human remains, they are associated with the mortuary spaces found at La Consentida. Additionally, this thesis uses previously published dates from La Consentida (Hepp 2019a; Powell 2020).

Mortuary Sites from Oaxaca

San Sebastian Etla

Excavations conducted by INAH approximately 15 kilometers north of Oaxaca City and 1.7km east of the site of San José Mogote uncovered 42 sets of Early Formative human remains. These remains were found over an area of 36

m^2 within the Etla arm of the Valley of Oaxaca, an area known to have supported at least 17 settlements during the Tierras Largas Phase (1400–1200 BCE) (Kowalewski et al. 1989). The valley's population was distributed into small settlements of less than 3 ha, containing between three and 10 houses. San José Mogote was an apparent exception, measuring roughly 7.8 ha with at least ten residential areas (Flannery and Marcus 2005). San José Mogote is mentioned briefly here because Flannery and Marcus suggested that the site became a regional center during the Early Formative Period, thus influencing the surrounding populations in the Valley of Oaxaca. The results from Cervantez Pérez and colleagues (2017) are provided below for inclusion in my analysis.

Cervantez Pérez and colleagues described the mortuary space at Etla as presenting the classic characteristics of a formal cemetery containing the remains of men, women, and children (2017). While the infants' graves are not associated with the adult burials and poor preservation prevented the sex determination of 50% of the interred individuals, I agree with the authors' statement of formal cemetery status. The lack of typical cemetery age distribution where infants and children are more heavily represented due to mortality and the even distribution of sexes and mortuary offerings lead me to suspect that this was a prescribed area for the Interment of a specific group within the population at San Sebastián Etla.

Santo Domingo Tomaltepec

Tomaltepec, like San Sebastián Etla, is an Early Formative Period village site in Oaxaca's highlands. However, the site sits in the eastern Tlacolula arm of the Valley of Oaxaca. Occupation at Tomaltepec began in the Early Formative Period and continued through the Late Formative. Data presented by Whalen (1981) are confined to the Early Formative Period between 1150 BCE and 1000 BCE. The research on Tomaltepec indicates four households relatively equidistant from each other and the cemetery complex. Only one structure at the site suggests any level of status distinction, household ESJ-1, which held the remains of imported obsidian and other high-value goods. Additionally, ESJ-1 was constructed upon an earthen mound. Whalen, however, concluded that there was a minimal status distinction at Tomaltepec in the Early Formative. The cemetery space at Tomaltepec held 80 individuals buried in 60 primary, 9 disarticulated, and 11 secondary Interments.

Cerro de la Cruz

Cerro de la Cruz is a 1.5-ha Late Formative (400 BCE–250 CE) site located on a hill in the Río Verde Valley on the Pacific coast of Oaxaca. Excavations uncovered two terraces with stone retaining walls and four low-status residences on four occupational surfaces. The upper terrace was characterized by an architectural complex of granite flagstone patio surrounded by the stone foundations of five structures numbered 1 through 5 (Joyce 1991b, 1994; Mayes and Joyce 2017). Burials were discovered associated with

Structure 1 on the upper terrace beneath the two uppermost floors and along the foundation walls.

The burials in Structure 1 of Cerro De La Cruz are contentious, as they provided the material to create data used in interpretations of what some (Sherman et al. 2010) have claimed might have been an attempted conquest by Monte Albán. The mortuary area in Structure 1 at Cerro de la Cruz contained 49 bodies. The analysis determined the interred individuals' sexes, finding 14 probable males, 11 probable females, and 24 indeterminate (Barber et al. 2013). Adults predominate in the burial area inside Structure 1, with 42 burials, while subadults comprise only 7. None of the graves within this mortuary space included burial goods. Mayes and Joyce commented that this is unsurprising because only 5% of the 86 total burials at Cerro de la Cruz contain grave goods. Structure 1 shows evidence of sequential burial at the site with frequent truncation of burials like Etla and other communal mortuary spaces in Oaxaca.

Methods

Radiocarbon dating of human remains is a gold standard for dating archaeological sites, as dating the collagen component of bones indicates to researchers when that person exhaled their last breath. While macabre, this information tells us when people actively used a given site. Tooth enamel was selected for this analysis due to the preservation bias favoring bioapatite over the collagen fraction of bone in clayey sediments, which will tend to accumulate water and leach the dateable collagen into the surrounding matrix. Bones have

bioapatite components that outlast their collagen fraction, which means they can be dated using the methods proposed in this study. However, the bioapatite fraction of bone may tend to have diagenetic carbon seep into its mineral matrix, influencing the dates to a greater degree than the more crystalline structure of tooth enamel (Zazzo and Saliège 2011).

Radiocarbon dating of enamel is not without challenges. While more durable and less permeable than bone, it can still be influenced by diagenetic carbon. Diagenesis includes all of the processes that involve the interaction between the buried tissues and the fluids that are percolating through the soil matrices that surround it (Hedges 2002; Kendall et al. 2018). Extrinsic and intrinsic factors both play a role in the direction and intensity of contamination.

Extrinsic factors linked to diagenetic changes include pH, temperature, microbial activity, pressure, and degree of saturation of the solution. Intrinsic factors connected to the physical properties of bioapatite include the size of crystals within the mineral matrix and the solubility and porosity of the bone. Sources of contamination within the burial environment concern both the mineral and organic phases. Tooth enamel is 97% mineralized, and organic carbon is only available in very small amounts, making large enough samples for laboratory analyses important even with accelerator mass spectrometry (Weinmann et al. 1942). Because the majority of enamel is mineral, I will briefly discuss the two modes of alteration that mineral carbonate can undergo *in situ*. Secondary minerals such as calcite can precipitate into the pores of bones and

enamel. Other factors include the isotopic exchange between the enamel's structural carbonate and the dissolved inorganic carbon in groundwater and the dissolution and reprecipitation of apatite, given appropriate pH conditions within the soil. If sufficient carbon is preserved in only some of the teeth sampled, I refined the relative chronology of mortuary practice at La Consentida by comparing successful dates with associated contexts and stratigraphic relationships. This method has been used previously in anthropological and paleontological studies (Chatters et al. 2014; Cherkinsky et al. 2013).

CHAPTER FOUR:

RESULTS

Radiocarbon Dates

Results of Radiocarbon Dating and Measurement by AMS

The nine teeth were submitted to DirectAMS for Accelerator Mass Spectrometry radiocarbon dating. The teeth were visually examined to determine the amount of enamel left intact from the previous isotope analysis. Nine teeth of sufficient weight were selected to be sent to the DirectAMS laboratory for dating. The uncalibrated dates were provided by the lab and are summarized in Table 2. The dates were calibrated in Oxcal Online using INTCAL20 to 2 σ confidence interval (Bronk Ramsey 2021; Reimer et al. 2020). The results of the calibration are illustrated in Figure 3. The dates for the individual burials are presented and discussed below. The dates from the mortuary complex are discussed in isolation and in relation to other dated contexts from La Consentida. Other dates included here for analyses include shell and charcoal dates taken from a probable feasting midden at the site, collagen samples from B12-I14, and carbon-rich sediments taken from hearths.

Burial Chronology at La Consentida

The individuals from burials discovered at la Consentida so far are discussed here divided by their context and by their absolute dates provided by this study from earliest to latest. The burials from LC09B are discussed first,

followed by the burials from LC12A. All dates discussed here use a 95.4 confidence interval and are reported with both 95.4% and 68.3% intervals (Figure 3).

The individuals from burials so far discovered at la Consentida are discussed here divided by their context and by their absolute dates provided by this study from earliest to latest. The burials from LC09B are discussed first followed by the burials from LC12A. All dates discussed here are reported with both 95.4% and 68.3% intervals. Individual B3-I4 had enamel, which dates to 1500–1320 BCE and was the deepest burial sample for this study in OP LC09B. Individual B4-I5 had enamel that was dated to 1500–1320 BCE. And Individual B1-I1 provided an enamel sample which dated to 1400–1210 BCE. Individuals B3-I4 and B4-I5 have radiocarbon dates that overlap to a significant degree. The three samples together give us an absolute date range for the LC09B mortuary space of 1500–1210 BCE.

The dates from LC12A start with Individual B6-I8 provided an enamel sample, which was dated to 1430–1230 BCE. Individual B10-I12 was dated to 1400–1210 BCE. Individual B5-I6 enamel dated to 1215–1016 BCE. Individual B8-I10 dated to 1125–933 BCE. Individual B12-I14 provided enamel dated to 1050–890 BCE. Individual B6-I7 provided enamel dated to 990–830 BCE. These samples provide a date range for the LC12A mortuary space of 1430–830 BCE. Immediately, the dates provide ranges for the two mortuary spaces that indicate that LC09B may have been in use slightly earlier than LC12A. However, LC12A was used

concurrently with LC09B and continued to be used later into La Consentida's occupation.

Table 2 Reported DirectAMS Radiocarbon Dates

DirectAMS Code	Submitter ID	Sample Type	pMC	1 σ error	BP	Radiocarbon 1 σ error
D-AMS 046585	B1-I1	tooth (enamel)	68.51	0.21	3038	25
D-AMS 046586	B3-I4	tooth (enamel)	67.47	0.22	3161	26
D-AMS 046587	B4-I5	tooth (enamel)	67.53	0.23	3154	27
D-AMS 046588	B5-I6	tooth (enamel)	69.51	0.24	2922	28
D-AMS 046589	B6-I7	tooth (enamel)	70.84	0.21	2769	SS24
D-AMS 046590	B6-I8	tooth (enamel)	68.16	0.28	3079	33
D-AMS 046591	B8-I10	tooth (enamel)	69.94	0.21	2872	24
D-AMS 046592	B10-I12	tooth (enamel)	68.49	0.23	3040	27
D-AMS 046593	B12-I14	tooth (enamel)	70.49	0.23	2809	26

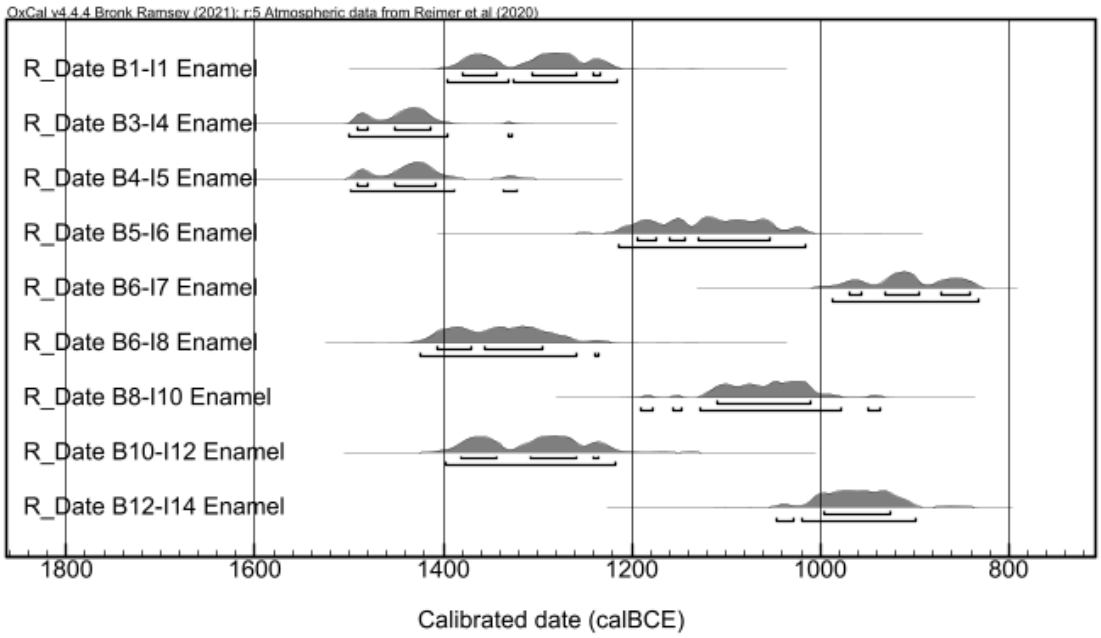


Figure 3 Calibrated Dates from Tooth Enamel Samples

Radiocarbon Dates from La Consentida

The total radiocarbon dates for La Consentida are presented here, including the nine enamel samples and two carbon-rich sediment samples submitted for AMS analyses as part of this study. Additionally, four shell, four charcoal, one wood carbon, four carbon-rich sediment and one bone collagen dates are included from other studies at La Consentida (Hepp 2019a; Powell 2020). The dates are illustrated in Figure 4. The ranges in blue are dates from tooth enamel, the ranges in red derive from the shell, and the green is from the traditionally dated material. Several interesting points are visible in the data presented in Figure 4. The enamel dates are younger than all the other dates

from the site. The shell dates, while clustering closer to the traditional charcoal and collagen dates, show a significant variance from the midden deposit with the date from Shell 1 of 3780–3630 cal BCE. One sample collected from a domestic building in OP LC12 G, referred to as Carbon Rich Sediment 4, has been dated to the Middle Formative Period 750– 410 cal BCE. Hepp (2019) considered the date suspect based on shallow deposition and possible post-depositional contamination. The enamel sample provided by B12-I14 is reported at 1050-890 Cal. BCE (95.4%), while the bone collagen collected from B12-I14's femur has previously been dated to 1690-1530 Cal. BCE (95.4%). The case for the rejuvenation of the bioapatite samples is further explored below.

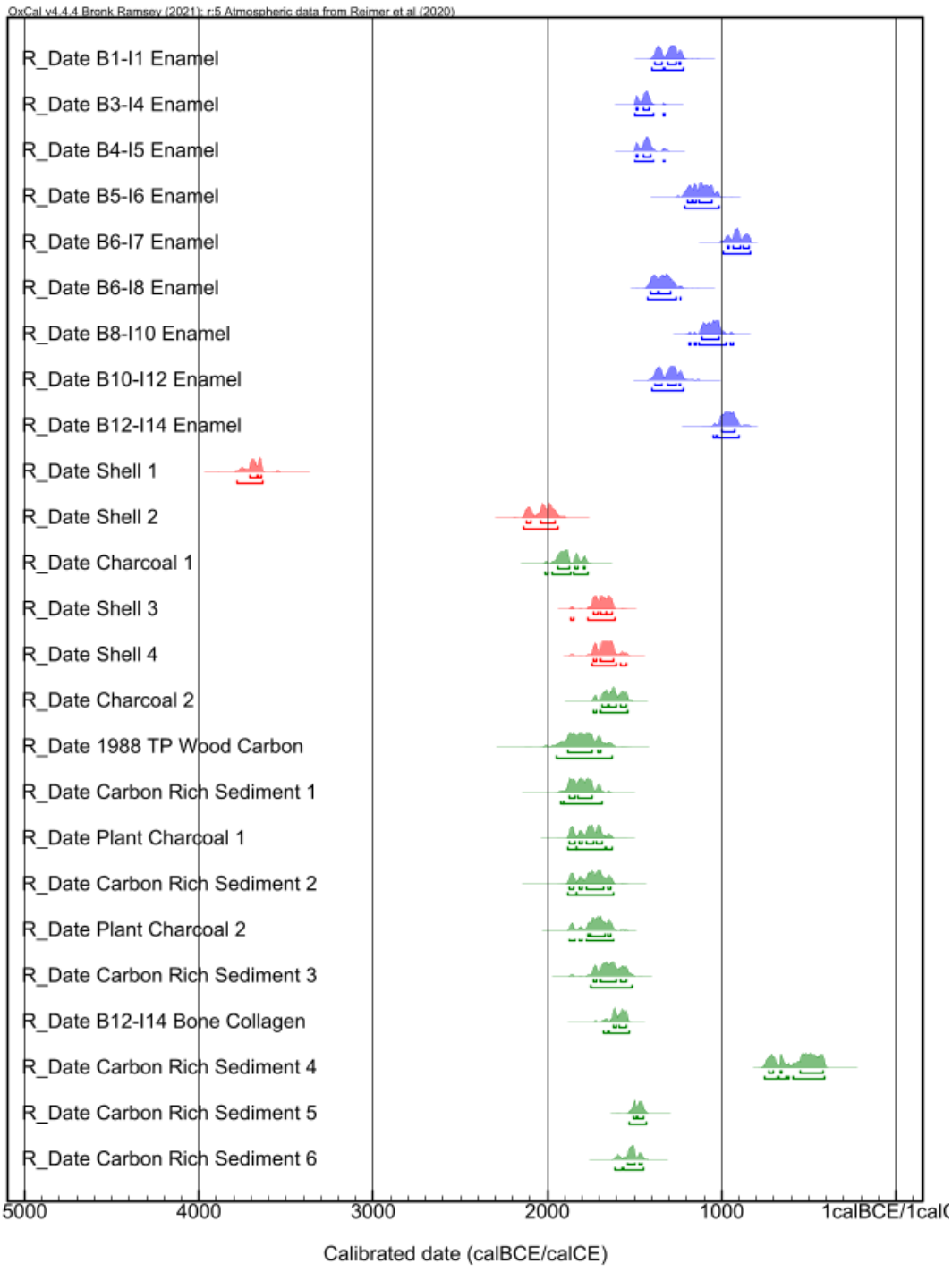


Figure 4: Calibrated Dates From la Consentida. Blue ranges are Enamel Samples Submitted for this Thesis; Red Ranges are Shell Dates from Powell (2020), and Green Ranges are Traditional Materials (Wood, Charcoal, Carbon-Rich Sediment) that Produce more Reliable Dates (Hepp 2019a).

La Consentida Antiquity and Bioapatite Rejuvenation

As previously stated, bioapatite was selected for directly dating the individuals buried at La Consentida due to the poor preservation of some of the human remains found so far at the site. There are, however, two dates from B12-I14 that were calibrated using Oxcal R_Combine to produce a direct date for that individual, resulting in an estimated age of 1690–1530 cal BCE (95.4%). This same individual was dated via enamel bioapatite by AMS and calibrated using IntCal20, producing an estimated age of 1050–890 cal BCE. The two date ranges provided by two different samples, derived from two different materials sampled from a single individual, produced a range of dates separated by 630 years. This difference in dates would potentially place B12-I14 in the Middle Formative Period instead of the Early Formative Period chronology previously established at the site (Hepp 2015, 2019a, 2019c). Due to this discrepancy, I suggest calibration for dating bioapatite samples must be developed before the widespread use of the method is adopted further in archaeology. The most traditional methods and materials of dating already in use at the site are explored below to add further weight to this determination.

In addition to the charcoal, wood, and carbon-rich sediment samples included in Figure 4, three additional lines of evidence articulate with the secure radiocarbon dates from La Consentida. These include obsidian sources imported by the community at La Consentida, pottery production, and ceramic styles employed. These lines of evidence demonstrate the site's antiquity and indicate

the mortuary spaces are contemporaneous with the site, rather than post-dating it as the enamel samples suggest.

Obsidian samples were collected at La Consentida in 2009 from fill, redeposited midden, and burial fill contexts as well as dated hearths. Forty obsidian flakes were selected for X-ray Fluorescence (XRF) analysis to determine the sources for obsidian tools. The sources of obsidian and their occurrence ratios within the sample were compared to other early village sites throughout Mesoamerica. La Consentida's obsidian sources indicated a greater emphasis on imported material from Guadalupe Victoria as opposed to material from Paredón, a noted source of higher quality obsidian used by Highland Oaxaca communities during the transition from the Early to Middle Formative (Blomster and Glascock 2010; Hepp 2019c; Joyce et al. 1995)Hepp (2019c) noted that the obsidian's sourcing is consistent with the established Early Formative Period date at La Consentida.

Finally, I will discuss the Tlacuache ceramic assemblage at La Consentida and its associations with the mortuary spaces and the secure dates positioning the assemblage securely in the Early Formative Period. In Pacific coastal Mesoamerica, the Soconusco region's Barra phase (1900–1700 cal BCE) is generally accepted as the earliest pottery (Clark and Blake 1994). According to prior research in Oaxaca, the earliest evidence of pottery comes from the Tierras Largas (1650–1500 cal BCE) phase, including Red-on-Buff horizon ceramics (Flannery and Marcus 1994). Tlacuache pottery appears to predate Tierras

Largas by two or three centuries and may represent the earliest ceramics in Oaxaca (Hepp 2015, 2019c). While contemporaneous with the Barra phase ceramics, Tlacuache ceramics vary in their ratios of ceramic forms, possessing more similarities to the Tierras Largas phase. The Barra phase vessel forms emphasize phytomorphic tecomates much more than the Tlacuache and Tierras Largas Phases. The Tlacuache assemblage consists mainly of jars, bowls, and bottles, differentiating it from its contemporary. Tecomates, while occurring at La Consentida, are rare rather than making up the bulk of the assemblage as they do in the Barra phase.

Tlacuache and Tierras Largas vessels, while similar in form, differ from each other in significant ways. The Tlacuache assemblage presents a higher percentage of bottles and tecomates than the Tierras Largas assemblage. Decoratively, the Tlacuache ceramics appear to lack the red-painted interiors and rocker-stamped exteriors of some Tierras Largas ceramics, while both assemblages exhibit the red paint used for exterior decoration (Hepp 2019c). Hepp noted that the similarity between the Tlacuache and Tierra Largas phases is greatest in the generic types of vessel forms found in early ceramics of central and western Mesoamerica rather than those of diagnostic forms (2019c). The data presented above demonstrates that the ceramics of the Barra, Tierras Largas, and Tlacuache phases all differ significantly and are to be assigned to specific assemblages in time and space. The ceramic data I turn below is of

particular importance to this thesis, as well as the discussion of the likely rejuvenation of the enamel samples from La Consentida.

Grater Bowls and Their Context at La Consentida

A specific class of ceramics found at La Consentida, grater bowls, are present in various forms, from rounded conical bowls with flat bottoms and conical bowls with pouring spouts to square and semispherical bowls. The two most complete bowls were recovered as offerings with two child burials (Hepp 2019c; Hepp et al. 2017, 2020b).

Figure 5: Incomplete Grater Bowl Found with B9-I11. Hepp et al., 2017

The first grater bowl (Figure 5) was discovered with Burial 9, Individual 11, approximately 108–128 centimeters below the surface. The B9-I11 individual was determined to have been three to four years of age at death. Individual B9-I11 is the third individual in the overall burial sequence from Op. LC12A, above B12-I14. This grater bowl was incomplete and fragmentary. The second grater bowl (Figure 6) was complete and discovered with Burial 11 Individual 13 approximately 147–170 centimeters below the surface. B11-I13 was estimated to be two to four years of age at death. This individual was the first in the Op. LC12A burial sequence just below B12-14. These two burials with Tlacuache ceramics are securely dated to the Early formative Period by production method and stylistically with ceramics in dated contexts bracket B12-I14 in space and possible time (Figure 2). This suggests that B12-14 could not have been a Middle Formative burial, as the enamel bioapatite dates might appear to suggest.

The evidence presented here indicates that B12-I14 and the other bioapatite samples are rejuvenated by as much as 600 to 700 years. The direct dates provided by collagen for B12-I14 and the burial contexts of both B9-I11 and B12-I14 and their associated ceramics indicate that significant rejuvenation of the bioapatite has occurred as Zazzo and Saliège have warned previously (Zazzo and Saliège 2011).

Figure 6: Complete Grater Bowl Found with B11-I13. Hepp et al., 2017

Mortuary Data

In this section, I present the compiled mortuary data from La Consentida and four other sites in Oaxaca. The data presented in the following paragraphs include the variables of body position, orientation, burial type, sex, and age. Following previously established field standards, these variables are defined below (Buikstra and Ubelaker 1994). Comparisons are drawn from the available data published for the sites of Santo Domingo Tomaltepec, Cerro De La Cruz, Yugüe, Río Viejo, and La Consentida, covering coastal and highland valley Oaxaca as well as diachronic and synchronic comparisons.

San Sebastian Etla Mortuary Data: The mortuary space at San Sebastián Etla contained the remains of forty-two individuals from forty-one mortuary deposits. No architectural features were identified in the area. Thirty-four primary inhumations were uncovered, along with six secondary burials. No difference in mortuary treatment between the primary and secondary burials was found besides the disarticulated and incomplete nature of the secondary burials. The team determined that the forty adults identified represent a contemporaneous use of the mortuary space, while the two infants dated to later reuse of the site based on spatial and stratigraphic analysis. Eighteen of the forty adult Interments contained burial offerings, 3 of which included more numerous offerings, leading the researchers to infer relatively higher social status held by those individuals. Two of the three high-status individuals were female, and one was of indeterminate sex due to preservation. Eleven of the forty adult inhumations were oriented east-west in an extended position.

Demographic data from San Sebastian Etla indicate an exclusive mortuary space for the Interment of adults (N=40; 100%) from the community. As stated previously, the only two interred individuals who were not adults were one child and one infant, who were buried during the repurposing of the site. The population of probable sex determinations consisted of twenty indeterminate individuals (N=20; 50%), eleven males (N=11; 27%), and nine females (N=9; 22%). Data for the site, however, are sparse, with body position and orientations mostly excluded from the literature. There is a mention of eleven of the burials

being oriented east-west (N=11; 27%). However, without additional data, interpretations, including this site, will be limited.

Santo Domingo Tomaltepec Mortuary Data: The data here are derived from Whalen's (1983) work at the Tomaltepec site in the Valley of Oaxaca's Tlacolula Branch. The mortuary data are based on sixty of the eighty primary burials, complete enough for mortuary analyses. All the primary burials were oriented east-west. For fifty-nine of these, the crania were oriented towards the east in an extended, prone position. Twenty-four (40%) of the interred individuals were determined male, twenty-five (42%) were female, and 30 were of indeterminate sex, including the unanalyzed individuals. Forty-four (73%) analyzed burials were interred in extended positions. Interestingly, fifty-nine (98%) of the analyzed population were buried in the prone position.

Table 3 Santo Domingo Tomaltepec Data

	Interme	Burial	Position	Male	Female	Sex IND	Primary	Seconda	Disturbe	%	% Prone	% Male	%Female
Santo Domingo Tomaltepec	60	E/W	59 prone	24	25	30	60	11	9	73%	98%	40%	42%

Cerro de la Cruz: The excavated areas of Cerro de la Cruz consist of three distinct areas referred to as "A," "B," and "C"(Joyce 1991b). These areas

were separated by the upper terrace wall (UTW), lower terrace wall (LTW), flagstone patio, 11 structures, and 115 buried individuals. Both retaining walls were oriented approximately east-west orientation, separated by 10 meters north-south. The Upper Terrace Wall ranged 0.3 m to 1.7 m higher from its base to the base of the Lower Terrace Wall.

Zone A at Cerro de la Cruz comprises the upper terrace and upper terrace retaining wall. The UTW marks zone A's southern boundary with a flagstone patio, and five stone structures (St1-5) were constructed on the terrace during the Minizundo Phase (400–150 BCE) (Joyce 1991b). The most prominent structure in Zone A is St1, covering 34.3 m^2 and was associated with 48 buried individuals. St2-5 were located west of St1, separated by a granite flagstone patio. Joyce notes that all the elements of Zone A were probably built contemporaneously as the Western wall of St1, the patio, and the eastern-facing contiguous wall of St2-4 are built flush against each other.

Zone B at Cerro de la Cruz comprises the terrace supported by the LTW, the LTW, and structures 6, 7, and 8. St6 is located on the eastern side of the site and comprises a line of granite stones running south from the UTW for 2.7 meters. St7 is located 16.6 meters west of St6, consisting of one wall segment with 2–3 courses of stone (Joyce 1991b). St8 lies 17 m northeast of St7, and its southern foundation comprises the upper course of stones for the LTW. Only 15.5 m^2 was cleared for St8. However, it revealed a complex series of deposits.

These included burned floor debris and burials and a small hearth feature containing charcoal, FAR, and burned ceramic sherds (Joyce 1991b).

Zone C at Cerro de la Cruz comprises Structures 9, 10, and 11. St9 is located south of St8 and consists of a single wall feature that runs nearly perpendicular south for 90 cm off the retaining wall. Although it was determined impossible to determine which side of the wall would have been the interior, no floor surfaces were discovered. Three burials, a small hearth, and three caches were discovered near the eastern side of the wall, however, suggesting that may have been the interior of St9 (Joyce 1991b). Structures 10 and 11 are located south of the LTW at a distance of 3.75 meters. Structure 10 was constructed using two parallel walls running north-south with 1.4 meters between them. Finally, Structure 11 is located 60 cm east of St10 consisting of a single row of stones making a wall oriented north-south with a multiple burial beneath its floor (Joyce 1991b).

Cerro de la Cruz Zone A Mortuary Data: Zone A, as previously discussed, is the uppermost terrace of Cerro de la Cruz, consisting of five structures and a flagstone patio and path. Excavations in Zone A uncovered 72 individuals, 58 of whom were securely dated to the Late Formative (400–150 BCE). Structure 1 (St1) had the most burials associated with it under what remained of a floor and outside the southern foundation wall, and southwestern foundation wall (Aguilar 2010; Joyce 1991b). Within St1 Burial Area 1 (BA1), 21 individuals were discovered, and six burials contained 13 more human remains. Four more burials

containing five individuals were uncovered outside the structure along the southwestern foundation's corner. Burial Area 2 was uncovered outside of the southern foundation of St1 containing nine individuals. One additional individual may have been buried in St1, B35 was located 3 meters east of the structure. Finally, for Zane A, six burials were located north of the UTW. These burials contained nine Interments stacked on each other(Joyce 1991b).

The demographics and the body positions and orientations are presented below. However, it should be noted that the largest subset of the interred population is individuals of unknown sex or age (N=40, 55.5%) and unknown body position (N=33, 45.8%) due to poor preservation and fragmentation of skeletal material. Males comprise the majority of analyzed individuals (N=20, 27.8%) of the Interments in Zone A (Aguilar 2010). Female Interments comprised the minority of interred individuals (N=12, 16.7%). Not surprisingly, most of the interred individuals of unknown sex were adolescents or younger (N=29, 40.3%). The body position of those Interments complete enough for analysis was predominately buried in an extended supine position (N=31, 43.1%), followed by two individuals (N=2, 2.7%) buried extended on their left side, and four (N=4, 5.5%) on their right in an extended position. An additional burial was uncovered in an extended position; however, which side the individual was buried on could not be determined. Finally, in Zone A, one individual was found flexed on their right side (Aguilar 2010; Joyce 1991b).

Despite Zone A consisting of most of the buried individuals at Cerro de la Cruz, there was a near absence of burial goods. Three individuals were each (N=3, 4.16%) discovered with one possible burial offering (Aguilar 2010).

Zone B at Cerro de la Cruz consisted of 20 individuals dating to the Late Formative Minizundo Period (400–150 BCE). Structure 8 was found to have seven burials containing fifteen individuals across six burials and Burial Area 3 (BA3) (Joyce 1991b). Burials eleven, twelve, twenty, and twenty-three in Zone B contained one individual each, while B13 contained four, B22 contained two, and BA3 contained five. The six burials and BA3 were in fill layers separated by four burned occupation surfaces under St8 (Aguilar 2010; Joyce 1991b). The final five burials in Zone B were located west of the foundation wall of St8. The ages of the interred individuals in this zone are predominately children (N=10, 50%), juveniles (N=3, 15%), and one subadult (N=1, 5%). Adults occupied the minority of burials in Zone B with five (N=5, 25%), and Middle Adults (N=1, 5%). Males in Zone A were the minority of Interments (N=2, 10%), followed by females (N=3, 15%) (Aguilar 2010). Most interred individuals could not be identified as either male or female (N=15, 75%). Aguilar notes that this high ratio of indeterminate-sex individuals compared to males and females in Zone B is due to their young age (2010). Body position, orientations, and burial goods for the Zone B interments are examined below.

The body positions for Zone B burials were interred similarly to those of Zone A. Two individuals (N=2, 10%) could not have their burial position declared

due to poor preservation of the skeletal material. Twelve individuals (N=12, 60%) were discovered in extended supine position. Three individuals (N=3, 15%) were found extended on their right side. One individual (N=1, 5%) was found flexed on their left side, while another (N=1, 5%) was found flexed on their back. One (N=1, 5%) final buried individual was found in Zone B in an extended, prone position (Aguilar 2010). In contrast to Zone A's lack of burial goods, five (N=5, 25%) of the buried individuals in Zone B were interred with grave furniture(Aguilar 2010; Joyce 1991b). Based on these data, it seems that Zone B and Zone A were intended for use by two different groups of people occupying Cerro de la Cruz. Aguilar (2010) notes that it appeared that individuals with a higher status were buried under the floor of St8 in Zone C than those buried under St1 in Zone A.

Excavations in Zone C uncovered thirteen burials containing twenty-one individuals. Five burials were excavated from structures 9,10 and 11. The other burials were discovered infill (Joyce 1991b). Young adults (N=5, 23.8%) comprise the largest subset of individuals in Zone C, followed closely by children (N=4, 19%), and adults (N=4, 19%). Juveniles (N=3, 14.3%) and subadults (N=3, 14.3%) (Aguilar 2010). The sex ratio of individuals interred within Zone C is more heavily weighted toward males (N=3, 14.3%) than females (N=1, 4.7%). However, this ratio may be skewed by most interred individuals being of unknown sex (N=17, 81%)(Aguilar 2010; Joyce 1991b). Body depositions for this zone will be summarized below.

In Zone C, the frequency of burial positions that could be determined was more equally distributed than in Zones A and B (Aguilar 2010). The highest frequency of body positions in Zone C was not able to be discerned (N=7, 33.33%), followed by extended right (N=4, 19.05%) and left (N=4, 19.05%). One individual each was interred in an extended position (4.5%) and flexed left (4.5%) and right (4.5%). Grave goods were limited to four instances (N=4, 20%); burial 7 contained three chert axes, and Burials 4 and 8, consisting of three individuals, contained ceramic sherds and one shell (Aguilar 2010; Joyce 1991b).

Rio Viejo Mortuary Data: Two operations at Río Viejo recovered burials dating to the Middle Formative Period Charco Phase (700–400 BCE). Eighteen burials were discovered; however, only Burials 9 and 10 were dated to the Late Minizundo Phase (400–150 BCE). Twenty-one individuals from Early Postclassic burials were recovered, including two (N=2) children buried in flexed positions outside of buildings, two (N=2) adults interred in a multiple burial underneath a patio, and one (N=1) adult male buried outside of a residential structure (Joyce et al. 2001; King 2006). These Postclassic burials at Río Viejo will provide a basis for discussing change through time in Oaxaca. However, they will not be intensely treated in this section as this body of work is more interested in the Formative Period.

Burials 8 and 9 comprised 5 individuals from the Late Formative Period (400–150 BCE). This small sample size may not allow for the most reliable comparison of frequencies between sites in Oaxaca; however, it may be useful

for intrasite comparison through time. One male (N=1, 20%) and one (N=1, 20%) female were identified in the Minizundo Phase burials. Three individuals of indeterminate sex (N=3, 60%) were attributed to a child, juvenile, and young adult. The depositions of the bodies comprised one middle adult and one young adult in extended position on their left side, one middle adult extended on their right side, one child flexed on their right side, and one Juvenile in an indeterminate position on their left side. Four (N=4, 80%) of the five burials were accompanied by burial offerings (Aguilar 2010). Interestingly, the only individual not buried with offerings was the middle adult female. I suspect this is a product of a small sample size.

Yugüe Mortuary Data: The earliest occupation at Yugüe has been dated to the Middle Formative Period Charco Phase (700–400 BCE). The platform at Yugüe and the largest substructure, Substructure 1, were constructed during the Early Terminal Formative Period Miniyua Phase (150 BCE–CE100). Burials at Yugüe were recovered from Areas B and C near Substructure 1 (Aguilar 2010; Barber 2005). In Substructure 1, a communal cemetery dating to the late Chacahua Phase (ca. CE 250) was discovered, and forty-four individuals were recovered. This burial area included numbers eight through forty-three, and all individuals were buried in $7m^2$ (Barber 2005). Two Chacahua Phase burials consisting of 3 (N=3, 6%) individuals outside of Area C. Three Miniyua Phase burials (150 BCE–CE 100) containing one individual each were excavated from the fill of Substructure 1.

Numerous taphonomic processes heavily influenced demographic data derived from the Yugüe skeletal assemblage. Only eleven (N=11; 22%) had a sex determination. Indeterminate sex comprises much of the sample at thirty-nine individuals (N-39; 78%) followed by eight probable females (N=8; 16%) and three (N=3; 6%) probable males. Adults comprised the largest portion of the skeletal collection at fourteen (N=14; 28%) individuals followed by eleven (N=11; 22%) individuals who could not have their ages determined due to fragmentation. Children comprised the third largest group at eight (N=8; 16%) individuals, followed by juveniles at seven (N=7; 14%). The remaining age groups were relatively evenly distributed. These included one (N=1; 2%) perinatal, one (N=1; 2%) subadult, two (N=2; 4%) young adults, three (N=3; 6%) middle adults, and three old adults (N3; 6%) (Aguilar 2010; Barber 2005). This high proportion of unidentifiable skeletal remains was due to two factors. First, the skeletal material was buried relatively shallow. Second, the truncation of previous burials by later ones resulted in damage to and removal of skeletal remains due to the reuse of the cemetery.

Body position and orientation within the Yugüe mortuary space generally adhered to the pattern of adults interred with their heads towards the west, extended and right-side positioning. Juveniles, however, were interred perpendicular to adults but lying on their left side with their heads towards the south. Most Interments were oriented with their heads to the South (N=9; 45%) followed by the east (N=6; 30%) and north (N=2; 10). Interments oriented to the

west (N=1; 5%), southeast (N=1; 5%) and southwest (N=1; 5%) were tied. The Majority of the body positions were unable to be determined (N=33; 66%), followed by Interments that were extended on their left side (N=6; 12%) extended right side (N=4; 8%), unknown body position on their right side (N=3; 6%), extended supine (N=2; 4%), fetal right side (N=1' 2%), and unknown body position left side (N=1; 2%) (Aguilar 2010; Barber 2005). Body position at Yugüe does appear to follow a trend of placing adults north-south and children east-west, a mortuary treatment distinct from La Consentida and elsewhere.

Conclusion

There is an incredibly wide variability in the mortuary treatments in Oaxaca, both within sites and between them. The practices at San Sebastián Etla, for instance, exclusively included adults during the Early Formative Period in a circumscribed area apart from domestic structures. At La Consentida, the prescribed mortuary spaces are separate from the domestic structures during the Early Formative, including three children (N=3, 21%). Cerro de la Cruz and its three distinct zones demonstrate the variability within a single site during the Late Formative with what appears to be a commoner burial space in Zone A, elite burials in Zone B, and household burials in Zone C. In the next chapter, I will discuss how La Consentida fits into the regional mortuary landscape synchronically and diachronically. The data from this chapter is used to conclude potential as yet under-investigated widespread mortuary practices during the Early Formative Period.

CHAPTER FIVE

DISCUSSION AND CONCLUSION

As noted in previous publications, the mortuary data presented above illustrate the diachronic and synchronic changes in burial practices throughout Oaxaca (Barber et al. 2013; Joyce 1991b; Mayes and Joyce 2017). This discussion will treat three topics: the burial traditions at La Consentida and Tomaltapec, demonstrating the antiquity of communal mortuary space use in Oaxaca, and possible distinct burial practices therein. The mortuary practices at La Consentida support the claim that the Cerro de la Cruz burial spaces result from continuous use by the occupants over time and not violent incursions by invading imperial forces from outside the region, such as Zapotecs from Monte Albán. These mortuary treatments and the specific modes of corpse disposal are examined through the lens of corporate identity creation and maintenance. Finally, I will discuss the bioapatite dates and the potential usage going forward specifically in how the dates should be used and potential techniques for mitigating the current shortcomings of the method.

Discussion

Comparative Analysis of Burial Practices in Oaxaca

At La Consentida, there is evidence for the development of a tradition of intentional placement of deceased individuals in specific locations within the site. This cemetery space is unique in time and space in coastal Oaxaca during the Early Formative Period. However, Tomaltepec, an Early Formative period site in

the Valley of Oaxaca, offers an opportunity to examine the similarities in the practices at both sites. Additionally, this examination may offer a glimpse into potential Archaic Period practices.

At La Consentida and Santo Domingo Tomaltepec, the burial spaces are supra-household or removed from the living spaces and other structures (Hepp et al. 2020b; Whalen 1983). Both these two areas have generally consistent burial orientations, with individuals interred east-west. Both Tomaltepec (N=59, 98%) and La Consentida (N=8, 57%) are predominated by prone burials. La Consentida and Tomaltepec have similar distributions in the representation of sexes in mortuary spaces. At Tomaltepec (n=80), the demographics were 31% male, 31% female, and 38%were indeterminate. At La Consentida (n=15), 43% of Interments were male, 29% were female, and 29% were indeterminate.

Similarly, at the site of San Sebastián Etla, a communal mortuary space was discovered dating to the Tierras Largas Phase (Cervantes Pérez et al. 2017). This site is likely more contemporaneous with La Consentida than Santo Domingo Tomaltepec and could provide more insights into the mortuary practices of Early Formative Oaxaca. The mortuary data gathered from the site are sparse, with little detail given on the treatments of the Interments. What is available will be discussed here. It is unfortunate, however, that much of the useful mortuary data is unavailable. The distribution of sexes at San Sebastián Etla is outlined in the previous chapter and interestingly appears similar to that at Cerro de la Cruz's Zone A Mortuary space (Figure 8). Perhaps this points to a burial tradition

at San Sebastián Etla in the Early Formative Period similar in nature to those practiced at Cerro De la Cruz during the Late Formative. Perhaps additional data may become available to investigate further but it is not the focus of this study.

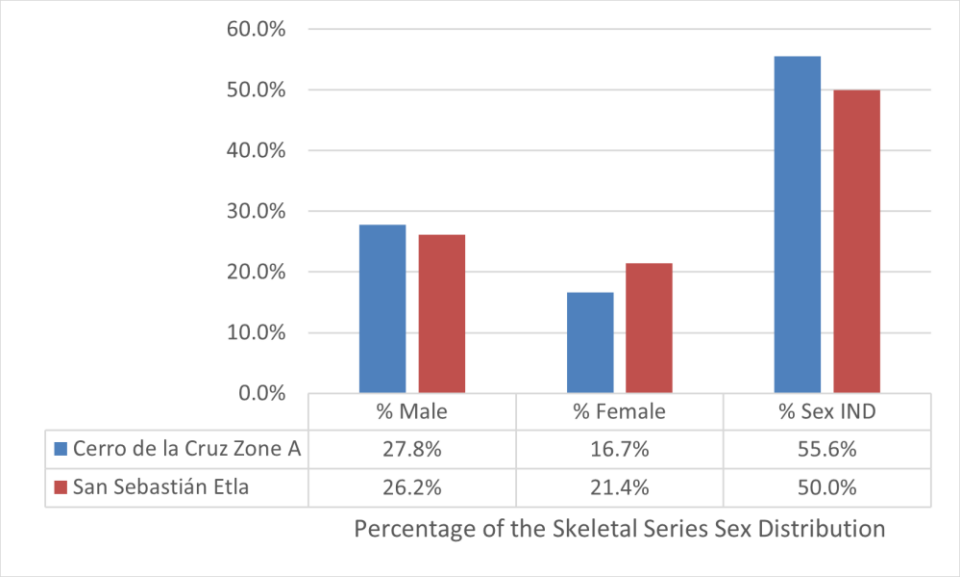


Figure 7 San Sebastián Etla Sex Distribution Compared to Cerro de la Cruz Zone A

An important note on distinguishing the sex of individuals at archaeological sites: individuals that are below the age of sexual maturity will not have a sex assigned. Before sexual maturity, diagnostic skeletal markers of biological sex have not yet developed. Generally, because of this fact, bioarcheologists will not assign sex. Additionally, there are two more confounding variables that may be at play in determining sex and age characteristics. The

second is the physical alteration of the skeletal remains, either pre-or-post-deposition. This can be the product of cultural manipulations, such as cremation, disturbance by excavation for new graves, the Interment of multiple bodies in a single burial event, or natural processes such as bioturbation. Finally, Skeletal remains may be damaged by chemical processes such as burial in acidic pH levels in sediments and the percolation of calcium carbonate via rain or groundwater. This percolation of calcium carbonate will often be distributed in layers onto bony material, which can either, in extreme cases, obscure details, making analysis difficult to impossible, as well as the development of microscopic formations within the bone matrix (Okumura and Eggers 2008).

At La Consentida, we see only four (N=4, 28.6%) individuals of indeterminate sex, three of whom were children. For comparison, at Tomaltepec (Figure 8), the number of individuals of indeterminate sex was thirty (N=30, 38%), and at Cerro de la Cruz, Zone A had 40 (N=40, 55.6%), Zone B had 15 (N=15, 75%), and Zone C had 17 (N=17, 81%) (Figure 9). Similarly, at Yugüe, thirty-nine (N=39, 78%), and at San Sebastián Etla, twenty-one (N=21, 50%) were of indeterminate sex.

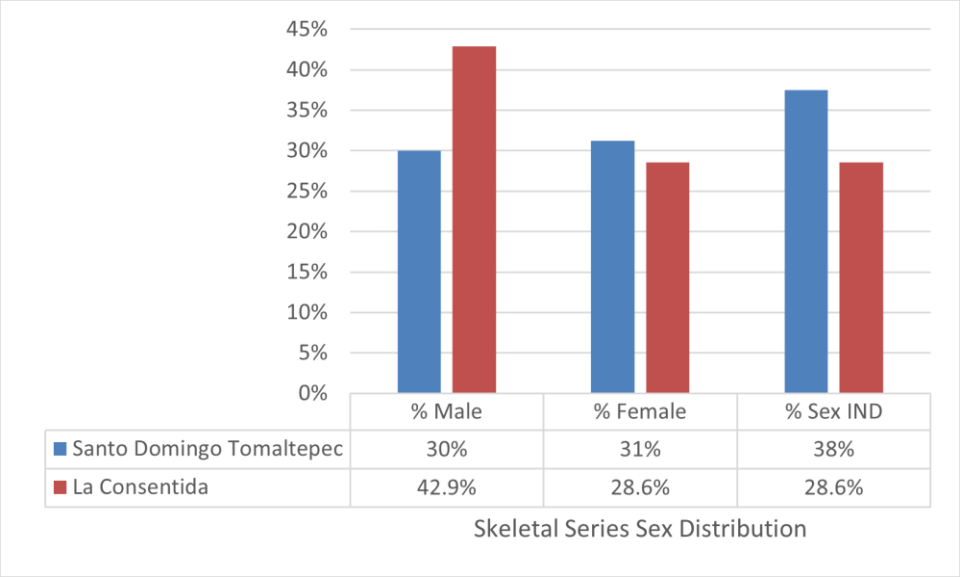
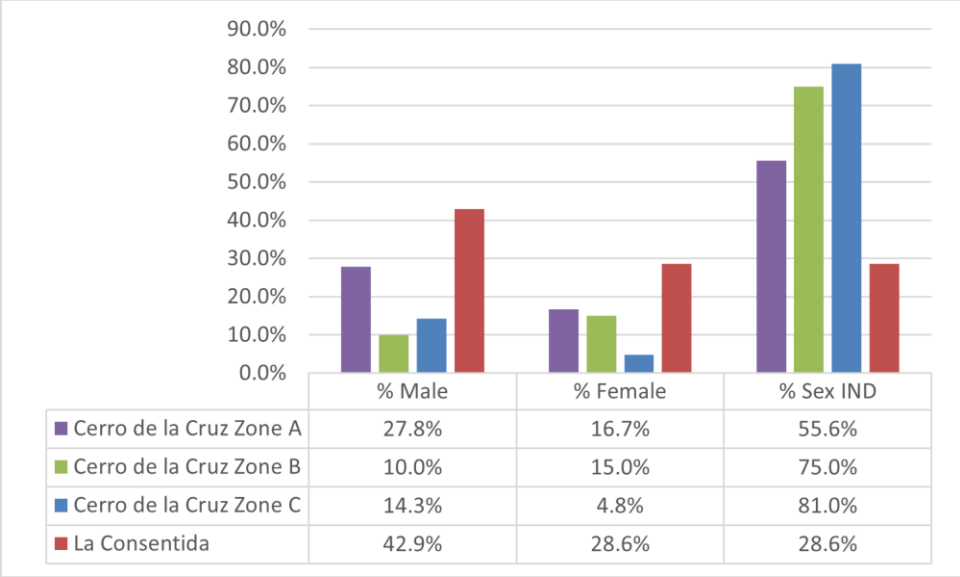


Figure 8 Comparison of Sex Ratios at La Consentida and Tomaltepec

In the La Consentida skeletal sample, three of the four individuals who were of indeterminate sex were children, and one was an adult whose remains were poorly preserved. When controlled for age and adults, indeterminate sex does not drastically change. For instance, Cerro de la Cruz Zone A drops from 55.6% indeterminate sex to 45.8%, while La Consentida drops from 28.6% to 9%.



	% Male	% Female	% Sex IND
Cerro de la Cruz Zone A	27.8%	16.7%	55.6%
Cerro de la Cruz Zone B	10.0%	15.0%	75.0%
Cerro de la Cruz Zone C	14.3%	4.8%	81.0%
La Consentida	42.9%	28.6%	28.6%

Figure 9 Sex Distribution Comparison from Mortuary Areas at Cerro de la Cruz and La Consentida.

Interestingly, where individuals were of indeterminate sex due to fragmentation or disruption, that could indicate repeated use of mortuary areas over time may be a signifier of community identity creation. It seems that throughout Oaxaca, as mortuary practices changed from communal burial areas separated from domestic structures to those located beneath structure floors, the incidence of indeterminate age and sex increased markedly. There may be some connection between the exclusive burial area of the Early Formative Period sites like La Consentida and Tomaltepec. In those early contexts, burial seems to have been relatively open in terms of both eligibility for entry and space for placing graves. Likewise, at Cerro de la Cruz, the Zone A burials within St1 appear to have had more relaxed rules for entry, similar to La Consentida, in that

they contained a similar proportion of subadults and low levels of status distinction. However, the Zone A mortuary space at Cerro de la Crus was physically bounded and Interments are confined to the structure and its immediate surroundings, such as the adjoining patio and outside St1's foundation walls. With so many Interments in St1, the overlapping, disturbing, and truncating of earlier burials was common (Joyce 1991a, 2010; Mayes and Joyce 2017). This practice occurs at nearly all the sites examined for this thesis, although its intensity varies.

Mortuary Practices and Community Identity and Memory at La Consentida

Mortuary archaeology is a lens through which researchers have investigated many hypotheses about past societies (Binford 1971; Robben 2017; Saxe 1971; Ucko 1969). These have ranged from examining social structures based on grave good analysis to regional interaction based on isotope analysis and treatments of marginalized groups (Gregoricka et al. 2014, 2014; Zuckerman 2017). Archaeologists such as Saxe (1971) envisioned mortuary practices as enacted to establish land rites or group entitlement to resources and as a claim to generational occupation of the land. At first glance, this thinking seems more people-centered than processual notions of energy expenditure during social hierarchy maintenance (Johnson 2019). However, it still seems to reduce the motives behind human activity to something akin to biological imperatives.

What we see in the La Consentida mortuary spaces leads me to believe that the area and its constituent parts were a conduit for the creation and

maintenance of group identity and memory formation. Halbwachs (1950) wrote that collective memory is rooted in space, in a specific place in reality. These physical locations resist change by the very nature of their material existence. Halbwachs provides an example of the urban city housing a population whose tastes and beliefs evolve; the people change, and generations come and go. The city remains largely the same, however. The physical spaces in which the bodies were placed at La Consentida and other cemeteries throughout Oaxaca may have met the social needs for a physical location for rooting memory and identity. I assert that the La Consentida mortuary space is a cemetery for creating group identity and collective memory. I support this claim with mortuary evidence from Santo Domingo Tomaltepec and other sites in Oaxaca.

The mortuary space at La Consentida created community identity by demarcating a specific space where group history, memory, and unifying identity could be relived in daily practice. The uniformity in burial treatment, grave layout, and continued use through time are testament to this. At Santo Domingo Tomaltepec in the Valley of Oaxaca, similar burial treatments were practiced, albeit on a larger scale. Sixty individuals there nearly mirror those interred at La Consentida in their burial treatment. The east-west orientations, predominantly prone body position, and relatively modest burial offerings are all consistent between these two sites. Disruption of previous burials for the Interment of later ones indicates identity and memory creation and maintenance.

Radiocarbon Dating Bioapatite

This work has fallen short of addressing one of the thesis's aims: producing a refined chronology for the mortuary space at La Consentida. The AMS dates from the nine teeth do not correspond to the relative chronology established at the site (Table 4) (Hepp et al. 2017). Despite the AMS dates falling short of expectations, interesting opportunities for potential prescreening and calibration methods emerged.

Table 4 Burial Chronology Sorted from Earliest to Most Recent BCE According to Enamel Dates. Relative Chronology Indicates the Relative Position of the Burial, with the Lowest Numbers Being Closest to the Bottom.

Individual	Enamel Dates 95.4	Uncalibrated	Relative Chronology
Burial 3, Individual 4	1501-1328	3161	10
Burial 4, Individual 5	1500-1322	3154	11
Burial 6, Individual 8	1425-1236	3079	5
Burial 1, Individual 1	1396-1217	3038	8
Burial 10, Individual 12	1389-1217	3040	13
Burial 5, Individual 6	1215-1016	2922	12
Burial 8, Individual 10	1125-933	2872	4
Burial 12, Individual 14	1047-899	2809	2
Burial 6, Individual 7	987-833	2769	6

The date ranges provided by two different samples, derived from two different materials sampled from a single individual, produced a range of dates separated by 630 years. If accepted, the more recent dates would potentially place B12-I14 in the Middle Formative Period instead of the more solidly built

Early Formative Period chronology already established at the site. The Middle Formative placement of B12-I14 does not make sense when following any lines of evidence explored here and in Chapter 4. All ceramics, obsidian sourcing, figurine, isotope, and radiocarbon analyses completed to date have secured that determination (Hepp 2019c, 2019a, 2022; Hepp et al. 2014, 2017). To avoid these issues in the future, prescreening should be widely adopted, and pretreatments further refined.

Pretreatment methods have been tested for enamel bioapatite dating, advocating for mechanical grinding of samples before leaching with acetic acid (Wood et al. 2016). Wood and colleagues found that the mechanical grinding of the enamel bioapatite removed the carbonate contaminates on the crystallite boundaries within the enamel samples. The rodent teeth used for their study were dated beyond the limit of radiocarbon dating (ca. 50 kya). Following standard hand grinding and experimental mechanical grinding, the samples produced ages of c.20 kBP for hand-ground material and c.30 kBP (Wood et al. 2016). The authors argued that their method substantially increases the efficacy of carbonate removed during leaching. However, not all the contaminants were removed, resulting in significant errors in dating. These authors concluded that tooth bioapatite dates should be considered the minimum age for archaeological study.

Pretreatment is another avenue for mitigating potential errors when using bioapatite for radiocarbon dating. Research has been conducted using

spectrometry to establish baseline levels of material-specific parameters in bone, dentin, and enamel (France et al. 2020). These parameters would be used to compare archaeological samples against modern control samples. The specific technique, attenuated total reflectance Fourier transform infrared spectroscopy (ATR-FTIR), is purported to be minimally destructive, usually less than 1 mg for a sample, and relatively fast. The sample undergoing ATR-FTIR analysis reflects incoming infrared radiation at the interface between the sample and a crystal with a high refractive index. The resulting spectra indicate specific molecular bonds within the sample (France et al. 2020). The spectra are examined to establish their peak heights compared to established baseline ratios of specific molecular bonds. France (2020) and colleagues note the most common ratios for consideration of bioapatite preservation where the infra-red splitting factor (IRSF), rations of B-type and A-type carbonate substitutions to phosphates (BPI and API), carbonate/phosphate ratio (C/P) and carbonate/carbonate ratio (C/C).

The research using ATR-FTIR has resulted in creating an index of peak heights for these molecular bonds against which future samples may be tested for contamination. The C/P ratio was determined to be the most distinctive and sensitive peak height for separating well-preserved from poorly preserved material. However, there is one problem: the library or index of these peak heights is relatively small for enamel bioapatite. This means that more samples need to be analyzed and contributed to the preservation index. This may be an interesting direction for future work with the samples from La Consentida, as

even faunal material can be examined to determine a baseline for potential carbonate contamination at the site.

Finally, I propose a potential stop-gap measure until a specific calibration can be achieved for AMS analyses or the preservation index for prescreening is robust enough for large-scale archaeology adoption. This simple calibration comes with caveats in that there needs to be some trusted dates from the site, as is the case for the Lower Río Verde Valley. Using OxCal online, I Calibrated the dates from the enamel samples and entered them along with the previous dates gathered from the site. OxCal calculated the Median date of each date range from a sample at the 95.4 confidence interval (Table 5). I then found the mean of the median dates for each category (the traditional materials, enamel, and shell). I then found the difference between the shell dates and the traditional materials, as well as between the enamel dates and the traditional dates. The difference between the traditional materials and the enamel and shell can be found in the third column of Table 5. With one outlier of carbon-rich sediment 4 removed from the traditional materials, the mean age of the traditional samples was 1678 BCE. For the non-traditional samples, the mean dates for the enamel were 1206 BCE, and 1793 BCE for shell. The difference in averages for traditional materials and tooth enamel was 376 years before removing the outlier and 472 years after the outlier was removed. The difference between the traditional materials and the shell dates came 685 years.

Table 5 Comparison of Median Dates at 2-σ from Traditional Materials Used in Radiocarbon Dating, Enamel Bioapatite, and Shell.

Sample	Median Date	Minus Outlier	Difference of averages	Difference with Outlier Removed
Carbon-Rich Sediment 1	-1800			
Carbon-Rich Sediment 2	-1740			
Carbon-Rich Sediment 3	-1640			
Carbon-Rich Sediment 4	-530			
Carbon-Rich Sediment 5	-1480			
Carbon-Rich Sediment 6	-1520			
1988 TP Wood Carbon	-1800			
Plant Charcoal 1	-1760			
Plant Charcoal 2	-1620			
Charcoal 1	-1890			
Charcoal 2	-1620			
B12-I14 Bone Collagen	-1590			
Traditional Materials Avg.	-1582.50	-1678.18		
B1-I1 Enamel	-1300			
B3-I4 Enamel	-1440			
B4-I5 Enamel	-1430			
B5-I6 Enamel	-1120			
B6-I7 Enamel	-910			
B6-I8 Enamel	-1340			
B8-I10 Enamel	-1060			
B10-I12 Enamel	-1300			
B12-I14 Enamel	-960			
Enamel Avg.	-1206.67		-375.83	-472.52
Shell 1	-3690			
Shell 2	-2020			
Shell 3	-1690			
Shell 4	-1670			
Shell Avg.	-2267.5	-1793.33	-115.15	-685.00

Based on the above data, I propose a regional correction for enamel bioapatite radiocarbon dating in the Lower Río Verde Valley. For this correction of the enamel dates at La Consentida, I have taken the differences between the means of the enamel samples and the trusted samples from the site. This difference shows that the average enamel date is 472 years younger than our traditional samples' average. This will be the lower boundary of the calibration. I then calculated the difference between the two dates recovered from the same individual at the site. The dated samples in question include the two human bone samples previously processed together using R_combine to establish a single direct date on human remains from B12-I14 (Hepp 2019a), and the enamel date from the same individual produced for this thesis. This difference gives us the upper boundary of our estimated calibration range. The suggested calibration is approximately 630–472 radiocarbon years older than the bioapatite samples from La Consentida and potentially the Lower Río Verde Valley. Hopefully, this can be useful for correcting the tendency for bioapatite dates to underestimate the ages of mortuary deposits.

Conclusion

Collective memory and identity formation can be seen at La Consentida by interrogating the mortuary data. The reuse of the space and the stability of the mortuary practices through site occupation are testaments to this. The data show a mortuary tradition in the Early Formative, distinct from the sub-floor and bell-shaped pit burials seen elsewhere in Oaxaca. Communal mortuary space and

supradomestic contexts with specific burial treatments, such as prone body position, typify the tradition. Specifically, these treatments include relatively modest offerings, east-west orientation, and prone body position. More data from additional Early Formative sites will hopefully bear this out. However, I am concerned that much of these data are lost or have yet to be recovered, following Flannery's observation in the Introduction to Whalen's 1981 work that "one wonders how many others have been missed," as Tomaltepec's cemetery was found outside of the surface level ceramic scatter. Incidentally, this also has implications for the reliance on surface surveys to estimate population levels in the Early Formative.

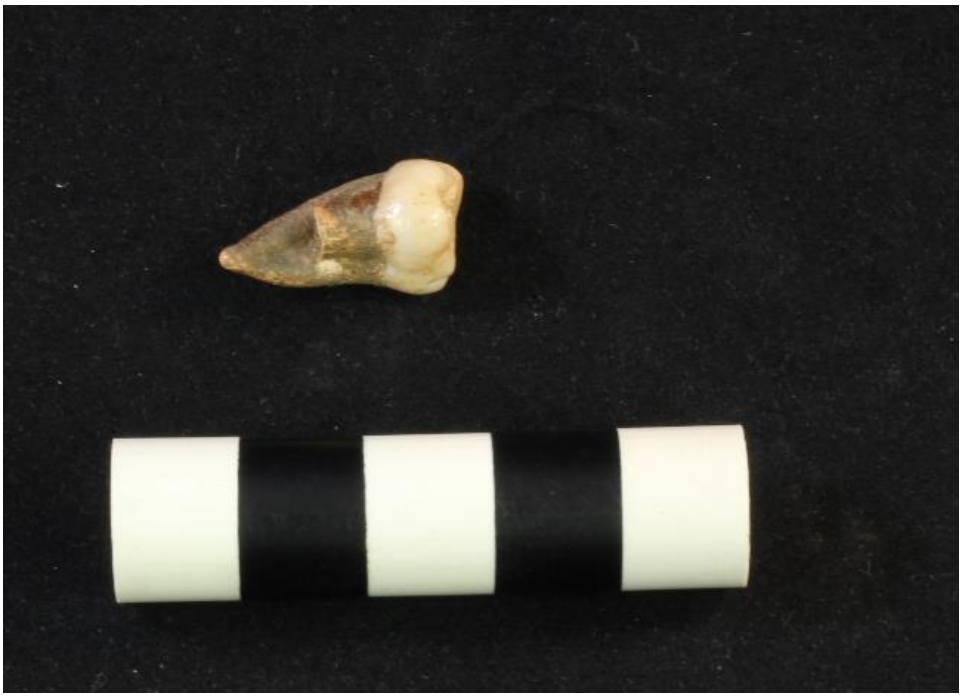
Direct radiocarbon dating of the individuals buried at La Consentida has proven to be more of a challenge than I anticipated despite the previous difficulties in dating collagen at the site. The dates are younger than the other dates that have been taken from the site, which was consistent with the literature on bioapatite samples. The responses to the younger dates provided by enamel seem to suggest two directions a researcher may proceed in. First, utilize the data as purely minimum dates for mortuary deposits and the site or, second, prescreening for contamination levels at the site. While purification and pretreatment methods have progressed, they still lead to underestimated dates by a large margin. In response to this problem, I tried to develop my calibration method for use under the specific circumstances operating at La Consentida. I was very lucky to have the reliable collagen date from B12-I14 on hand; without it, I don't think this would have been

possible. The resulting calibration range of approximately 500 years older than bioapatite radiocarbon dating at La Consentida is recommended.

APPENDIX A:

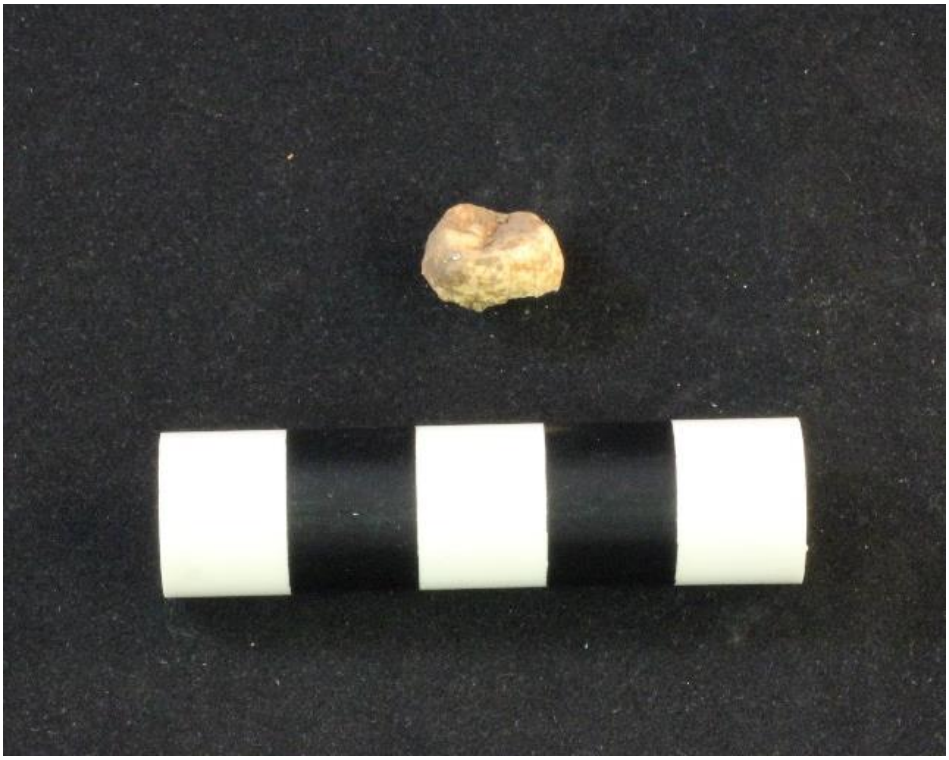
SAMPLED TEETH PHOTOGRAPHS

Attached here are photographs of the nine teeth selected for radiocarbon dating for this study. General observational notes on condition, dental pathology and field designations by Dr. Guy Hepp are provided.



B1-I1 LLM2

B3-I4 LLM3



B4-I5 ULM3

B5-I6 URM1

B6-I7 LLM3

B6-I8 LLM2

B8-10 LLM3

B10-I12 LRM2

B12-I14 LLM2

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