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FAUNAL SUBSISTENCE STRATEGIES AMONG INITIAL PERIOD COASTAL FISHERS AT THE GRAMALOTE SITE IN THE MOCHE VALLEY OF PERU

by

Rachel C. McTavish

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ABSTRACT

FAUNAL SUBSISTENCE STRATEGIES AMONG INITIAL PERIOD COASTAL FISHERS AT THE GRAMALOTE SITE IN THE MOCHE VALLEY OF PERU

by

Rachel C. McTavish

The University of Wisconsin-Milwaukee, 2013
Under the Supervision of Professor Jean Hudson

This faunal analysis focuses on vertebrate remains from the northern coastal site of Gramalote in the lower Moche Valley of Peru. Gramalote dates to the Initial Period (1800-900 BC), a time of great change due to a rise of inland agricultural and increasing sedentism. This intrasite analysis of fauna at Gramalote seeks to contextualize potential subsistence shifts through time. Subsistence specialization regarding fish exploitation of coastal fishers is explored through faunal analysis of vertebrates at this site. For an ecological perspective, this project examines the application of Moseley's Maritime Foundations of Andean Civilization and Optimal Foraging Theory models.

The sample analyzed comes from a stratified unit Unit 18A, resulting from the 2005 excavations at the site directed by Jesus Briceño Rosario (Briceño and Billman 2008). The total sample consisted of 22,940animal bones, of which 14,542 are the focus of this analysis. To understand possible chronological shifts in the importance of fish, three questions were examined. How does the vertebrate composition by class compare between the 2005 sample and the data previously reported by Pozorski? For Unit 18A, does the relative importance of fish steadily increase over time? How can we add the variable of depositional context to our evaluation of change over time?

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Thanks to my family's unending support, in particular my parents' never-wavering belief in my abilities helped me to continue to work towards this project, no matter what hard life lessons rocked my confidence. My friends, as a second family, were extremely helpful in keeping me on target by providing many opportunities for caffeine, sweets, encouragement, and kicking me out of the archaeology lab by midnight.

Dan Shea was easily been one of the most influential people in my life; his was a close mentor to me and is an integral part of my academic career. His abilities to tell vivid stories from field, lab, and teaching experiences guided and inspired me in pursuit of archaeology. His continued guidance and encouragement throughout this process will never be forgotten. This thesis is humbly dedicated to his memory.

CHAPTER 1: INTRODUCTION

The site of Gramalote is located along the northern coast of Peru (Figure 1.1) and includes well-stratified deposits that span a significant time of change in coastal subsistence practices. Calibrated AMS dates for the stratigraphic unit analyzed here represent a range between 1610-1410 B.C. (Hudson et al. 2012). This date range places Gramalote within the Initial Period, 1800-900 B.C., (Figure 1.2). The Initial Period is when ceramics are first present in the local archaeological record, and it is associated with increasing agricultural intensification at inland sites (Moseley 2001; Wilson 1999). This is of particular significance because as new subsistence practices developed in the inland valleys, existing practices along the coast may have been affected. Faunal remains can provide valuable information about the nature of such changes.

This study examines a sample from a vertebrate faunal assemblage excavated at Gramalote in 2005 under the direction of Peruvian archaeologist Dr. Jesus Briceño Rosario as part of a salvage project (Briceño et al. 2006). The research had logistical support from a heritage non-profit, MOCHE Inc, supervised by Dr. Brian Billman of the University of North Carolina, Chapel Hill. This assemblage is curated by the Peruvian INC (Instituto Nacional de Cultura del Péru) in their storage facility at Huaca El Dragon in Trujillo, Peru. My data consist of faunal remains from Unit 18A, a 2.5 x 2.5 meter unit. This unit was excavated to sterile reaching a total depth of 1.4 meters (Briceño 2006 et al.; Briceño and Billman 2008). The vertebrate sample on which this thesis is based consists of a total NISP of 14,542 remains identified to taxonomic class. The combination of a large sample of vertebrate remains with a well-dated stratigraphic sequence allows for an evaluation of subsistence patterns through time at Gramalote.

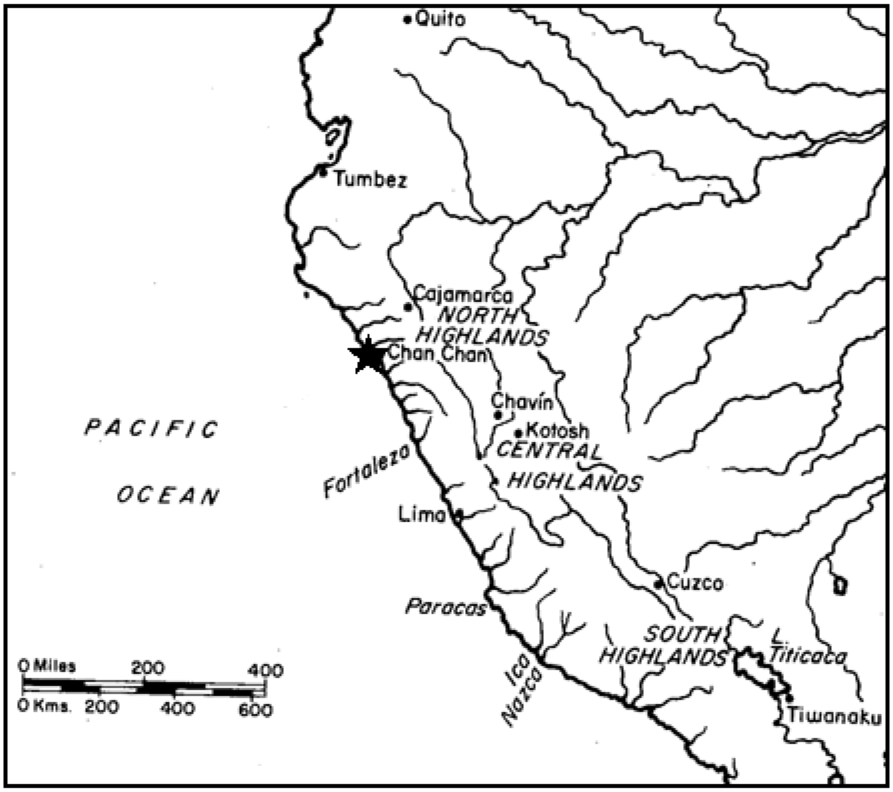


Figure 1.1 Map of North coast Peru, adapted from Moseley 2001:22. The site of Gramalote is indicated with star.

Since it was first surveyed by C.M. Hastings in 1973 as part of Harvard's Chan Chan—Moche Valley Archaeological Project (CCMVP), the site of Gramalote has been the focus of several Initial Period subsistence studies (e.g., Pozorski 1976; Pozorski and Pozorski 1979; Hudson et al 2012). Shelia Pozorski excavated at Gramalote as part of her dissertation research in association with CCMVP (Pozorski 1976; Pozorski and Pozorski 1979; Moseley and Macky 1970). Pozorski's analysis (1976) integrated vertebrate, invertebrate and paleobotanical remains at Gramalote and nine other sites. One goal of her research was to create a regional interpretation of subsistence. Her analysis resulted in the first reported radiocarbon dates and midden analyses for Gramalote. As part of her interpretation, she proposed the potential for a trade network linking coastal fishing groups with inland agriculturalists during the Initial Period

(Pozorski 1976). Her analysis incorporated invertebrate and vertebrate remains to gain insight to overall site subsistence strategies. During her analysis, shellfish was a higher-ranked resource than fish. Pozorski noted the presence of fish, birds, and marine mammals, and the quantification of their use through time is the focus of this analysis. Pozorski's analysis is reviewed in more detail in Chapter 3 and compared to the Unit 18A sample in Chapter 4.

Dates	Period	Cultural Phase
	Late Horizon	
1500-		Inca
	Late Intermediate Period	Chimu
1000-		
	Middle Horizon	
500-		Moche
A.D. 0- B.C.	Early Intermediate Period	Gallinzo
		Salinar
500-	Early Horizon	Cupisnique
1000-	Initial Period	
1500-		
2500	Preceramic Period	
4000 10000	Lithic Period	Paijan

Figure 1.2 Generalized Chronology of Peruvian Coast, adapted from Moseley 2001:22-23.

Two theoretical models exist which predict that the residents at coastal sites, such as Gramalote, focused their subsistence economy on the exploitation of marine resources, especially fish. I have borrowed from the Maritime Foundation of Andean Civilization (MFAC) hypothesis proposed by Moseley (1972, 1982, 2002) and Optimal Foraging Theory (OFT) (e.g., Burger et al. 2005; Pyke 1984; Smith 1983) to model my expectations of Initial Period subsistence strategies at Gramalote. I will briefly review these here.

Moseley's Maritime Foundations of Andean Civilization

Moseley's MFAC hypothesis was developed specifically for the coast of Peru. It argues that marine resources could potentially sustain large-scale sedentary human populations and these groups could construct monumental architecture without relying on an agricultural surplus. In his model, Moseley focuses explicitly on the productive coastal fisheries, although he does consider the potential of other marine resources (e.g., marine mammals). Ecologically fish can be viewed as a sustainable and stable resource in the sense that they reproduce rapidly and in large number. This long-term stability is a basis for theories of the eventual development of proto-state and state level societies in the region.

The distinct ecology of Peru plays a key role in this model of interaction between humans, their environment, and their cultural trajectory. This distinct ecology includes rich coastal fisheries, hyper-arid coasts, and the steep Andes terrain (Moseley 1982, 2002; Sandweiss 2008; Wilson 1999; Reitz et al. 2008). Anchovies and sardines are an especially important resource base of coastal fisheries since they are small schooling fish and occupy a lower trophic level. The use of boats and nets allowed prehistoric and historic groups the ability to obtain large quantities in a short amount of time.

During the Preceramic and Initial periods, domesticated plants first appear in the local coastal archaeological record. However, the plants grown along the coast are considered “industrial crops,” a phrase used by Moseley to describe those crops used for non-edible economic purposes (e.g., cotton used for cordage and textiles and gourds used as containers and floats). This is in contrast to edible plants such as maize (Hudson 2004; Moseley 1972, 1982, 2001). In contrast to industrial crops, food crops in general and grain or cereal crops in particular appear relatively rarely at coastal sites during these time periods. This further demonstrates the importance of marine resources in the coastal diet (Mosley 1982, 2001).   In accordance with MFAC, a shift in maritime subsistence strategies in the form of an intensification of fishing is an aspect of my expectations for Gramalote.

Optimal Foraging Theory

In addition to MFAC, this thesis also borrows expectations from Optimal Foraging Theory (OFT). OFT is derived from game-theory economics and relies on an underlying assumption that humans will act in a rational and efficient manner (Sih and Christensen 2001; Smith 1983). According to OFT, foragers will choose resources that maximize returns (often measured in number of calories) relative to the labor or energy needed to procure and process the resource. Risk buffering theories, promoted as an addendum to OFT, are based on the assumption that foragers will sometimes choose a variety of high-return resources to exploit instead of focusing more exclusively on the highest ranked resource. In this way, if one resource fails, then other resources can be exploited more intensely to supplement the decreased caloric intake from the depleted resource (Smith 1983:267).

Although OFT and dietary buffering models can be expanded to include invertebrates and ethnobotanical specimens, this study focuses solely on vertebrate taxonomic classes. I use it in this thesis because it provides an ecologically grounded heuristic device against which to evaluate the data.

Given the aridity of the Peruvian coast, marine resources are more readily available than terrestrial resources. Therefore, energetic efficiency would predict either large meat packages, such as marine mammals, or abundant and clustered resources, such as fish, to be the top-ranking resources (Pyke 1984). Due to the cost-benefit factors of procurement, transportation, and processing, fishing may have been more efficient and more reliable year-round than hunting marine mammals (Pyke 1984). Fish are aggregated and dense along the coast (Pyke 1984; Sandweiss 2008, 2009). Based on OFT models, I expect fish to be the top-ranking vertebrate resource at Gramalote and that its importance will increase through time as sedentary populations increase.

My ecological perspective thus combines two models (MFAC and OFT) used to explain and predict subsistence change in coastal Peru (Carr and Fradkin 2008; Chapdelaine 1993; Moseley 1974, 1992; Smith 1983; Pyke 1984). Both models support an economy based heavily on fishing. They also support an increase in the reliance on fish over time, as human population sizes and sedentism increased. At Gramalote, Unit 18A’s clear stratigraphic levels, with midden and occupational surface contexts will provide a temporal sequence by which to test the fit of these ecological models.

Research Goals

The primary research goal of this study is to test the implications of these ecological models with the stratified faunal record from Briceño's 2005 excavations at Gramalote. The guiding hypothesis is that through time, the occupants at Gramalote may have shifted from a more generalized marine subsistence strategy, as seen at Preceramic coastal sites, to an increasing focus on fishing. Key among the implications of this is that quantitatively significant changes over time in the relative importance of fish would be visible in the archaeological record. Specifically, I examine these questions:

1) How does the vertebrate composition by class compare between the 2005 sample and the data previously reported by Pozorski?
2) For Unit 18A, does the relative importance of fish increase over time?
3) How can we add the variable of depositional context to our evaluation of change over time?

Plant and invertebrate resources are other important aspects of subsistence strategies. Future analysis of such materials from Unit 18A could make a valuable contribution to the fuller understanding of the deposit. This thesis however, focuses only on the vertebrate remains and on analysis at the taxonomic level of class (e.g., mammal, bird, fish); this represents an approach well suited to better understanding the role of fish in comparison to other vertebrate resources.

Data for this study was obtained during the summer of 2011 in the UWM lab facility in Huanchaco, Peru. The data collection was done in collaboration with Dr. Hudson and Ph.D. student Roberta Boczkiewicz; this represented a total NISP of 15,339.

Hudson and students collected additional data representing a total NISP of 7,601 in the summer of 2009; these data were reviewed and incorporated in the present study. The combined total NISP was 22,940 and represented a total weight of 14,294.1 grams of bone.

Thesis Organization

This thesis is organized as follows. Chapter 2 presents background material on the environment and ecology of coastal Peru, including specific details on the northern Peruvian coast and the Moche Valley. Chapter 3 presents an archaeological culture history background, for the region and the site, focusing on the Preceramic and Initial Periods. Chapter 4 describes the 2005 excavation methods, sample size and preservation, laboratory protocols, specimen identification, and quantification. Chapter 5 presents the results of my analysis of Gramalote and compares it with Pozorski's original faunal analysis. Chapter 6 summarizes my conclusions and offers recommendations for future investigations.

CHAPTER 2: ENVIRONMENTAL BACKGROUND

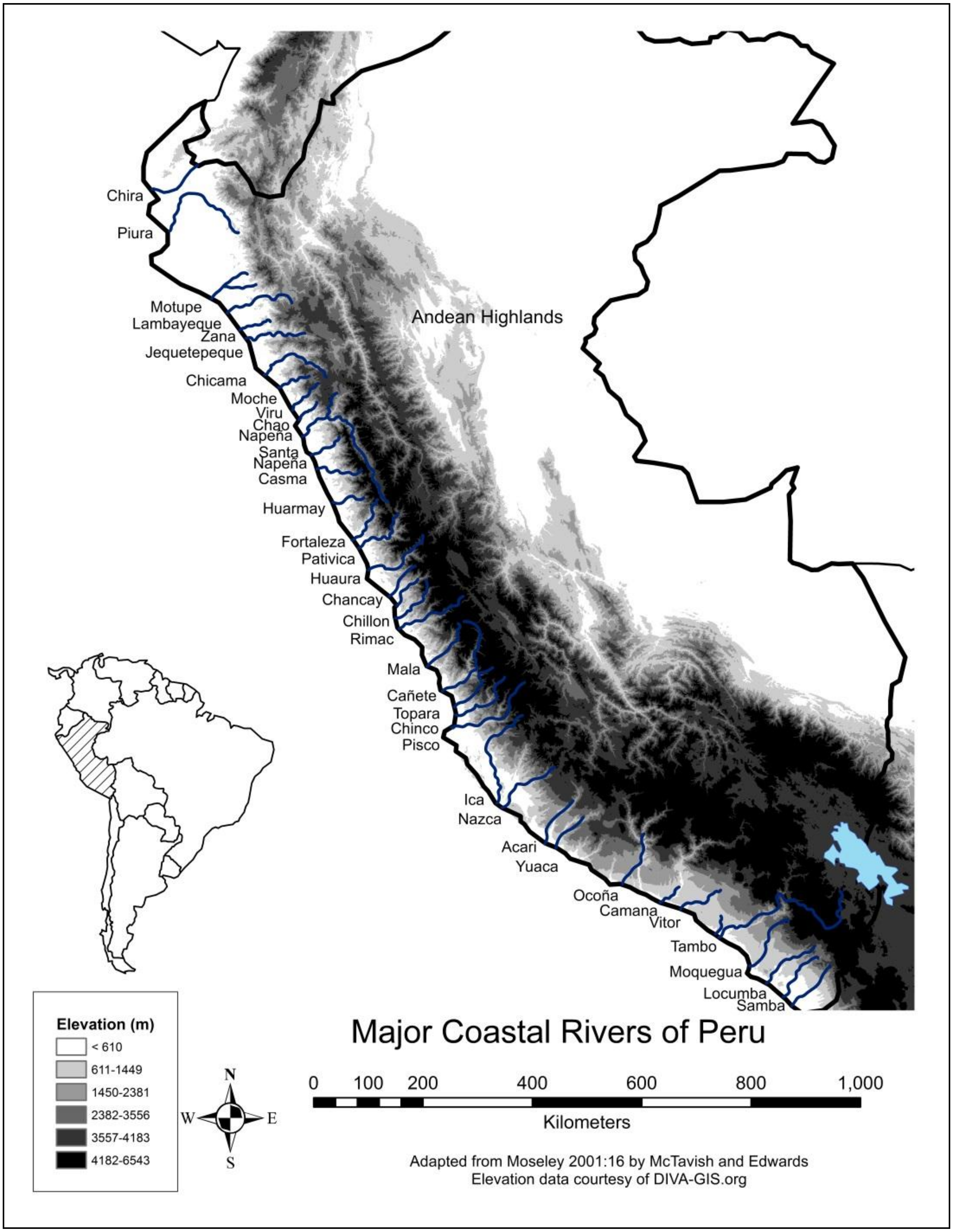
The study area is situated in the north-central Andean region of Peru. This broad region contains deserts, mountains, and a cold-current upwelling along the coast. The current provides one of the richest fisheries in the world (Sandweiss 2008, 2009). While this area is productive, the environmental extremes can also put constraints on inhabitants and require local adaptations. Such environmental adaptations have been the focus of archaeological research (e.g., Moseley 1974, 2002; S. Pozorski 1976; Pozorski and Pozorski 1979; Rietz 1988; Wing 1984). This chapter describes the juxtaposition of the highlands and the coast, the role of El Niño, and then focuses on the environmental diversity of the Moche Valley.

Highlands

The Andean highlands run through Peru from north to south. They contribute to environmental effects felt along the coast. The overall temperature and rainfall is more consistent in the highlands than in lowland and coastal regions (Burger 1982, 1989). There is heavy rainfall on the eastern slopes since moist air moves west across the Amazon from the Atlantic Ocean. Elevation differences also play an important role in temperatures, local flora and fauna, and agricultural potential.

Subsistence in this region is dependent upon agriculture and herding, often pursued simultaneously, both in prehistory and historically. Llama and alpaca are herded and their dung can be used as fertilizer to enrich the mountain soils, while fallow fields may have been used for pasturing (Moseley 2001). Since there is a series of unpredictable rainfall fluctuations, farming in multiple elevation zones provides a buffering strategy referred to as vertical agriculture. This "verticality" allows for diversity in diet (Moseley 2001:45).

The highlands are often divided into three elevation zones based on the types of agricultural plants that grow most efficiently. The higher *suni* zone (located at 3200-4000masl elevation) consists of a series of ridged cliffs with land productive for domesticates adapted to high altitude farming (e.g., tubers, chenopodium). The *quechua* zone is at the foot of the mountains and mountain valleys (2500-3200masl elevation), where crops such as maize, squash, and various vegetables thrive (Burger 1989). The lower *chaupiyunga* zone, located on the west side of mountains (1000-2500masl) is warmer than the upper highland zones, and therefore is more productive for agriculture for crops such as, chili, avocado, and fruit trees (Billman 1996; Burger 1989). For a comprehensive view of Peruvian elevation throughout the country, see Figure 2.1.



Major Coastal Rivers of Peru

Adapted from Moseley 2001:16 by McTavish and Edwards
Elevation data courtesy of DIVA-GIS.org

Figure 2.1 Major Coastal Rivers of Peru

Coast

The coast of Peru is often divided into three broad coastal regions of Peru, north, central, and south. The trajectory of the Humboldt Current and the El Nino counter current play a role in the ecological variations represented by this division. The environments vary due in part to ocean temperatures at the varying latitudes, which has impacts on the associated fisheries, and in part to river flow from the Andes (Alheit and Niquen 2004; Billman and Huckleberry 2008; Maliuf and Reyes 1989). Vegetation patterns vary as does agricultural potential (Billman 2002).

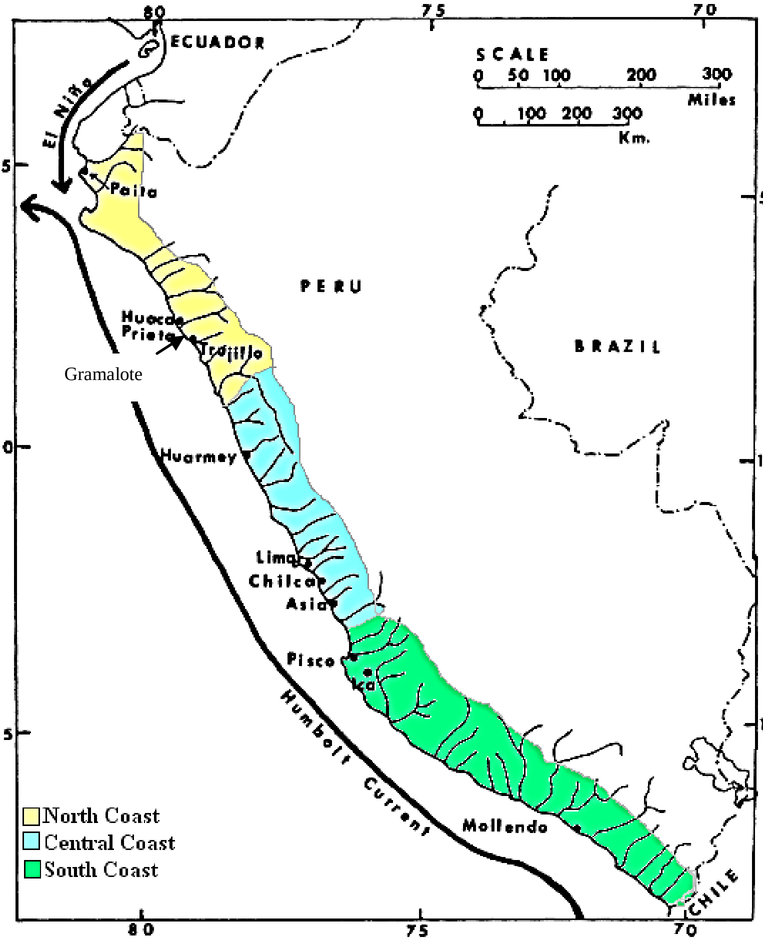


Figure 2.2 Peruvian Coastal Zones and Ocean Currents. Adapted from Parsons (1970:293) and Fagan (1999:291). Approximate location of Gramalote indicated

In general, the coast of Peru is characterized by hyper-aridity. River valleys, which provide a semi-reliable fresh water resource, are described by Moseley as oases in the sense that they are separated from each other by long distances of arid semi-desert (Moseley 2001). These valley “oases” supported both the pre-agricultural hunter-gatherer populations and the subsequent agricultural populations. These river valleys also serve as a reference when discussing different archaeological sites. Given the desert-and-oasis nature of the Peruvian coast, the location of a site in terms of proximity to the desert coastline and regions of inland fog-fed vegetation (*lomas*) is significant, as is its location relative to neighboring sites within the same valley. Archaeological evidence indicates that in the North and Central coasts regional groups utilized irrigation canals and inland sites to exploit agricultural resources (Billman 2002; Haas 1985; Moseley 2001).

The Peruvian coastal current also known as the Humboldt Current, plays a critical role in coastal ecology. It flows counter-clockwise to collide with the western coast of South America at approximately 38º South latitude. Where the current hits the northwest coast of Peru, a bordering marine shelf protrudes and brings displaced water to the ocean surface, causing an upwelling of colder water to replace the surface water. This creates surface water of approximately 20° Celsius. When air masses from the southwest hit the cold waters, they trap cold air below a warm air layer. As a result, from May to October a thick cloud of fog moves along the coastal shore (about 500 km) but never condenses to produce any significant amount of precipitation (Bohle-Carbonell 1989; Cavez et al. 1989; Marzloff et al. 2009).

El Niño

El Niño is a cyclical climatic shift, which has unpredictable timing and varying degrees of ecological impact. The El Niño counter-current hits the northern Peruvian coast as western winds bring warmer water from the West Pacific, causing a disruption in fish patterns. During El Niño episodes, the fauna most affected in the Peruvian coastal ecosystem are the marine mammals and sea birds that depend primarily on particular species of fish or shellfish that are temporarily decimated because of significant shifts in ocean temperatures (Rogers et al. 2004; Placzek et al. 2009; Zavalaga et al. 2002).

Ecologists Andrew Bakun and Kenneth Broad posit that El Niño may be partially responsible for the lucrative fishing economies of coastal Peru (Bakun and Broad 2003: 460). El Niño events significantly affect anchovies and sardines. Anchovy populations in particular become drastically reduced while sardine populations intensify. Sardines are evolutionarily adapted to oceanic shifts and thrive when El Ninos create a decline of predatory and competitive species (Bakun and Broad 2003; Alheit and Niquen 2004). Therefore, even during El Niño events, Peruvian fisheries are able to sustain their economic output by shifting from one species of fish to another. During prehistory this could have been fundamental for human population stability once nets and boats made the capture of small schooling fish efficient. Archaeological evidence makes it clear that these technologies were in place by the Late Preceramic if not before.

Moche Valley

Gramalote is located in the Moche Valley. The Moche River runs from the Andes to the Pacific and is approximately 102 km long, with only six tributaries (Billman 1996).

There are various ecological zones within the Moche valley, due to the variability in elevation encompassed by the river's watershed (Billman 1996; ONERN 1973). This generates differences in agricultural potential and available faunal resources. Table 2.1 lists the ecological divisions of the Moche Valley described by Billman, combining elevation data and environmental zones.

Table 2.1 Moche Valley Environmental Zones

Moche Valley Divisions	**Moche Valley Elevation (Billman 1996)**	**Environmental Zones (ONERN 1973; Billman 1996:29)**
Upper Valley	800-4,200 masl*	Thorn scrub, humid grassland, very humid grassland
Middle Valley	300-800 masl	Scrub desert
Lower Valley	0-300 masl	Desert

*meters above sea level

Most coastal river valleys are divided into three subsections, upper, middle, and lower. Gramalote is in the lower Moche Valley. The distinctions between the valley regions are significant for understanding available faunal resources.

As described by Billman (1996), the lower Moche valley goes from the “ocean to the valley neck at Cerros Oreja and Galindo. Prominent topographic features...include the broad alluvial fan of the Moche River and isolated hills” (Billman 1996:29). The climate varies in aridity, but the entire coast is desert. Agriculture is only possible in this region with the use of irrigation canals, a large labor investment. Outside of irrigated areas, vegetation is infrequent (Billman 1996; T. Pozorski 1982). The middle Moche valley is located in the foothills of the Andes. Precipitation is higher than in the lower valley, and irrigation is limited due to extreme topographic relief. The upper Moche valley is characterized by steep mountainous terrain. This region is more ecologically diverse than the lower and middle valleys.

> “Below 1,600 m elevation, agriculture is only possible with water control techniques because of arid and semi-arid conditions, however year-round warm weather allows the cultivation of two crops and a wide variety of cultigens. Above 1,600 m elevation rainfall agriculture is possible, but the extent of cultivation and the types of crops that can be grown are limited by severe topography and cold temperatures. (Billman 1996:27)”

The geomorphology of the coastline is variable producing different habitats for marine resources: rocky, sandy, mixed rocky, and sandy littoral habitats (Billman 1996: 35; T. Pozorski 1982; Pozorski and Pozorski 1979). Different fishing technologies are used to obtain resources in each type of habitat, such as haul nets, gill nets, and line fishing (S. Pozorski 1982; Billman 1996). Fishermen in the Moche Valley in the bay of Huanchaco can still be seen using gill nets while in *caballitos de torora*, small one-man reed boats (Hudson 2009; Billman 1996). The continental shelf and Humboldt Current allow for conditions favorable to high densities of phytoplankton. This supports the large schooling fish, which in turn are the primary food sources for larger marine resources (e.g., sea lions and sea birds) that are harvested by human populations on the Moche Valley coast.

Summary

The study area is bounded by the Andes Mountains to the east, and the Pacific Ocean to the west. While agricultural potential along the coast is limited because it is dominated by desert, the ocean provides an abundance of marine resources that permitted relatively large, stable populations of prehistoric foragers to survive. El Niño events influence the composition of marine resources, but do not appear to affect significantly the productivity of the fisheries (Reitz et al. 1988; Sandweiss 2009). Inland precipitation and temperature fluctuates based on elevation. Rivers, which run from the mountains to the coast, are an important source of fresh water. When land was irrigated via river water, prehistoric groups were able to practice agriculture; however, it is important to note that different domesticates were cultivated at varying elevations within the river valleys. The Moche River is one such valley in northern Peru. Irrigation is possible inland, though elevation, temperature, and levels of precipitation affect agricultural productivity. The coastal portion of the Moche Valley is desert, in prehistory the inhabitants of this region relied primarily on marine resources. To this day, some traditional fishing technologies are still employed by fishermen of this region.

CHAPTER 3: CULTURE HISTORY AND SITE BACKGROUND

The Peruvian coast has a long history of prehistoric occupation, the Paijan hunter-gatherer-fishing groups (10,000-3000 B.C.) through the Late Horizon and the Incan empire (A.D.1450-1550) (see Figure 1.2). This chapter focuses on the time around the occupation of Gramalote, including the Late Preceramic Period (3050-1800 B.C.) which immediately precedes the main occupation at Gramalote during the Initial Period (1800-900 B.C.). This chapter concludes with a discussion of the site background of Gramalote, focusing on Pozorski’s 1976 and the 2005 salvage excavations. The approximate locations of sites mentioned in the text are indicated on Figure 3.1.

Late Preceramic Period

The Late Preceramic Period (3050-1800B.C.) is also known as the Cotton Preceramic Period. It is defined by an increase in site settlement planning, the continuation of plant cultivation, and a continued reliance on marine resources along the coast (Burger 1989; Keatinge 1988; Pozorski and Pozorski 1990; Moseley 2001; Quilter 1991; Wilson 1999). During this period, sites with U-shaped architectural complexes emerged along the coast and continued into the Initial Period as larger ceremonial centers continued to be constructed (Burger 1989; Moseley 2001; Keatinge 1988). There is some debate as to the temporal parameters of the Preceramic (see Quilter 1991 and Burger 1989), and to the timing of coastal and inland monument building (Haas and Creamer 2006; Pozorski and Pozorski 2005). Thus, the Late Preceramic is significant to understanding developments on the north coast prior to the occupation of Gramalote.

While plant domestication and agriculture developed earlier in the highlands than along the coast, during the Late Preceramic Period (3050-1800 B.C.), coastal groups were farming cotton (Moseley 2001:99). This industrial crop was used for textile manufacture as well as for manufacturing fishing nets (Hudson 2009; Keatinge 1988; Moseley 2001). Evidence of cotton in the form of net fragments as well as remains of food plant cultigens such as chilies and avocado have been recovered at coastal Preceramic sites such as Paloma and Huaca Prieta.

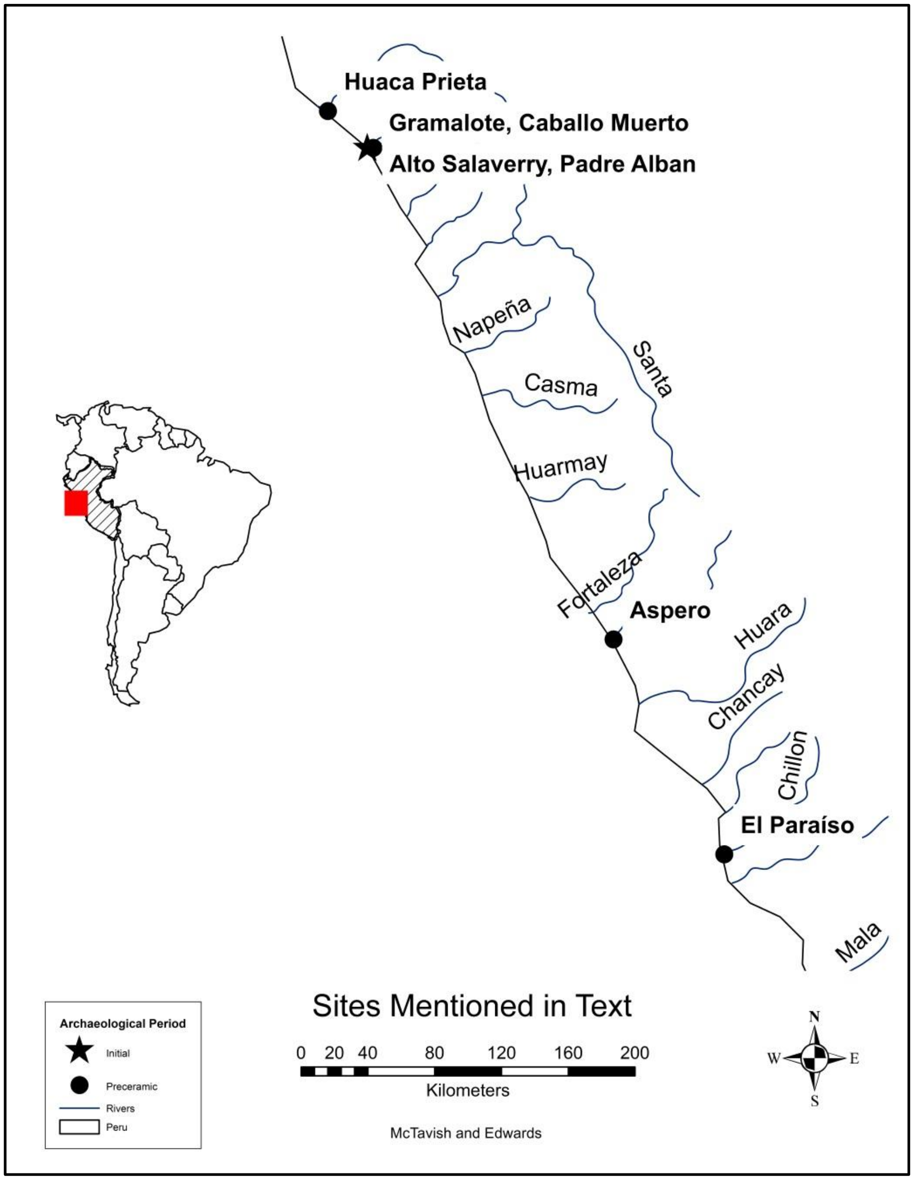


Figure 3.1 Preceramic and Initial Period Coastal Sites

Key Preceramic Sites

El Paraíso is a significant Preceramic site and was used to connect coastal fishing sites to monumental architecture in support of MFAC. The site (2000 to 1400 B.C.) is located near the mouth of the Chillón River. It is a mound complex encompassing approximately 60 hectares and is an early example of monumental stone architecture El Paraíso was excavated by the *Proyecto Bajo Valle del Chillón* in the early 1980s (Quilter 1985:279). This site is a possible example of early U-shaped architectural designs. El Paraíso shows evidence of a sedentary fishing community with a mixed reliance on cultigens, such as squash, beans, peppers, guava, and lucuma (Quilter et al. 1991). Cotton has been recovered in the form of fishing net fragments and textiles.

Áspero is a site located at the mouth of the Supe Valley where early monumental construction coinciding with site habitation during the Preceramic has been recovered. An early reexamination of the site by Moseley and Willey describes the site (Moseley and Willey 1973:458); Feldman (1980) later excavated the site. There are multiple types of architecture present, including sunken architecture, sunken plazas, mounds, and small habitation dwellings (Feldman 1980, 1985). There were also 17 elevated structures found at Áspero, six of which were classified as "corporate labor platforms" or "corporate labor constructions in the form of artificial platform mounds" (Moseley and Willey 1973:459). Two of the oldest and largest pyramidal mounds at the site are Huaca de los Sacrificos (4260±150 to 3950±150 B. P.) and Huaca de los Idolos (4900±160 to 1970 ±145 B. P.), dating their construction as early in the site development (Feldman 1985:71). The basic subsistence strategy of the site inhabitants at Aspero consisted of fishing and hunting marine mammals, as attested by faunal remains recovered at the site in addition to the recovery of fishhooks and cotton net fragments. There is evidence of plant cultigens such as achira, beans, squash, avocado, and peanuts (Moseley and Wiley 1973:457-458). Áspero, as an early site with monumental architecture and evidence of habitation around these structures, has been used in debates regarding the nature of socio-political complexity for the development of the larger Andean region (e.g., Haas and Creamer 2006; Feldman 1980, 1985; Fung 1988; Moseley 2001; Pozorski and Pozorski 2005; Quilter 1991

Huaca Prieta is an important Preceramic site in the Chicama Valley. First excavated by Junius Bird in 1946, it has been dated to approximately 2500 B.C. (Bird 1985). Excavations have continued under the supervision of Thomas Dillehay from 2006-2011 (Dillehay et al. 2012). A stone and earth platform mound was present and measures approximately 138m x 62m and about 32m high. Sedentary group occupations have been recovered near the mound engaging in largely maritime subsistence strategies. Industrial crops such as gourds and cotton were used for textiles, fishing nets, bowls, storage jars, and net floats. Cotton textiles show marine iconography, such as fish and shellfish designs, which has been interpreted as a reflection of the significance of marine resources (Bird and Hyslop 1985, Whitaker and Bird 1949). While evidence of food cultigens such as squash, avocado, and chilies, have been recovered at the site there remained a strong marine emphasis (e.g. shellfish, fish, sea mammals, guano birds).

In the Moche Valley, Padre Alban and Alto Salaverry are coastal Preceramic sites near Gramalote. Shelia Pozorski test excavated and analyzed these sites and explored the idea of transitions between Preceramic and Initial Period subsistence strategies (Pozorski 1976). She developed these issues further in subsequent publications

(Pozorski 1982; Pozorski and Pozorski 1979, 2005, 2006). Padre Alban is a site located near the Huanchaco Bay along the Pacific coast (Pozorski 1979: 173). It is a small area, which Pozorski interprets as a seasonal or temporary occupation after excavations uncovered cotton cords and nets but no textiles or permanent architecture (Pozorski 1979). Alto Salaverry (1480±110 B.C.) located along the south of the Moche River mouth covers approximately 1.8 hectares (Pozorski and Pozorski 1990:483-484). It is considered a permanent settlement as evidenced by domestic structures, dense refuse middens and public or ceremonial architecture (S. Pozorski 1976). There is also evidence of a strong reliance on marine resources, such as shellfish, fish, and marine mammals. However, gourd, cotton and squash are present, along with pepper, beans, lucuma, avocado, guaynabo (Pozorski 1976).

In sum, the Late Preceramic Period along the north coast is a time of increasing sedentism and the beginnings of public architecture. A variety of plant domesticates are increasingly used, although there is no evidence of reliance on maize in particular or plant domesticates in general. Marine resources remain a consistently important food source.

Initial Period

The Initial Period (1800-900 B.C.) marks the introduction of ceramics along the Peruvian coast, an increase in socio-political complexity, and increasing use of irrigation in floodplain agriculture (Billman 1996, 2002; Stanish 2001; Moseley 2001). There is considerable debate about socio-politics in the Initial Period. In his review of emerging Andean states, Stanish highlights several of these debates (Stanish 2001:50-51). He reviews Pozorski and Pozorski's work at Pampa de las Llamas-Moxeke, and their arguments for the use of elite objects in relation to emerging polities. They suggest the development of "a number of polities in the Moche, Casma, Supe, and Chillon valleys in the north and central Peruvian coast" (Stanish 2001:50; Pozorski and Pozorski 1987:45). On the other hand, Burger (1989) and Schreiber (2001) focusing on the broader Andean world, argue that the Initial Period is, "a time of simple chiefdom development" (Stanish 2001:51). Overall, the degree to which socio-political complexity manifested along the coast is under debate, further highlighting the significance of investigating of Initial Period sites from multiple localities.

Within this debate about socio-political complexity, the role of landscape modification is critical. In addition to monumental architecture, site inhabitants manipulated the landscape to irrigate agricultural fields. Prior to canal irrigation, the coastal practice is argued to have involved less labor-intensive methods of taping into the water table where it was close to the surface. While this was not practiced at sites directly adjacent to the coast, inland sites within 20 km of coastal sites appear to have engaged in this form of agricultural intensification (Billman 2002).

An example of agricultural intensification during the Initial Period in the Moche Valley is the Caballo Muerto site complex (Pozorski and Pozorski 1979, 2005). It is a late Initial Period mound complex with various domestic structures excavated within and adjacent to mounds. Caballo Muerto is located in the *Rio Seco* gorge, approximately 17 km from the Pacific coast. This site complex has a U-shaped architectural layout with the positioning of ceremonial mounds. Huaca de Los Reyes (1300-1100 B.C.) is a mound within Group II which contains ceremonial architecture (Keatinge 1988:90). This pyramid contains structures with red, yellow, and white painted relief friezes.

Excavations of the mounds revealed evidence for “differences in layout, ceramics, and radiocarbon dates from the Initial Period into the Early Horizon” (Pozorski and Pozorski 2008:616). This site illustrates the elaboration of architectural designs and the increase in agricultural intensification that was occurring during the span of the time represented by the Late Preceramic through the Early Horizon. Shelia Pozorski’s dissertation work (1976) suggests a possible connection of this inland site with coastal sites since the faunal materials recovered at Caballo Muerto include fish and shellfish.

Agricultural developments during this period have been of particular interest to archaeologists and investigated in several valleys along the north coast of Peru. Pozorski has indicated that in the north coast, there was a shift from water table farming to irrigation agriculture after about 900 B.C. (Pozorski 1979). Park (1983) and Billman (1996, 2002) have traced the development of irrigation and agriculture potential for the north coast of Peru, specifically focusing on the Moche Valley (Table 3.1). According to Billman, one difficulty with this research is a lack of radiocarbon dates from a variety of sites. However, his work has indicated that the easiest part of the Moche Valley to irrigate would have been the Middle Valley (Figure 3.1), shown by a “dramatic shift in population” from this section of the valley to the coast (Billman 2002:379). During the Preceramic Period, plant cultivation was limited to the easily irrigable regions of the Middle and Lower Moche Valley (Billman 2002:379).

Table 3.1 Moche Valley Irrigation Agriculture Developments
(adapted from Parker 1983:157, Billman 2002:378)

Moche Valley, Parker 1983:157		
Period	**Time Frame**	**Development**
Chavín Period	1000-200 B.C.	Small-scale canal irrigation
		Agriculture replacing fishing for "land economy"
Initial Period	1800-1000 B.C.	Continuation of floodwater farming
Preceramic	2500-1800 B.C.	Introduction of agriculture into area
Moche Valley, Billman 2002:378		
Period	**Time Frame**	**Development**
Initial Period/Early Horizon	1800-400 B.C.	Irrigation expands to the Middle valley and northern Lower valley
Late Preceramic	2500-1800 B.C.	Water table and sunken field agriculture

Within the Moche Valley, the development of irrigation has been the focus of multiple research projects, which focuses on sites that span from the Preceramic into the Early Horizon (Table 3.1). During the Preceramic and Initial Period, groups engaged in near-river water table farming. Late in the Initial Period and the subsequent Chavín Period or Early Horizon, irrigation farming begins to rival fishing as a subsistence strategy, even along the coast. Billman notes that irrigation is not used in the north portion of the lower valley until the end of the dated Gramalote occupation (circa 1400 B.C.). Thus, it appears that early agriculture begins in the upper Moche Valley and eventually spreads to the coast (Figure 3.2).

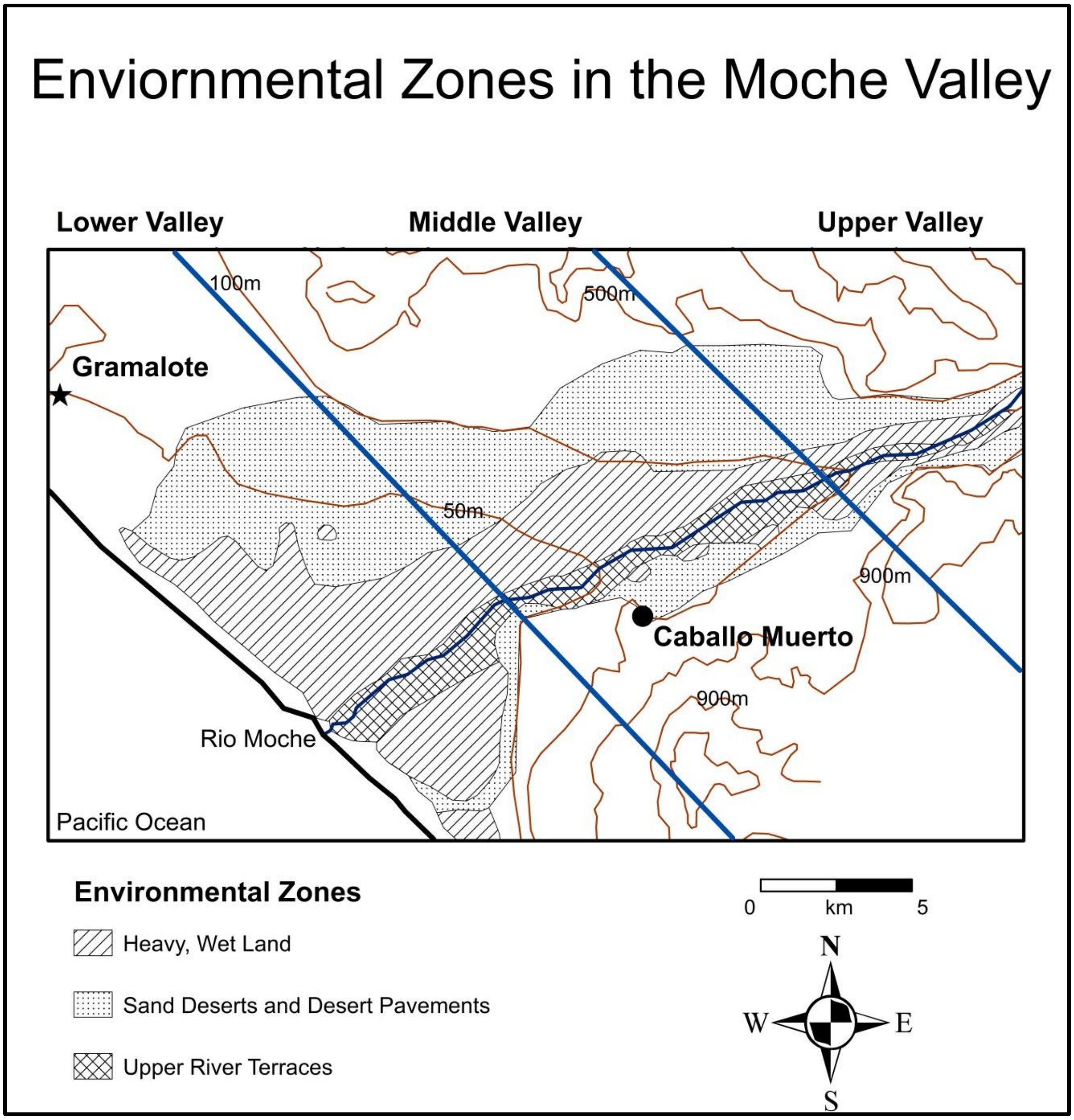


Figure 3.2 Environmental Zones in the Moche Valley. Adapted from Park 1983:156

The process of agricultural innovations as reflected in the archaeological record are also tied to landscape modification research focused on canal building and labor-expenditure calculations (Billman 2002). Prehistoric agricultural research is significant for contextualizing subsistence strategies and is referenced in Pozorski's faunal work at Gramalote as a hypothesis about resource networking between coastal fishers and inland agriculturalists.

Gramalote, being in the arid coastal region, was not in a location conducive for non-irrigation agriculture, as opposed to the site of Caballo Muerto (Figure 3.2). While excavations at Gramalote have recovered plant cultigens, the majority of the daily subsistence appears to be marine-focused. This supports the ecological prediction (MFAC and OFT) of a maritime subsistence. The subsequent analysis of the Unit 18A sample examines if this reliance increases through time, specifically fish.

Site Background

Gramalote was first surveyed by C.M. Hastings in 1973 and then excavated by Shelia Pozorski (1976) as a part of the larger Harvard Chan Chan-Moche Valley Project. Pozorski excavated 2 controlled cuts and approximately 20 test pits, across the 16,500 m area of the site; she identified the presence of ceramics, and dated the site to the Initial Period. In 2005, three additional units were excavated in conjunction with salvage efforts along the eroding southwestern margin of the site (Briceño et al. 2006; Briceño and Billman 2008). Continued excavations (2010) led by Yale PhD candidate Gabriel Prieto have focused on the western site profile. Details of Pozorski, Briceño, and Prieto's works are reviewed below.

Gramalote is situated on a low plateau adjacent to a dried creek bed approximately 600m from the ocean (Pozorski 1976). On the surface, the Gramalote site consists of multiple artifact scatters, with dense artifact deposits, stratified middens, and buried architecture below the surface. The site is located approximately 250 meters from the coast (Briceño and Billman 2008; Pozorski 1976; Pozorski and Pozorski 1979).

Shelia Pozorski's 1976 Excavations

Pozorski's faunal work at Gramalote was one component of her larger dissertation goal, to evaluate, "subsistence components of ten prehistoric sites in the Moche Valley" (Pozorski 1976:1). She was specifically looking at procurement strategies and processing techniques for vertebrate and invertebrates to elucidate temporal shifts, and whenever possible, spatial ones. All ten sites were located within 20 km of the coast.

Pozorski's excavations at Gramalote consisted of test pits and targeted two types of refuse areas within these sites: "relatively deep deposits with evident natural stratification" and "shallow deposits consisting of a single homogenous refuse-bearing layer" (Pozorski 1976:38). In total, approximately 16,500 m^2 were mapped with refuse and scattered architecture were mapped (Pozorski 1976:22-22). She notes how the architecture was covered with refuse and then studied by Donald Weaver (no published report available). While she does not include specific numbers of test pits, 20 are indicated on her site map (1976:291), as adapted (Figure 3.2).

Gramalote contained a stratified deposit (Cut 1) approximately 100 cm x 50 cm, and 195 cm in depth (Pozorski 1976:39). There were three natural levels in this midden, and due to the large natural stratigraphy levels, Pozorski separated arbitrary 10cm levels to assess subtle shifts in subsistence and increase subsistence artifact recovery (Pozorski 1976:47). Half-inch mesh was used to screen the northern unit, while quarter-inch mesh was used for the other excavations at Gramalote for better subsistence data recovery. Pozorski's subsistence analysis included only the 1/4 inch samples (Pozorski 1976:46-47). Cut 1 was the focus of her analysis of Gramalote subsistence (Figure 3.3). Cut 2 contained a buried stone wall at approximately 65 to 95 cm, and a flexed burial recovered at 165 cm (Pozorski 1976:47); this stratified midden was not incorporated into her subsistence analysis.

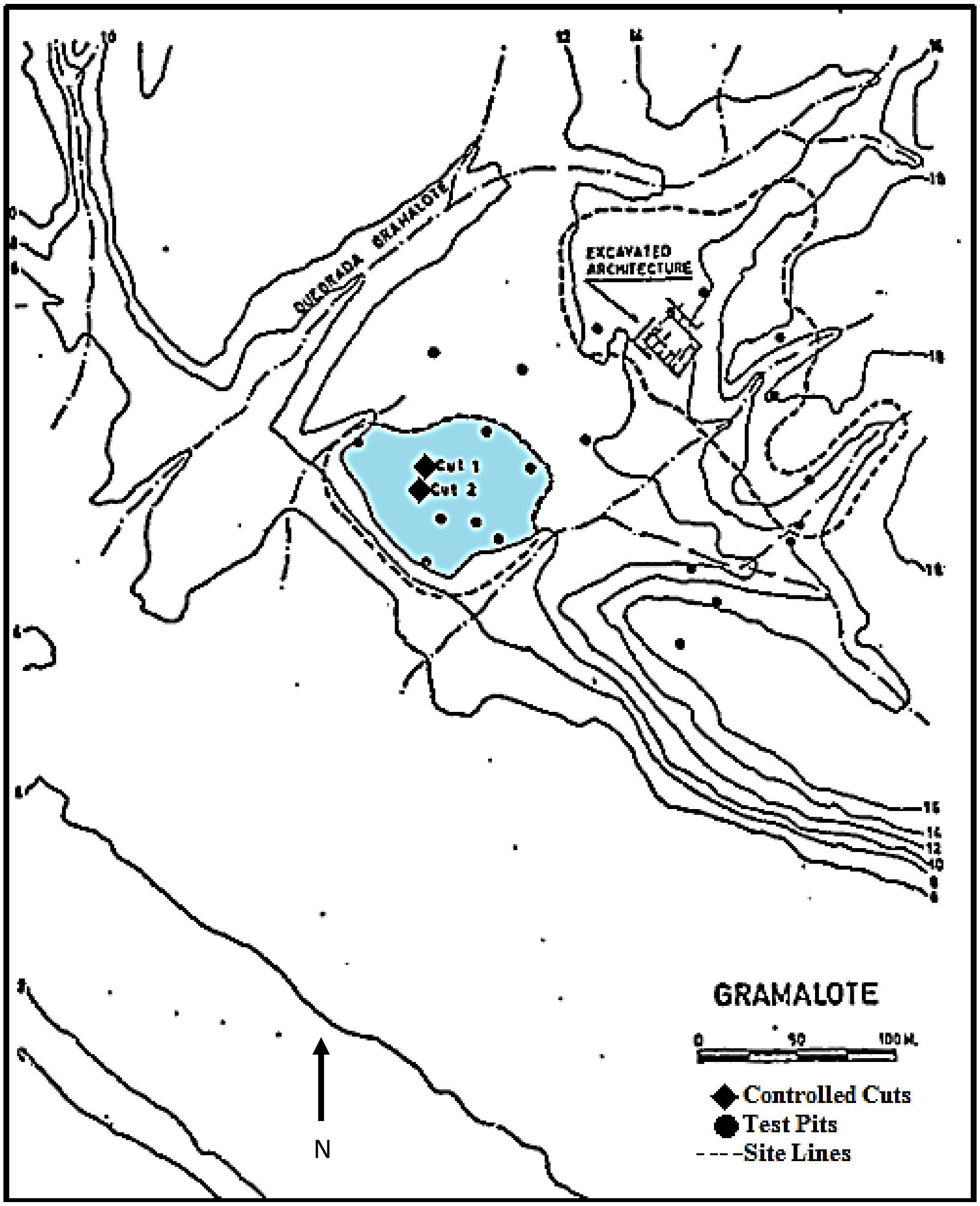


Figure 3.3 Pozorski's 1976 Excavation areas of Gramalote, focused area shaded, adapted from Pozorski 1976:291

In the coastal region of Peru, the average date for the introduction of ceramics is approximately 1800 B.C. (Moseley 2001). Pozorski published a series of radiocarbon dates for Gramalote (Pozorski and Pozorski 1979:418). Six dates were taken from a three-strata sequence in Cut 1. These are shown in chronological order with provenience details below (Figure 3.2). Although these include some stratigraphic reversals, all dates fall within the Initial Period range of 1800-900 B.C.

- 1100±110B.C. from the second stratum from the surface
- 1120±90 B.C. third stratum from the surface
- 1300±120 B.C. third stratum from the surface
- 1430±60 B.C. first stratum from the surface
- 1580±130 B.C. first stratum from the surface
- 1590±80 B.C. second stratum from the surface

Pozorski used samples from Cut 1, and focused her analysis on remains recovered from ¼ and 1/16 inch mesh. While the total NISP is not available, most bone weights were reported. Her quantifications methods were adapted to her research goals. These include the desire to compare the relative importance of vertebrates and invertebrates; to do this she collected weights, estimated the minimum number of individual animals (MNI), and estimated biomass. Her interpretive goals were to make comparisons between sites rather than to analyze variations within sites, thus she combines data from all strata of Cut 1 to create a single summary of Gramalote subsistence. Her resulting interpretations of Gramalote focuses on the relative importance of shellfish overall, and a potential network exchange with Caballo Muerto (e.g., fishermen and agriculturalist interactions). Because the focus of this thesis is on the relative importance of different vertebrate classes, I present those comparative data for Pozorski's sample (Table 3.2).

Table 3.2 1976 Vertebrate Data from Gramalote, adapted from Pozorski 1976:330-331

Taxa	MNI	Weight (g)
Fish		
Mustelus sp. sand shark, tollo	2	865
Rhinobatos planiceps guitarfish, guitarra	1	40
Myliobatis peruvianus ray, raya	1	2.5
Paralonchurus oeruanus croaker, roncador	1	5
Scianea gilberti croaker, corvina	4	90
Sciaena deliciosa croaker, lorna	4	_
Genypterus maculatus eel, congrio	1	_
UNID Fish	_	25
Birds		
Pelecanus sp. Pelican	1	22.5
UNID Bird	_	505
Mammals		
Misc. rodent	1	_
Otaria byronia sea lion, lobo del mar	1	280
UNID mammal	_	537.5

This represents the same general part of the site that Pozorski describes as a domestic area, comprised of midden refuse area, possibly distinct activity areas, and buried architecture. Briceño and Billman's salvage excavated this general area further in 2005, documenting artifact types, describing buried architecture and human burials, and contextualizing initial findings with previous work (Briceño et al. 2006; Briceño and Billman 2008).

Briceño and Billman's 2005 Excavations

Excavations at Gramalote conducted under the supervision of Jesus Briceño through the INC, followed the methodological standard of other Cerro Oreja Archaeological Projects (Billman et al. 2006; Briceño and Billman 2008). Since no structures were visible above the ground surface, the site was gridded into10m units, and then divided into 2.5m x 2.5m sub-units. Excavations were focused on the southwest margin of the site where it was exposed by a modern road cut. They began at Unit 18, sub-unit 18A specifically (Figure 3.4). Excavations were expanded into Unit 17, specifically sub-unit 17D with overlapping cultural contexts.

Natural depositional levels were assigned provenience designations (PD). Sub-unit 18A was given the initial PD numbers 1 through 19, and then continued from PD 60 to PD 81. All excavated materials were screened using 1/4, 1/8 and 1/16 inch mesh and flotation samples were taken. Soils were very compact due to the high presence of salts, which made it difficult to recover some cultural materials; excavators noted difficulty in ceramic recovery due to the compaction in soils and salt. A summary for the distribution of general artifacts recovered in Unit 18A is significant in contextualizing the faunal sample for this thesis (Table 3.3 and Table 3.4). Buried architecture and burials were encountered during the excavation. These are described in Appendix B. Briceño and Billman describe the site as a sedentary fishing village, similar to Pozorski, with evidence for dwellings, hearths, cooking features, burials, architecture, and substantial middens.

Ceramics appear to be ubiquitous, while there is an interruption of shell, fauna, floral, and lithic materials in *capas* 7, 8, and 9. These *capas* lay directly above a possible Tsunami event. Immediately above this area, six pachamancas features or small stone cooking areas were recovered in close proximity to one another (see Figure 5.7).

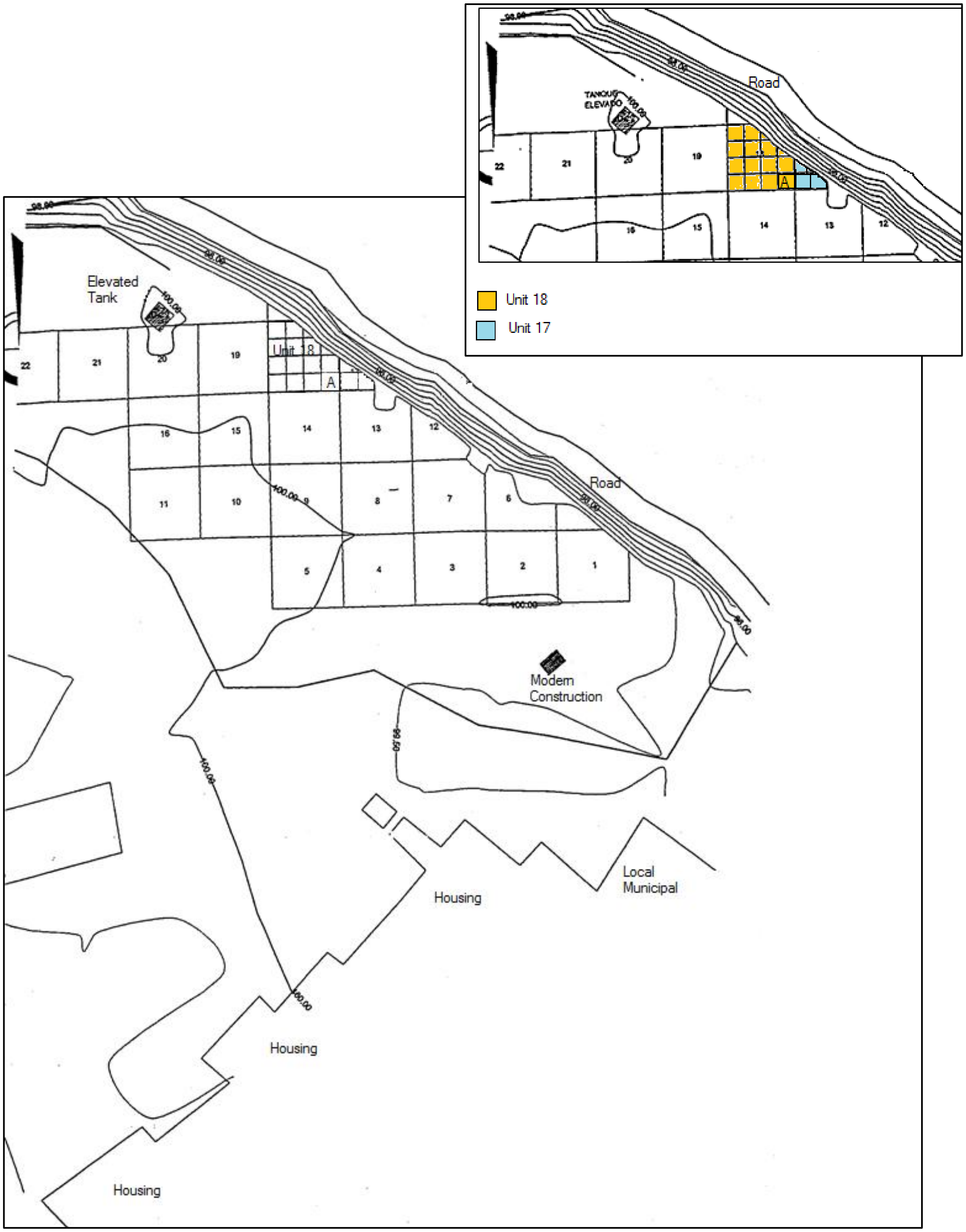


Figure 3.4 2005 Excavation Maps, adapted from Briceño et al. 2006

Table 3.3 Summary of Unit 18A provenience and artifacts

Capa	PD	Level	Soil Color/Consistency	Shell	Fauna	Flora	Ceramics	Lithic
1	1, 2	1 (surface)	grey	X		X	X	
2	3, 4, 5, 6	2, 3	semi-grey	X	X	X	X	X
3	7, 8, 9, 10, 11, 12, 13	3, 4, 5	yellow mud and grey soil, compact by presence of salts	X	X	X	X	X
4	15, 16	6, 7	compact filling like capa 3	X	X	X	X	X
5	17, 18	8	“pachamancas” with gray floor areas within	X	X	X	X	X
6	19, 60, 61, 62, 63	9, 10, 11, 12, 13	semi-grey	X	X	X	X	X
7	65, 66, 67, 68, 69	14, 15, 16, 17, 18, 19	yellowish clay in western area, not in northeast corner*				X	
8	65	14	thick compact yellow clay				X	
9	65	14	semi-compact sand with organic debris arranged by area		X**		X	
10	71	20	gray sand with sticks exposed to salt water, possibly temporary wall	X		X	X	
11	72	21	yellow					
12	73	22	organic filler	X		X	X	
13	74	23	compact yellow soil	X	X	X		
14	75, 76, 77, 78	24, 25, 26	compact organic debris	X	X	X	X	X
15	79, 81		compact yellow soil				X	
16	80						X	

*3 levels of compact sediments, center level covered three “compactions” of clay, arranged one after the other, separated by thin layers of sand

** Whale bone, partially burned

Table 3.4 Summary of Unit 18A structures and features

Capa	PD	Structures	Other	Comments
1	1, 2			Modern materials present- disturbed context
2	3, 4, 5, 6		Fragments of string, nets, cotton threads	
3	7, 8, 9, 10, 11, 12, 13	Level 2 round structure with two burning areas	Shell with boulder wrapped in fabric	
4	15, 16		Textile fragments	
5	17, 18	6 “pachamancas”	Textile fragments, cotton thread,	Articulated bird wings on floors of “pachamancas”
6	19, 60, 61, 62, 63		Feature containing small shell fragments, likely exposed to very high heat	Fragment of pottery decorated in PD 19, similar to those found at Huaca Prieta by Bird (1985, Figure 36) in burial 876
7	65, 66, 67, 68, 69			
8	65			
9	65			
10	71		Possible Tsunami flood event	
11	72	wall on west side of sub-unit five post-holes oriented approximately north-south		
12	73			
13	74	three small post-holes oriented east-west	Floor cut in north sub-unit adolescent burial (PD74, Feature I)	Southwest corner excavated as deposit (PD 78, Feature 1) cutting into sterile soil filled mostly with shell and animal bone
14	75, 76, 77, 78		Red pigmented mica	
15	79, 81	south stone walls	Child burial (PD 79, Feature I)	
16	80			Small area in southwest corner excavated further until consistent sterile soil

Gabriel Prieto's 2010 Excavations

In 2010, excavations led by Prieto reexamined this area of the site, cleaning approximately 60 meters of the western site profile and extends inwards (Prieto 2010:5). This work exposed an architectural area consisting of stones walls with "a complex system of entryways with elevated thresholds, patios, as well as large and small rooms" (Prieto 2010:4). Prieto interprets this as a domestic area. Complete analysis of this work is not yet published. Marine resources were recovered, but not detailed in this paper. The focus of Prieto's currently available work is expanding our knowledge of architectural complexities and ritual activities at Gramalote.

Summary

Gramalote was occupied during a period of significant cultural and technological changes. Specifically, research is being conducted along the coast to examine changes in the rise in socio-political complexity, increased reliance on fish and domesticated plants and animals, and new technologies such as ceramics and irrigation agriculture (e.g., Billman 2002, Burger and Salazar-Burger 1991, Dillehay et al. 2004, Sandweiss 2008, 2009, Pozorski and Pozorski 2005). Despite the numerous research projects at sites like Gramalote, there are still many unanswered questions which ongoing research will aid in regional contextualization.

The Gramalote site has been a locus of several important excavations targeted at better understanding the transition from the Late Preceramic to the Initial Period along the north coast of Peru (Briceño et al. 2006, Briceño and Billman 2008, Pozorski 1976, Prieto 2010, Velasquez 1987). Pozorski's work presented a basic framework for subsequent subsistence interpretations, while comparing vertebrates, invertebrates and botanical samples. She further provided the dates to confirm an Initial Period occupation at Gramalote. Briceño and Billman’s excavations have presented a temporal cultural sequence for the same general area of the site, and provided a full description of the buried architecture. Prieto’s work, while still underway, offers a preliminary examination of the ritual life at the site, as carried out in domestic areas. His continued excavations will help to contextualize the basic lifeways of the site occupants.

CHAPTER 4: METHODS

This chapter describes how the faunal assemblage was excavated, how the assemblage was identified and quantified in Peru, and how the resulting database was subsequently analyzed quantitatively in the United States.

Excavation Methods

The total site of Gramalote covers approximately 300m. The study assemblage comes from Unit 18 which is 2.5x2.5 m across and 1.4 m deep (Briceño et al. 2006). In Unit 18A, bone was recovered using 1/8 inch mesh in the field. Descriptions of individual *capas estratigráficas* (stratigraphic levels), adapted from Briceño and Billman (2008) are provided in Appendix A. This sample was excavated by provenience designations (PD) within *capas*. Although the excavation stratigraphy is complex, as shown in Figure 4.1, the *capas* typically span the width of the unit, encompassing diverse levels and provenience features (e.g. lenses, natural and cultural intrusions). *Pisos* (floors) represent living surfaces of some kind that extend across the unit. This study utilizes the *Capas* to investigate changes through time.

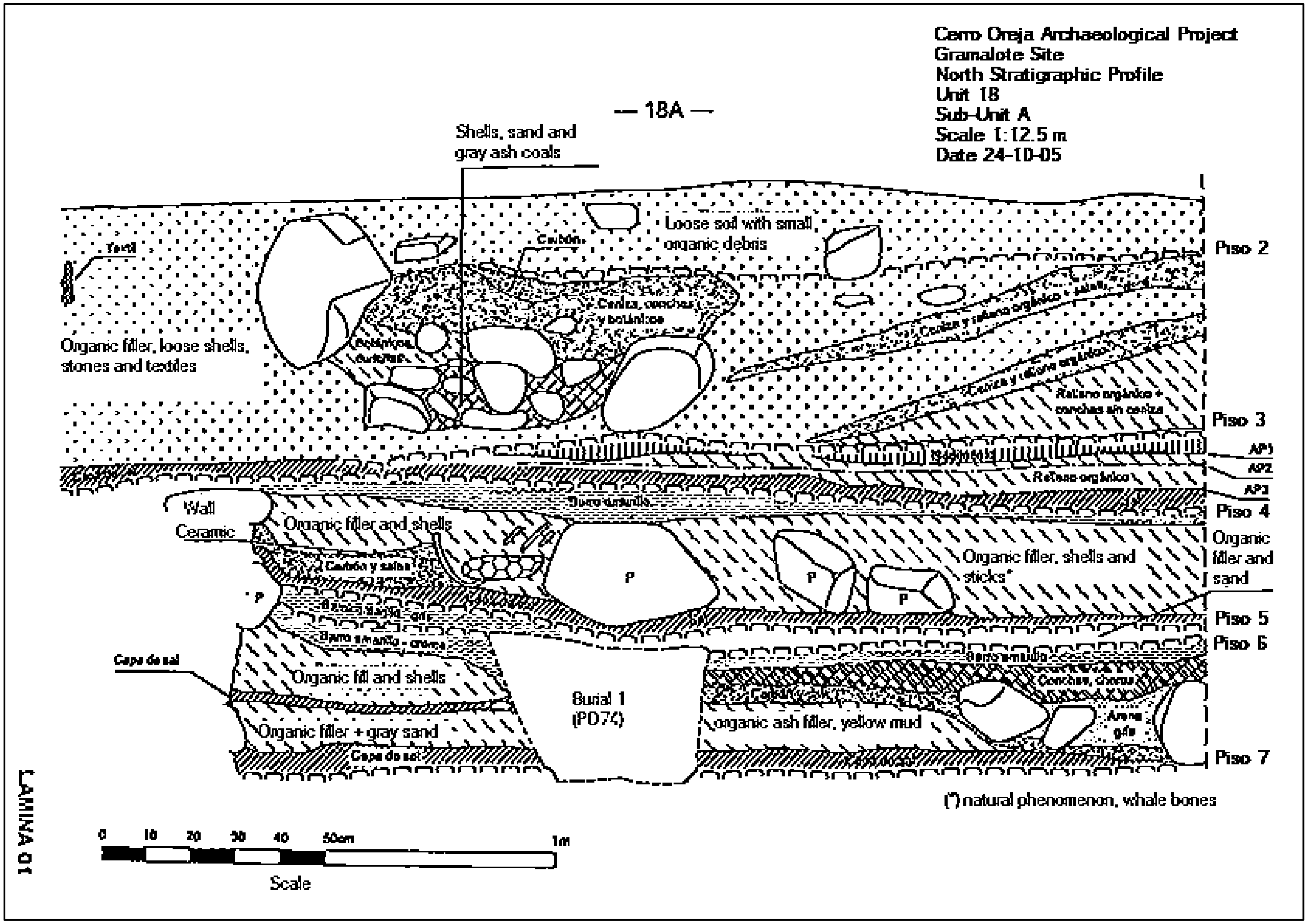


Figure 4.1 Gramalote Unit 18A North Profile, adapted from Briceño et al. 2006, translations by McTavish

Sample Size and Preservation

This assemblage exhibits excellent preservation, with recovered textiles, a range of faunal specimens of varying robusticities, and diverse organic materials. The preservation allows for the analysis of a variety of vertebrate specimens. The stratigraphic nature of the provenience divisions allows for the study of faunal resource shifts through time. A total 22,940 bones were identified from Unit 18A, weighing 14,294.1 grams (Table 4.1). This study focuses on the 14,542 bones identified to taxonomic class. On-going research by others focuses on more specific taxonomic identification of the fish bone (Boczkiewicz et al. 2012) and the birds and mammals (Hudson et al 2012).

Table 4.1 Class NISP and Weights

2011: Hudson, Boczkiewicz, McTavish		
Class	**NISP**	**Weight (g)**
Mammal	717	978.8
Fish	6445	1091
Bird	1549	362.9
Reptile	6	0.3
UNID	6622	315.2
Total	*15339*	*2748.2*
2009: UWM Study Abroad		
Class	**NISP**	**Weight (g)**
Mammal	3638	503.6
Fish	1474	10501.0
Bird	2305	457.3
UNID	184	84.0
Total	*7601*	*11545.9*[1]
SUM	**22940**	**14294.1**

In 2009, UWM students began the Gramalote identifications as part of a study abroad class with Hudson; they identified 7,601 vertebrate remains to taxonomic class, weighing

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[1] Includes one whale bone, resulting in a much higher weight in relation to NISP

approximately 11,545.9 grams (Table 4.1). This sample was from provenience designation (PD) numbers 17, 18, 71, 74, 75, 76, 77, 78, and 79. In 2011, in collaboration with Hudson and Boczkiewicz, I completed the 18A taxonomic class identifications, adding 15,339 vertebrate specimens, weighing approximately 2,748.2 grams.

Laboratory Protocol

Faunal materials had already been separated from the other archaeological remains by the Peruvian excavation team. An inventory was taken of the faunal bags, paying particular attention to the provenience information used by the Peruvian team (e.g. *capa*, PD, storage box number).

Bones were gently washed using water and then air-dried. When partially or completely dried, the bones were checked for salt encrustation. Salt-encrusted bones were given a secondary washing, then dried. When necessary, drying was expedited by spreading the bone across large, fine-meshed screens, positioned to allow air circulation, with fans and desk lamps to provide further air circulation and heat. If salt encrustation was extreme, the bones were soaked in water for 15-30 minutes. In most cases this was sufficient to dissolve the salts. If after this washing process, the bones were still salt-encrusted to a degree that would result in exaggerated weights; it was noted and entered into the database. While salt encrustation can damage the structure of bone (Baxter 1994; Brothwell 1972), it was infrequent in the faunal sample analyzed.

The laboratory procedures for sorting and recording information are described. The goals of this study focus on class-level differences. These goals match the available comparative collection and skill level. After my rough sorting into taxonomic classes, identifications were reviewed by Dr. Hudson and confirmed, revised, or refined to a more specific level identification for birds and mammals. Roberta Boczkiewicz refined the identification for a subsample of the fish.

As specimens were identified, information was recorded on tags (Table 5.2). The tag data was then recorded in a digital database to be used for further analysis in the United States. The assemblage was re-boxed and returned for continued curation by the INC in Trujillo, Peru.

Table 4.2 Recorded Information

Box (curation)
Unit
Capa (strata)
PD (provenience designation)
Class
Taxon
Element
Part
Side
Age
Modifications: burnt, cut, gnawed, worked
Count
Weight (grams)
Identification by
Date of Identification

Identification

Identifiable elements were evaluated with the available comparative collections, with particular attention paid to expected local fauna and to differentiating marine and terrestrial mammals and birds. Comparative collections of local fauna, assembled by

Hudson and Kaufman during previous lab seasons were used in combination with illustrated guides (i.e. Wolniewicz 2001; Reitz and Wing 2008; Cooper and Schiller 1975; O'Connell 2000) and photographic guides generated by Hudson from specimens in the University of Wisconsin-Madison Zoology Museum. Identifications to taxonomic classes were based on diagnostic attributes such as class-defining articular ends of bones, and structural characteristics, such as compact bone thickness (Brewer 1992:229; Reitz and Wing 2008:38).

Identifications beyond the class level, made by Hudson and Boczkiewicz include the following. Fish include: lorna drum *(Sciaena deliciosa)*, minor stardrum (*Stellifer minor*), Peruvian hake (*Merluccius gayi peruanus)*, Peruvian banded croaker (*Paralonchurus* peruanus), Peruvian weakfish (*Cynoscion analis*), shark (*Mustelus sp*.), ray (*Myliobatis chilensis*), anchovy (*Engraulis ringens*), and sardine (*Sardinops sagax sagax*) (Boczkiewicz et al. 2012). Mammals include sea lion (*Otaria flavescens*), pinniped (*Pinnipedia*), cetacean (*Cetacea*), and rodent (*Rodentia*) (Hudson et al. 2012). Birds include cormorant (*Phalacrocorax*), Peruvian booby (*Sula variegata*), Peruvian pelican (*Pelecanus thagus*), and Humboldt penguin (*Spheniscus humboldti*) (Hudson et al. 2012).

Fragmentation can affect class level identifications. When a class level distinction could not be made through basic skeletal morphological characteristics, the specimen was assigned into an unidentified category (UNID). The intent of this analysis was to be conservative with identifications.

The differentiation between marine and terrestrial vertebrates is significant for answering my research questions. Although the articular ends of the elements are usually necessary for element identification species identification, more general morphological characteristics associated with the different gravitational pressures of water versus land and air sometimes allow otherwise undifferentiated marine and terrestrial mammals to be separated (Anken and Rahmann 2001; Reitz and Wing 2008). Such characteristics include compact bone thickness and density, surface texture, and internal bone structure.

Salt encrustation can lead to heavier weights based on soil matrix rather than taxonomic class. Whenever possible, salt-encrustation was removed. If it biased the weights, then this was noted. In cases where washing led to further fragmentation of bone, associated fragments were kept together and counted as a single identified specimen.

Quantification

I use both bone weight and the number of identified specimens (NISP) to compare faunal usage through time. Both measures represent primary data (Lyman 1994:38; Reitz and Wing 2008); each has particular strengths. Bone mass is a proxy for meat weight, which can help in determining resource usage (Hesse and Wapnish 1985). NISP represents the most basic observational unit, is suitable for a variety of statistical tests, and often facilitates comparisons with other faunal reports. I use Zeder's (1991) definition of "identified" to mean a specimen, which is identified to taxonomic class, will be counted in the total NISP (Zeder 1991:79). Specimen is defined as a bone or tooth fragment. Only vertebrates were counted in the sample studied. There is a potential bias towards the identification of fish elements when using NISP due to their distinctive skeletal structure. A shift in emphasis between marine and terrestrial, or fish specialization can be traced using the combination of bone weight along with overall NISP.

CHAPTER 5: RESULTS AND ANALYSIS

This chapter reviews the results of my analysis of vertebrate remains from the site of Gramalote. I began my study with the intent of evaluating how the 2005 sample compared with Pozorski's original generalizations about subsistence at the site. I also took a closer look at potential changes to subsistence patterns during the several hundred years that the site was occupied. Given the ecological expectations of OFT and MFAC reviewed in Chapter 1, I expected that fish would increase in importance during the Initial Period. The analysis that follows addresses this starting expectation. It further contributes insights into the importance of depositional type (midden versus occupational surface) when evaluating temporal change within a single stratified unit. This chapter is organized as follows. It begins with summary data by provenience, followed by a comparison of the Unit 18A faunal sample to Pozorski's 1976 analysis, and then an evaluation of data in reference to my original expectations. This is followed by a discussion of depositional contexts. The chapter ends with a summary of key results.

Results from Unit 18A

A total NISP of 22,940vertebrate remains were recovered from Unit 18A. Of these, 14,542 were identified to class level as fish, bird, or mammal. The 6,726 bones remaining were left as unidentified vertebrate or "UNID". Figure 5.1 illustrates the percentages identified by both NISP (70.3%) and bone weight (97.2%). The undifferentiated bone was not included in the analysis that follows.

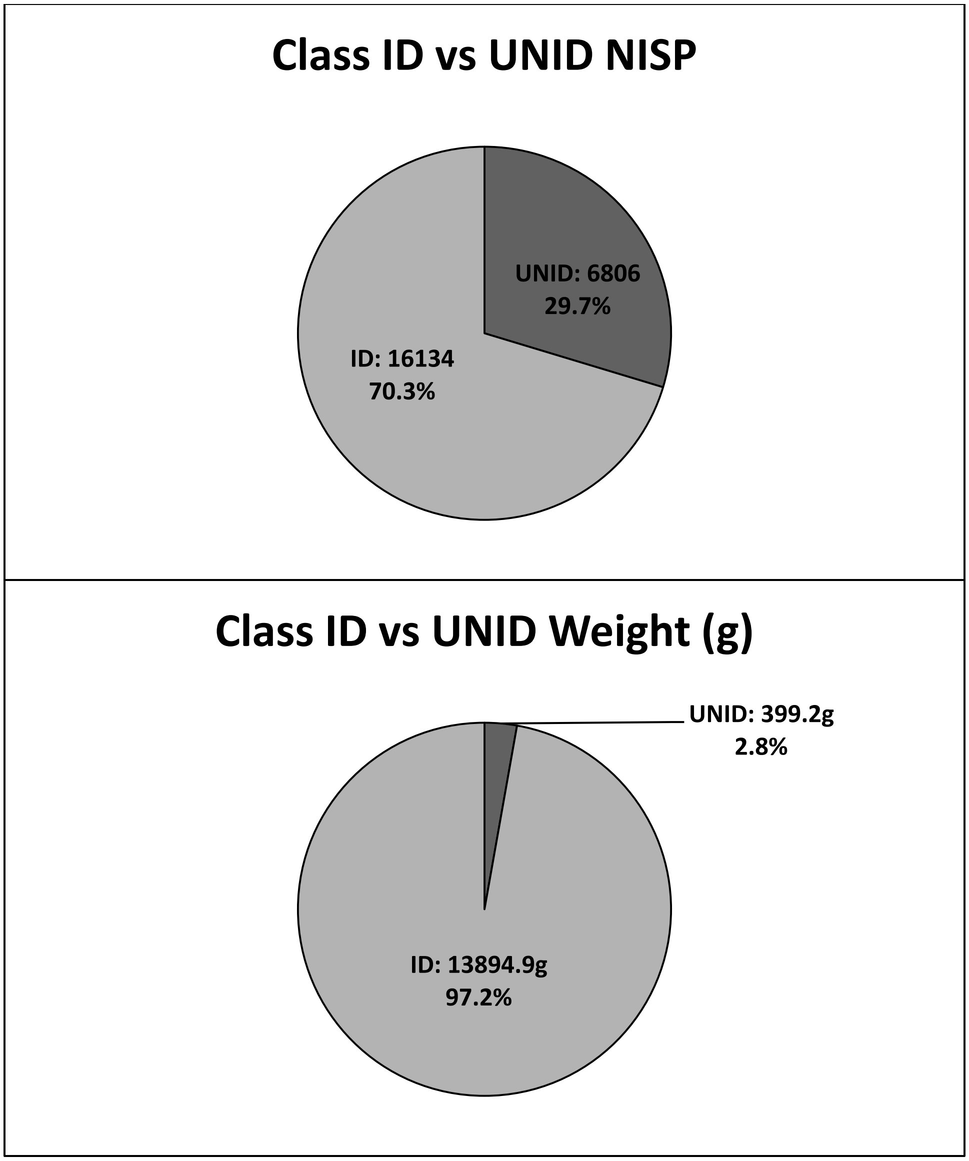

Figure 5.1 Unit 18A Percent of Bone Identified

For the purposes of this study, it was important to subdivide the taxonomic classes into marine or non-marine. The majority of the mammal bone was identified as marine; the criteria used included compact bone thickness and structure, as noted in the Methods chapter.

The marine mammal bones identified to genus or species represented 26.87% of the mammal NISP (Table 5.1); cetaceans and pinnipeds, including sea lion, were represented. Terrestrial mammals accounted for only 2.74% of the mammal NISP. The only terrestrial mammals identified were rodents, none of which were guinea pig. Due to a lack of soil staining on the rodent bones and the frequency of fairly complete skeletal representation, the rodent bones were considered non-cultural inclusions. This marine emphasis is also seen in bone weight. Identified marine taxa represent 87.70% of total mammal weight while terrestrial bone weight is only 0.06%. Given the dominance of marine mammals among the more identifiable bones, and the lack of terrestrial mammals among the class-level identifications, my analysis of class-level mammal bone classifies it as a marine resource.

Table 5.1 Mammal Identification Levels: NISP and Weight (g)

	NISP	**Weight (g)**	**% NISP**	**% Weight (g)**
Class ID	1103	414.4	70.39%	12.24%
Marine species ID	421	2969.71	26.87%	87.70%
Terrestrial species ID	43	1.96	2.74%	0.06%
Total	*1567*	*3386.07*	*100.00%*	*100.00%*

The majority of the bird bone was also judged to be marine rather than terrestrial. To date NISP=234 or 8.7% of the bird bone has been identified at the genus or species level; all of these were marine birds (cormorant, booby, pelican, and Humboldt penguin). An additional NISP=8 or 0.26% of the bird remains retain osteological features suitable for identification beyond class-level but do not match the birds which were available as skeletal comparatives (Table 5.2). Given the predominance of marine birds among those identified to genus or species, I am regarding the birds for this class-level analysis as marine resources; however, the possibility of non-marine birds is acknowledged.

Table 5.2 Bird Identification Levels: NISP and Weight (g)

	NISP	Weight (g)	% NISP	% Weight (g)
Class ID	2773	2662.49	91.37%	90.68%
Marine species ID	254	269.26	8.37%	9.17%
Possible future species ID	8	4.23	0.26%	0.14%
Total	*3035*	*2935.98*	*100.00%*	*100.00%*

Overall, when considering the importance of marine versus terrestrial species in Unit 18A, an examination *capa* by *capa* is important (Table 5.3 and Table 5.4). As demonstrated above, the only terrestrial species or genus identified represent mammals; these consist of a total NISP=43. When comparing this to the total NISP of 14,542, the impact of terrestrial fauna is minimal within this sample. This is further corroborated when considering the bone weight of marine vertebrates is 7,918.05 grams compared to 1.96 grams for terrestrial vertebrates. While there may be some terrestrial vertebrates unidentified at the class level between bird and mammal, the potential for bias within the class-level analysis is judged to be minimal.

Table 5.3 Taxonomic Class NISP by *Capa*

Capa	**Marine**			**Terrestrial**
	Bird	**Mammal**	**Fish**	**Mammal**
1	9	10	17	-
2	22	7	100	6
3	138	295	874	26
4	496	70	1331	2
5	1816	319	2619	-
6	66	75	4023	9
13	2	0	1	-
14	486	705	1018	-
TOTAL	*3035*	*1524*	*9983*	*43*
SUM	*14542*			

Table 5.4 Taxonomic Class Weight (g) by *Capa*

Capa	**Marine**			**Terrestrial**
	Bird	**Mammal**	**Fish**	**Mammal**
1	0.92	3.3	4.35	-
2	9.25	14.25	24.58	0.07
3	40.56	400.39	295.7	1.53
4	76.3	31.1	135.8	0.02
5	2409.1	127.4	217.4	-
6	235.85	527.73	630.3	0.34
13	1.3	-	1.3	-
14	162.7	2281.9	286.3	-
Total	*2935.98*	*3386.07*	*1596*	*1.96*
Sum	*7919.74*			

Composition by Taxonomic Class

How does the vertebrate composition by class compare between the 2005 sample and the data previously reported by Pozorski?

During the 2005 excavations at Gramalote, the salvage efforts emphasized an area of the site where Pozorski's 1976 excavations showed a series of highly stratified midden contexts, as noted by the excavators (Briceño and Billman 2008). Since the Unit 18A sample came from the same approximate area of the site as the 1976 sample, these two assemblages should reflect a comparable resource ranking. As noted in Chapter 3, Pozorski's primary data was reported as weights rather than NISP. Since bone weight is the quantification that allowed direct comparisons, the strength of bone weight needs to be reviewed. It can be used as a rough dietary proxy and allows for other analysts to compare raw data to their own samples (Lyman 2008). For this thesis, the comparison is used to determine if there was a shift in overall dietary emphasis for the site, as sampled in 1976 and 2005 from a similar area (see Figure 3.2 and Figure 3.3).

This comparison of bone weights for Pozorski's 1976 sample and Unit 18A suggests a difference in vertebrate emphasis (Table 5.5 and Figure 5.2). The proportions of vertebrates at Gramalote in the Unit 18A sample show less fish and more bird, when compared to Pozorski's sample. Overall, the Unit 18A sample shows mammal as the top ranking resource (42.79%), followed closely by bird (37.08%) and then by fish (20.13%). This is the opposite of Shelia Pozorski's 1976 sample, where fish were the highest resource represented by weight (47.31%), mammal ranked second (32.03%), and bird ranked third (20.67%).

Table 5.5 Taxonomic Class Bone Weight (g) Comparison of Pozorski's 1976 and Unit 18A samples

	1976 Sample		2005 Sample (Unit 18A)	
Class	**Weight (g)**	**Percentage**	**Weight (g)**	**Percentage**
Fish	1207.5	47.31%	1594.28	20.13%
Bird	527.5	20.67%	2935.98	37.08%
Mammal	817.5	32.03%	3388.03	42.79%
Total	*2552.5*	*100.00%*	*7918.29*	*100.00%*

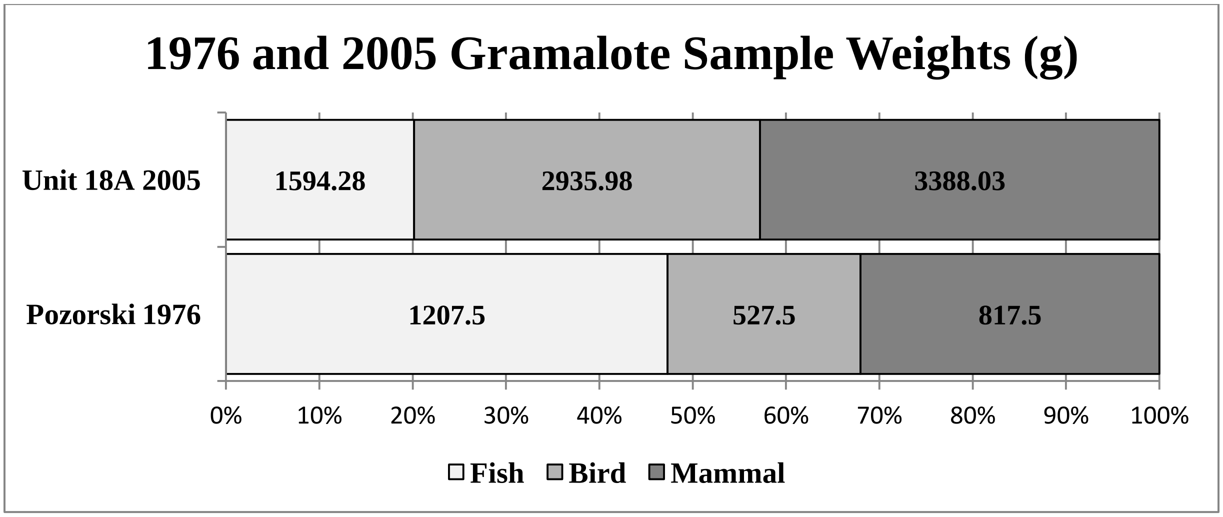

Figure 5.2 1976 and 2005 Gramalote Sample Weight (g) Comparison

The differentiation in faunal representation at Gramalote highlights the significance of looking at the Gramalote sample from an intra-site perspective.

Pozorski's 1976 excavations suggested a variety of contexts across the site, including structures and middens. Both faunal samples are localized to single units. The 2005 unit was relatively large, 6.25m^2, while the 1976 unit was only 0.5m^2 (for more details refer to Chapter 3). There is some difference in sample size between the two faunal samples as well. These factors may help to explain why the resource rankings appear so different.

The next step in my analysis is to look more closely at the stratigraphic details and variations represented by the 2005 sample. I do this by reviewing faunal composition for each of the *capa*, looking for patterns over time and evaluating other potentially relevant details related to the depositional nature of each capa.

Chronological Changes in the Relative Importance of Fish

For Unit 18A, does the relative importance of fish increase steadily over time?

To accept a hypothesis of fish steadily increasing through time, the expectation would be a continuous increase in the proportion of fish to non-fish vertebrates through the stratigraphic *capas*. Therefore, while an increase may be measured by comparing the lowest to the uppermost *capas* with comparable sample sizes (*capas* 14 and 3), a steady increase through time would show an increase of fish in each sequenced *capa*. The stratigraphic excavation of Unit 18A revealed 14 distinct *capa*, 8 of which had faunal remains. The faunal data per *capa* are summarized in Table 5.3 and Table 5.4. *Capas* 3, 4, 5, 6, and 14 contributed most of the faunal remains. It is clear from both NISP and weight totals that marine resources account for almost all the remains recovered. However, there are some distinct variations in the balance between the three key marine groupings of fish, bird, and mammal. I will examine this variation by first focusing on the contribution of fish. For this analysis, I will use NISP to gauge an initial representation of fish versus other classes of vertebrates. This is followed by bone weight as weight is used as a proxy for dietary emphasis. In examining the proportions of fish to non-fish among all the *capas* in Unit 18A, it does not appear that fish gradually increase through time in representation or in dietary emphasis (Figure 5.3 and Figure 5.4). Rather than a steady increase in fish through time, the data shows no consistent trend. Therefore, I eliminated the *capas* with less than 1,000 total NISP to see if the fluctuations in fish to non-fish comparisons were due to inadequate samples (Figure 5.5 and Figure 5.6).

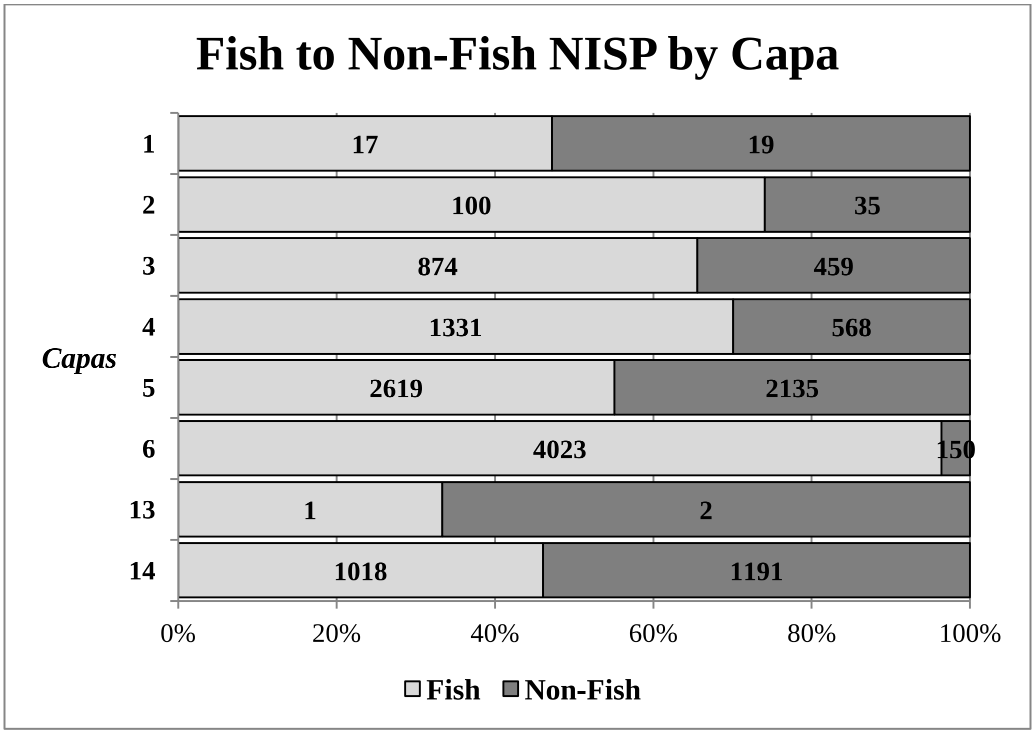

Figure 5.3 Fish and Non-Fish NISP Comparison by *Capa*

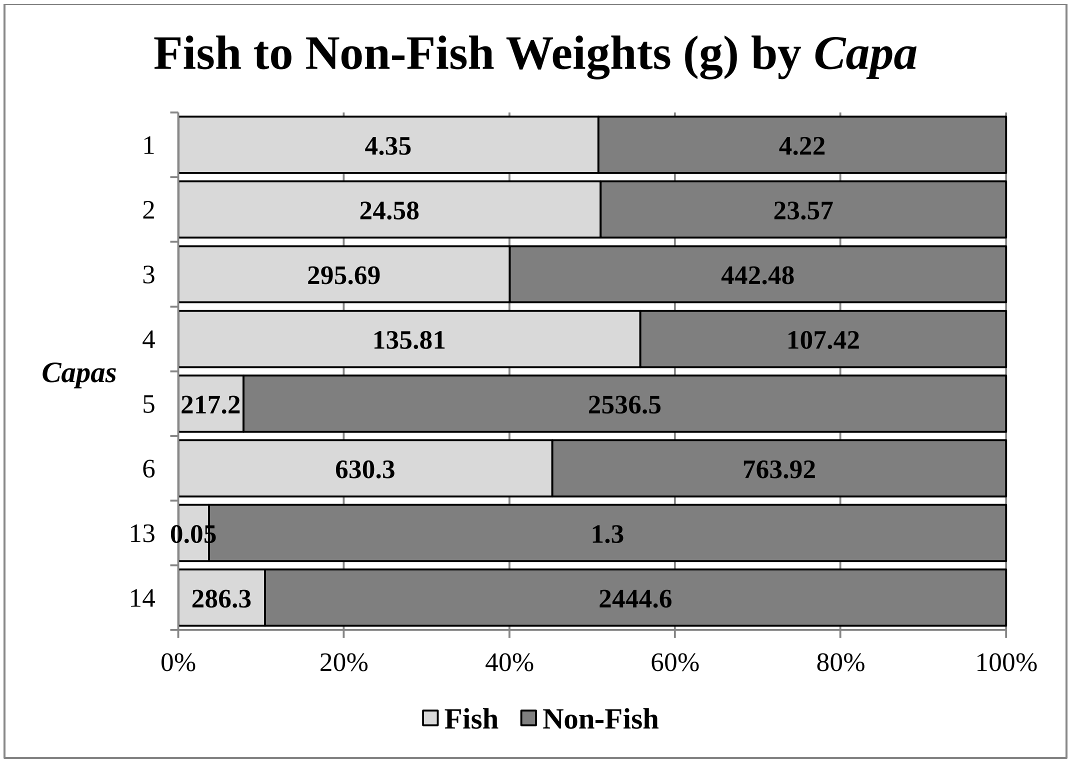

Figure 5.4 Fish and Non-Fish Weight Comparison by *Capa*

When only the most robust *capa* samples are used, there is still no consistent trend of increasing amounts of fish. While *capa* 3 shows a noticeable increase in fish from *capa* 14, fluctuations of fish proportions relative to non-fish vertebrates among the *capas* remain. The ecological expectations, as framed by MFAC and OFT, do not appear to be fully confirmed at Gramalote; fish did not dominate in the earliest occupation of the site, and while their importance did increase over time, the trend is far from smooth. A closer look at the depositional and cultural nature of the individual *capas* can contribute a preliminary set of reasons for these fluctuations.

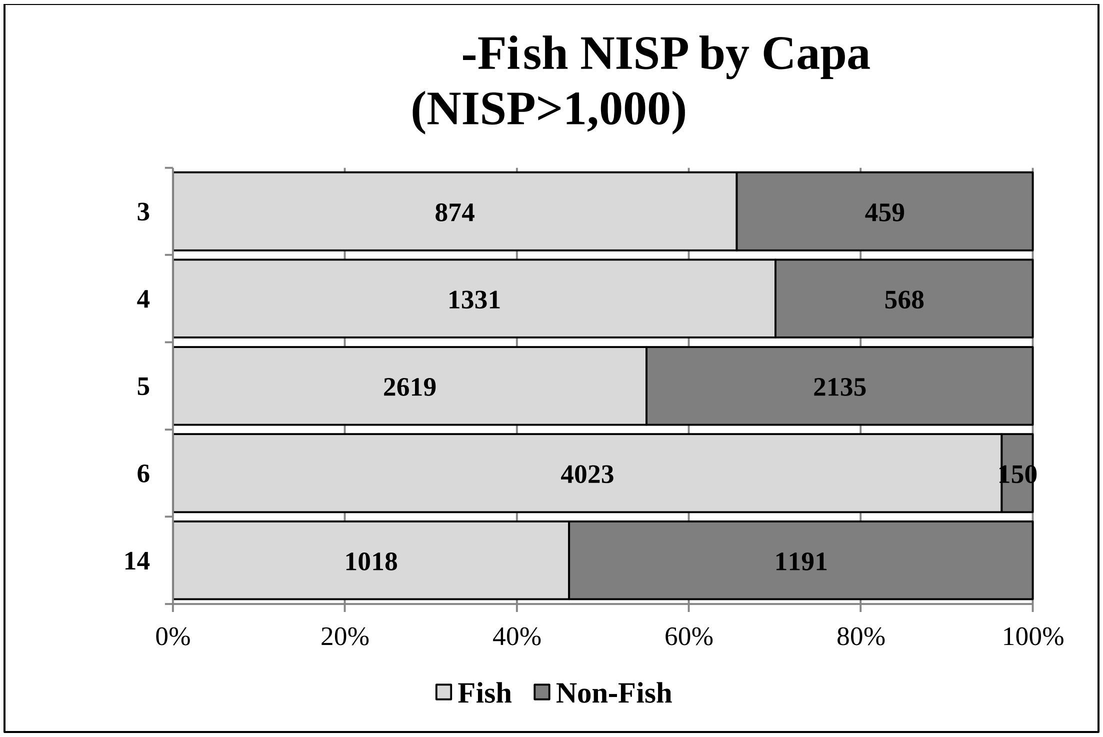

Figure 5.5 Fish to Non-fish by *capa* (NISP>1,000)

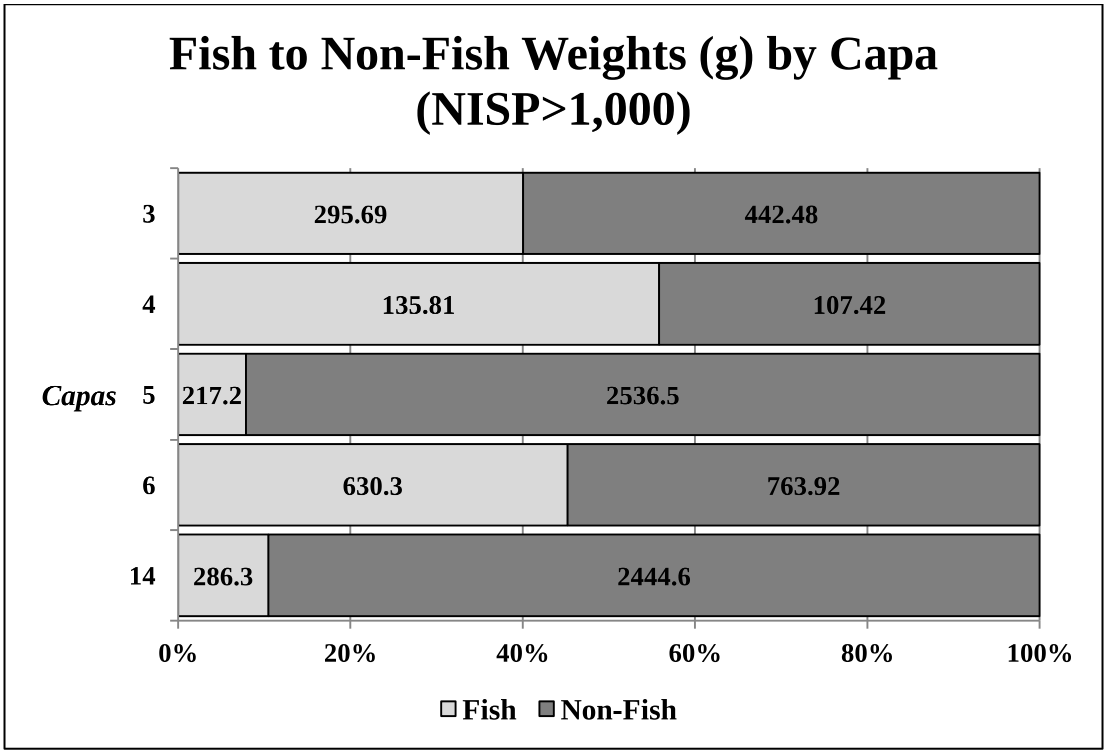

Figure 5.6 Fish to Non-fish by capa (NISP>1,000)

The Role of Depositional Context

How can we add the variable of depositional context to our evaluation of change over time?

The *capas* in Unit 18A differ in their artifacts, soils, and features (see Table 3.3 and Table 3.4 for details). One way to view this is to contrast midden with occupational surfaces. A closer look at the cultural contexts of each *capa* highlights the variety represented. Is there a productive middle ground that factors in specific contexts and their effect on the faunal record but still allows the broader chronological shifts to be recognized?

For example, *capa* 14 contains a variety of artifacts with compact organic debris suggestive of midden (Table 3.3 and Table 3.4). *Capa* 13 contains very little fauna (NISP=3), but this is likely due to the presence of an adolescent burial (see Appendix B for more details). Another small sample of fauna comes from *capa* 9, which contains a whale bone, thus a high mammal bone weight, but has been interpreted as a possible building or furniture-related function due to its close proximity to a structure wall (Briceño and Billman 2008). While *capa 6,* similar to *capa* 14, was a likely midden context, it contained small shell fragments, which the excavators have indicated were likely exposed to high heat, possibly a hearth-cleaning event. *Capa 5* contains the six *pachamancas*, or stone cooking features, with articulated bird wings associated. The original excavators (Briceño et al. 2006; Briceño and Billman 2008) hypothesized a possible public feasting and/or ritual event, since the six *pachamancas* excavated are in close proximity to each other (Figure 5.7). *Capas* 3 and 4 both contain compact fill with the presence of salts and a variety of artifacts (e.g. shell, ceramics, lithics, and textiles). Despite the similarities in soil composition and the variety of artifacts, *capa* 3 contained a round structure with two burned areas. This structure is different from the *pachamancas* in *capa* 5 and is not associated with articulated animal remains.

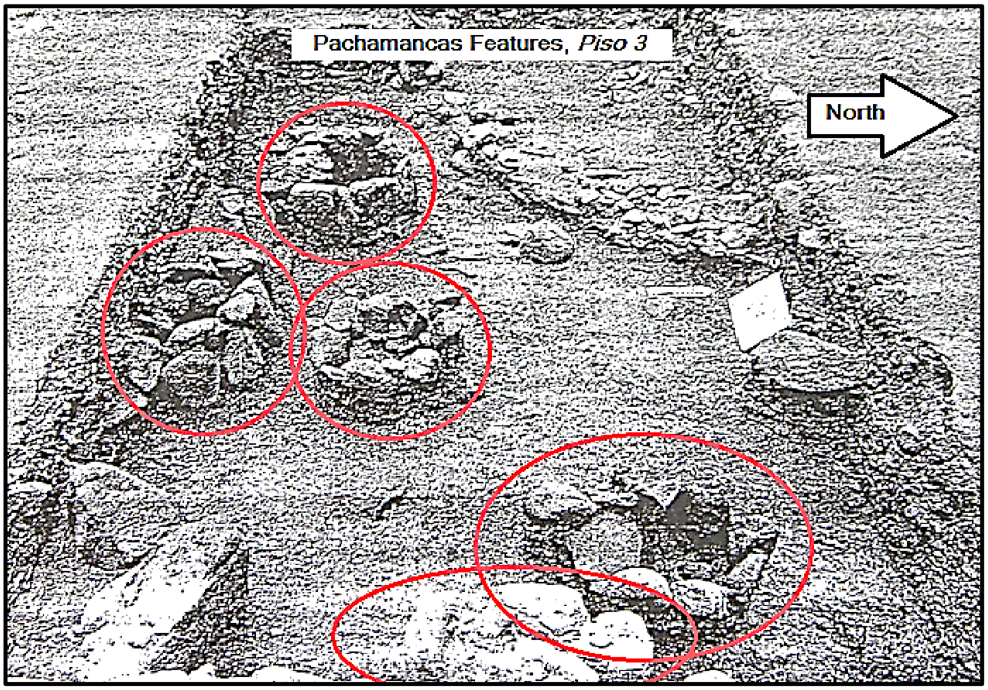

Figure 5.7 *Pachamancas* Features, photograph adapted from Briceno et al. 2006

It is not clear why fish would be so highly represented in Unit 18A, since there are no chronological patterns fitting an explicitly ecological framework. Future identification of fish to species might contribute to a better understanding of the differential depositional episodes from Unit 18A. It is important to note that the class-level identification show that the contexts, as represented by the types of artifacts, ecofacts, and features, vary between the capa, and these may help to explain differences in faunal composition once refined faunal identification are made.

In Table 5.6, occupational surface contexts are shaded darker (*capas* 3 and 5), while midden contexts are lightly shaded (*capas* 4, 6, and 14). These *capas* also represent robust sample sizes with a total NISP of over 1000 bones per *capa* (Table 5.6

and Figure 5.8). Figures 5.9 and 5.10 illustrate the results of viewing midden trends separately from living surfaces.

Table 5.6 Taxonomic Class NISP by *Capa*

Taxonomic Class NISP by *Capa*			
Capa	**Bird**	**Mammal**	**Fish**
1	9	10	17
2	22	13	100
3	138	321	874
4	496	72	1331
5	1816	319	2619
6	66	84	4023
13	2	0	1
14	486	705	1018
TOTAL	*3035*	*1524*	*9983*

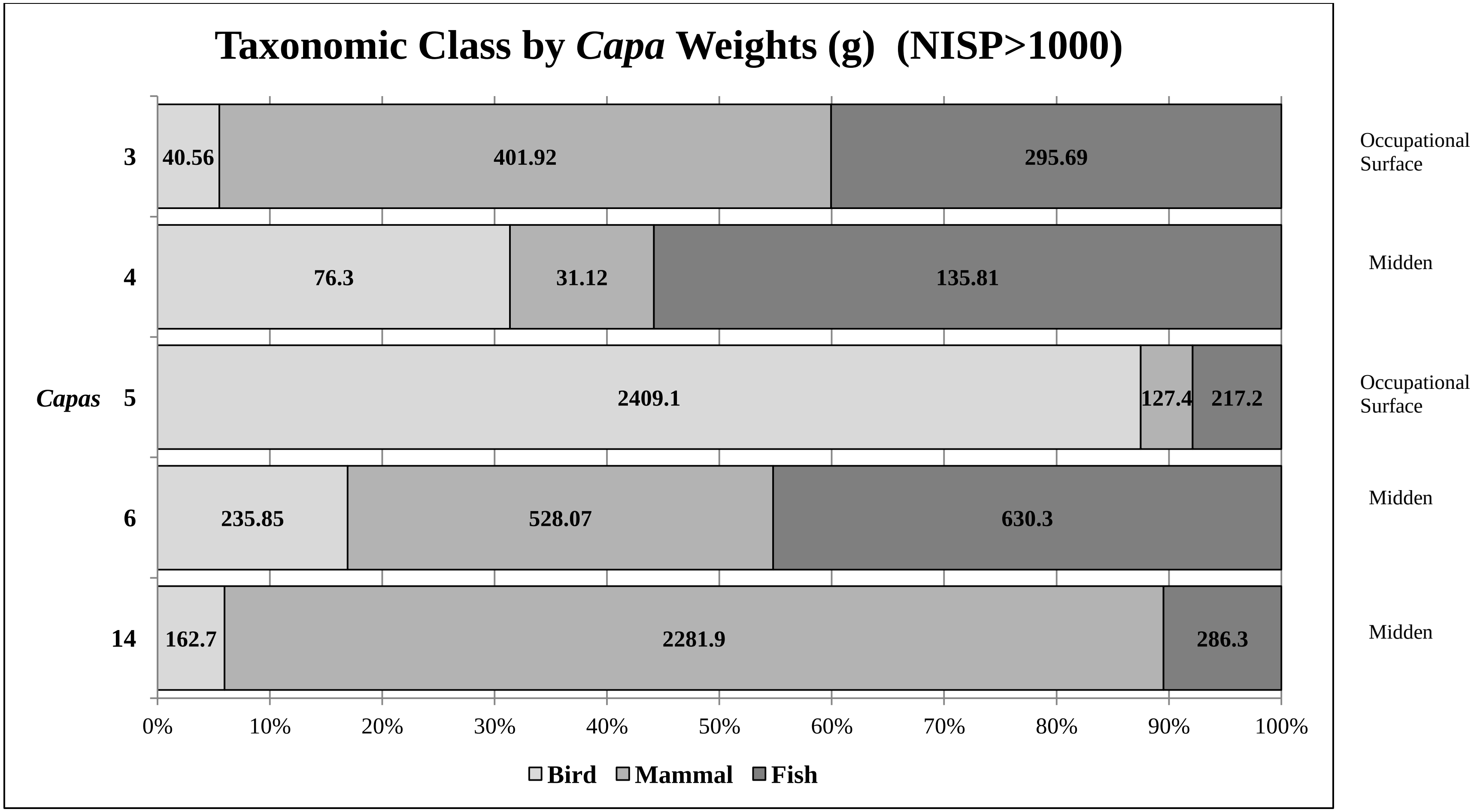

Figure 5.8 Taxonomic Weight (g) by *Capa*

In midden contexts (*capas* 14, 6, and 4), the importance of fish and bird increase through time, while mammal decreases (Figure 5.9). The increasing importance of fish matches the original ecological expectations derived from MFAC and OFT. Birds may increase due to a shift in fishing technology, such as increased use of nets, as diving birds may become easily tangled in nets.

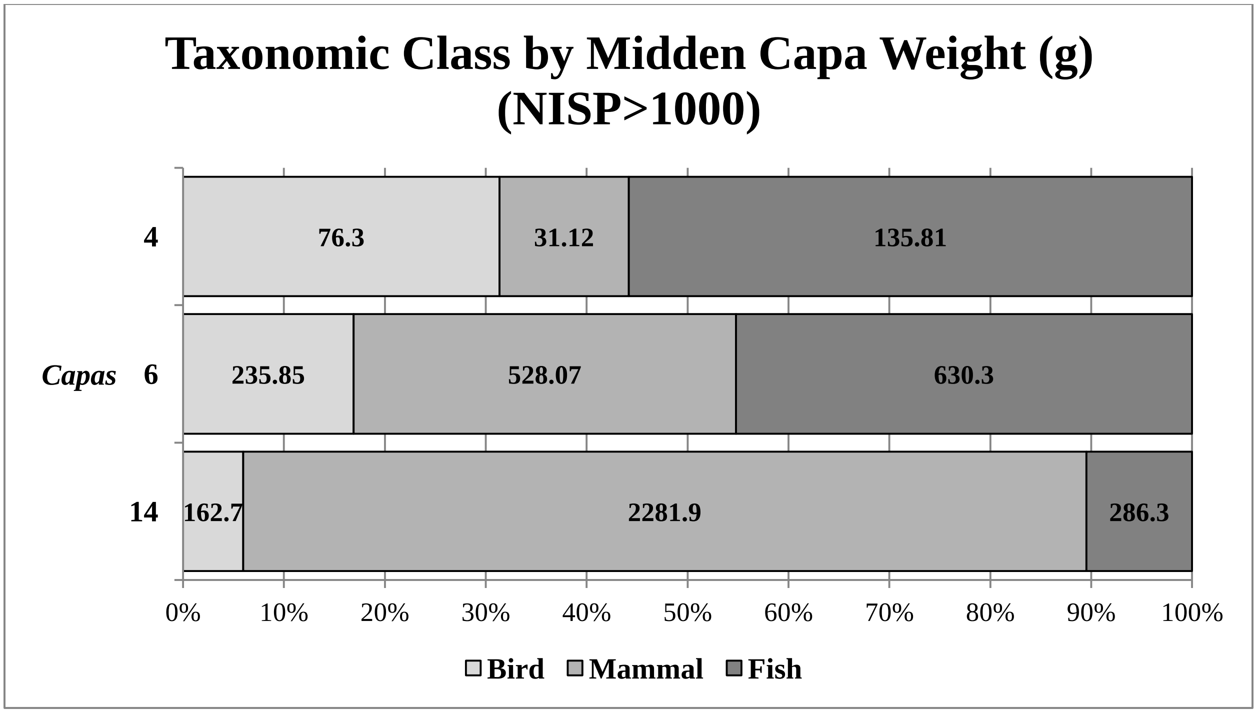

Figure 5.9 Taxonomic Class by Midden *capa* Weight (g) with NISP>1000

In occupational surface contexts (*capas* 5 and 2), the importance of fish and mammals appear to increase very rapidly, while bird appears to drop dramatically (Figure 5.10). *Capas* 5 and 3 can both be considered occupational surfaces. This is indicated by the presence of *pachamancas* in *capa* 5 and a round reed structure with associated burned areas in *capa* 3. The decrease in bird may be due to *capa* 5 containing articulated bird wings associated with *pachamancas,* while *capa* 3 did not (see Table 5.6 for NISP). In contrast, *capa* 3 contained a possible dwelling and may be representative of more commonplace food.

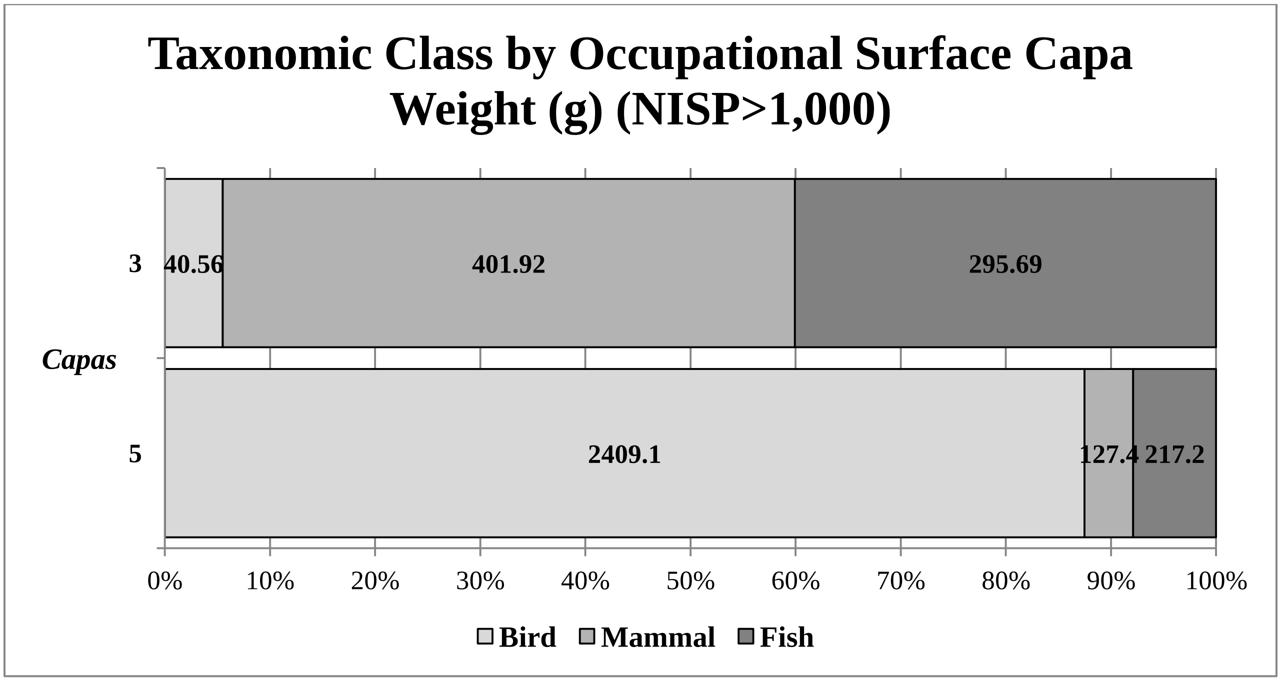

Figure 5.10 Taxonomic Class by Occupational Surface *Capa* Weight (g) with NISP>1000

What is striking when comparing these context-filtered perspectives on the role of fish is the clarity of the trend predicted ecologically: the use of fish increases steadily over time. Fish debris do not appear to accumulate at the same rate in occupational surfaces as they do in midden. Midden dump contexts show a more robust expression of the chronological shifts than do the active living areas. When midden is compared with midden over time, the trend is clear. When living surface is compared with living surface over time, the trend is again clear.

Overall, when looking at subsistence changes over time and using the stratigraphic sequence of a single unit, it can be very useful to treat midden deposits as a distinct type from occupational surfaces. Both contexts accumulate subsistence debris, but not necessarily in the same proportions. When Unit 18A is filtered in this manner, the previous sense of ambiguity in trends is removed and replaced with a consistent increase in fish over time, at one scale in middens and another scale on living surfaces.

Summary

This project aimed to describe patterns in the Unit 18A vertebrate sample at class-level identifications. The sample of 14,542 bones identified as fish, bird, and mammal were compared to Pozorski's 1976 analysis using bone weight. The comparison of bone weight showed that while the same area of the site was excavated, the 2005 assemblage as a whole ranks fish lower (20.13%) than the 1976 assemblage (47.31%). This discrepancy illustrates the necessity for class-level data to be chronologically contextualized to evaluate subsistence emphases. Pozorski's work remains significant in regional comparisons and longer temporal analyses for the Moche Valley and the Northern Peruvian Coast. The Briceño and Billman 2005 sample analyzed here adds to our understanding with its focus on chronological change during the Initial Period and attention to depositional contexts.

Subsistence shifts among vertebrates were evaluated against expectations from an ecological framework (OFT and MFAC) which proposed increasing reliance on fish throughout the Initial Period. Overall, this pattern was not seen until midden and occupational surfaces were compared separately. The initial ambiguity in chronological vertebrate representation (NISP) and dietary significance (bone weight) was then eliminated; fish increased to different degrees among midden and occupational surfaces through time. This shows the significance of considering cultural and depositional context in addition to ecological parameters when interpreting subsistence strategies within stratigraphic units.

CHAPTER 6: CONCLUSIONS

The stratified dataset from Gramalote allowed the study of temporal shifts in fish utilization during the Initial Period.

Previous studies (Billman 1996; Moseley 1974; Haas and Creamer 2006; Pozorski and Pozorski 2006) have suggested that an overall sedentary lifeway along the coast and the increase of agricultural communities inland may have led to a modification of established marine resource management. During this analysis, the overarching goal of quantifying fish exploitation through time was considered from an ecological perspective (OFT and MFAC).

The coast of Peru has an arid climate and there is a long history of prehistoric occupation. During the preceding Late Preceramic Period, coastal sites show an increase in site settlement planning and a continuation of plant cultivation with a sustained reliance on marine resources (Pozorski and Pozorski 1990, 2005; Moseley 2001; Quilter 1991; Wilson 1999). U-shaped architectural complexes developed and continued into the Initial Period (Burger 1989; Moseley 2001; Quilter 1991). During the Initial Period, there was an increase in residential sites inland from the coast associated with the appearance of ceramics and increasing evidence of irrigation agriculture.

The arid terrestrial ecosystem is juxtaposed with a rich marine ecosystem, providing the ecological structure for one of the richest fisheries in the world (Moseley 2001; Sandweiss and Keefer 2004; Wilson 1991). MFAC suggests that given this rich marine ecosystem, prehistoric groups had the potential to maintain stable populations through the exploitation of fisheries; reliance on agricultural surplus was not a prerequisite for sedentism or monumental architecture. OFT predicts that groups with such a rich marine resource base will exploit fish as an optimal resource, due to the high returns with low costs for procurement, year-round availability, abundance, and clustering.

In quantifying vertebrate resources through time, the ecological models (OFT and MFAC) predict fish to rank highest in overall NISP and weight. While fish were well represented in this sample, two of the original ecological expectations were not met: 1) fish did not appear as the dominate resource in the earlier part of the Initial Period, where marine mammals played that role; and 2) the increasing importance of fish over the span of the Initial Period, while evidenced by the contrast between lowermost and uppermost strata, did not appear as a smooth and steady trend. Exploration of the reasons for the latter pattern led to a refinement of analytic approach: closer attention to the fuller ranges of archaeological evidence for depositional context per *capa*, in particular the differentiation of midden deposits form occupational surfaces. When midden deposits are considered separately from living surface deposits, fish do show a steady increase in importance over time, and that aspect of the original ecological expectations is confirmed.

Mammals within occupational surfaces also increased, while they decreased in midden contexts. These divergent patterns may be due to only two occupational surface *capas* for comparison (*capas* 3 and 5). However, it is also likely that this difference in mammal representation differing due in part to divergence in general discard patterns among areas where people were actively moving (occupational surfaces) and where they were accumulating refuse (middens).

Birds increased in midden contexts, but decreased in occupational surface. This is likely due to differences in site area usage through time, and is possibly related to different occupational surface uses in this area of the site. This can be inferred through the architecture features (e.g. cane structure in *capa* 3 and *pachamancas* with articulated bird wings in *capa* 5). Possible differences in vertebrate signatures among midden contexts may be due in part to shifts in processing activity areas throughout the site occupation.

Unit 18A shows that while agriculture was increasing for inland sites, maritime resource exploitation remained the focus of Gramalote occupants throughout the Initial Period. The relative importance of fish, marine mammals, and birds appear to vary through time and by depositional context. Chronological fluctuations in vertebrates at the class level demonstrate the importance of understanding the depositional contexts represented by each stratigraphic unit. This analysis shows the importance of understanding the nuances of stratigraphic levels, because overall patterns can be deceiving. This is further demonstrated by the comparison of Pozorski's reported bone weights for Gramalote with those from the Unit 18A sample.

Although both samples targeting an apparent midden area within the site, the resulting rankings of vertebrate resources were not the same. This suggests that midden samples are not necessarily homogeneous and that the horizontal extent as well as the vertical depositional complexity should be considered. For subsistence strategies, site-wide conclusions using class-level data may show divergent patterns if not contextualized. Thus, intra-site analyses accompanied with inter-site comparisons are well suited for discussion of temporal trends. The faunal interpretations for the 2005 sample presented here provide one view of Initial Period coastal subsistence. It serves as a reference point for continued intra-site analyses for temporal lifeway and site use shifts within the Initial Period at Gramalote.

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APPENDIX A

BOX (*CAJA*)	UNIT	*CAPA*	PROVENIENCE DESIGNATION (PD)	CLASS	COUNT	WEIGHT(g)	QUANTITATIVE COMMENTS
1	18A	1	2	Bird	9	0.92	
1	18A	1	2	Fish	17	4.35	
1	18A	1	2	Mammal	10	3.3	
1	18A	1	2	UNID	8	0.39	
1	18A	2	3	Bird	1	0.92	
1	18A	2	3	Fish	1	0.38	
1	18A	2	3	Mammal	2	0.31	
1	18A	2	4	Bird	4	1.25	
1	18A	2	4	Fish	22	2.36	
1	18A	2	4	Mammal	1	0.05	
1	18A	2	4	UNID	4	0.24	
1	18A	2	5	Bird	11	5.99	
1	18A	2	5	Fish	59	17.24	
1	18A	2	5	Mammal	8	12.9	
1	18A	2	5	UNID	26	3.63	
1	18A	2	6	Bird	16	1.09	
1	18A	2	6	Fish	18	4.6	
1	18A	2	6	Mammal	2	1.06	
1	18A	2	6	UNID	25	3.06	
1	18A	3	7	Bird	31	15.16	
1	18A	3	7	Fish	133	38.81	
1	18A	3	7	Mammal	30	37.11	
1	18A	3	7	UNID	137	11.65	

BOX (*CAJA*)	**UNIT**	***CAPA***	**PROVENIENCE DESIGNATION (PD)**	**CLASS**	**COUNT**	**WEIGHT(g)**	**COMMENTS**
2	18A	3	8	Bird	21	6.88	
2	18A	3	8	Fish	203	52.81	
2	18A	3	8	Mammal	25	16.78	
2	18A	3	8	Reptile	1	0.03	
2	18A	3	8	UNID	63	4.1	
2	18A	3	9	Bird	59	13.54	
2	18A	3	9	Fish	406	145.25	
2	18A	3	9	Mammal	189	245.14	
2	18A	3	9	UNID	363	20.86	
3	18A	3	10	Bird	6	0.2	
3	18A	3	10	Fish	23	1.31	
3	18A	3	10	Mammal	2	0.28	
3	18A	3	10	UNID	5	0.28	
3	18A	3	11	Bird	17	4.31	
3	18A	3	11	Fish	95	39.2	
3	18A	3	11	Mammal	32	47.6	
3	18A	3	11	UNID	33	5.54	
3	18A	3	13	Bird	1	0.08	
3	18A	3	13	Fish	10	1.33	
3	18A	3	14	Bird	3	0.39	
3	18A	3	14	Fish	104	16.93	
3	18A	3	14	Mammal	43	55.05	
3	18A	3	14	UNID	119	7	

BOX (*CAJA*)	UNIT	*CAPA*	PROVENIENCE DESIGNATION (PD)	CLASS	COUNT	WEIGHT(g)	COMMENTS
3	18A	4	15	Bird	98	16.24	
3	18A	4	15	Fish	281	53.76	
3	18A	4	15	Mammal	16	11.3	
3	18A	4	15	UNID	323	24.84	
3	18A	4	16	Bird	398	60.06	
3	18A	4	16	Fish	1050	82.05	
3	18A	4	16	Mammal	56	19.82	
3	18A	4	16	UNID	1146	47.98	
4	18A	5	17	Bird	293	57.65	
4	18A	5	17	Fish	893	90.6	
4	18A	5	17	Mammal	82	25.7	
4	18A	5	17	UNID	8	17.2	15.6 grams not counted
5	18A	5	18	Bird	1439	226.1	
5	18A	5	18	Fish	1724	120.15	
5	18A	5	18	Mammal	223	80.6	
5	18A	5	18	UNID	243	22	
6	18A	6	19	Bird	313	69.46	
6	18A	6	19	Fish	1313	137.75	
6	18A	6	19	Mammal	116	48.31	
6	18A	6	19	Reptile	3	0.22	
6	18A	6	19	UNID	1464	69.41	
10	18A	6	60	Bird	241	44.6	
10	18A	6	60	Fish	997	136.81	

BOX (*CAJA*)	**UNIT**	***CAPA***	**PROVENIENCE DESIGNATION (PD)**	**CLASS**	**COUNT**	**WEIGHT(g)**	**COMMENTS**
10	18A	6	60	Mammal	84	144.68	
10	18A	6	60	UNID	1678	59.58	
11	18A	6	61	Bird	278	100.63	
11	18A	6	61	Fish	1191	205.88	
11	18A	6	61	Mammal	75	313.22	
11	18A	6	61	reptile	2	0.02	
11	18A	6	61	UNID	1075	45.88	
13	18A	6	62	Bird	42	21.19	
13	18A	6	62	Fish	522	149.77	
13	18A	6	62	Mammal	26	21.86	
13	18A	6	62	UNID	153	10.8	
14	18A	10	71	Mammal	450	8091.2	
20	18A	13	74	Bird	2	1.3	
20	18A	13	74	Fish	1	0.05	
18	18A	13	74	Mammal	16	145.4	
9	18A	14	75	Bird	117	59.8	
9	18A	14	75	Fish	224	58.5	
9	18A	14	75	Mammal	96	161.6	
9	18A	14	75	UNID	-	8.3	not counted
15	18A	14	76	Bird	154	48.5	
15	18A	14	76	Fish	363	105.2	
15	18A	14	76	Mammal	114	103.7	
15	18A	14	76	UNID	-	10.5	not counted

BOX (*CAJA*)	**UNIT**	***CAPA***	**PROVENIENCE DESIGNATION (PD)**	**CLASS**	**COUNT**	**WEIGHT(g)**	**COMMENTS**
16	18A	14	77	Bird	139	35.4	
16	18A	14	77	Fish	230	55.2	
16	18A	14	77	Mammal	116	84.4	
16	18A	14	77	UNID	-	12.7	not counted
17	18A	14	78	Bird	76	19	
17	18A	14	78	Fish	213	65.7	
17	18A	14	78	Mammal	379	1931.8	
17	18A	14	78	UNID	5	13.3	13.2 grams not counted
20	18A	15	79	Bird	9	0.2	

APPENDIX B

Summary Translations by Rachel McTavish from Briceño and Billman 2008

Architecture

Three stone walls were clearly defined during the excavations of sub-unit 18A. Wall A, was called the "west wall" from *capa* 9, spanning 2 meters constructed of stones, boulders, and two whale vertebrae held together by a yellow mud for mortar. Wall B is at the southern end with an east-west orientation and approximately two meters in length. The excavators indicate that these two walls were at one time connected. Wall C is on the east side and was not fully excavated; however, the sections uncovered measured 1.10 meters, and it appears to discontinue at the northeast corner, possibly allowing access into the structure. Due to time constraints, the southeast corner was not excavated fully; therefore, the relationship of Wall C to Wall B could not be determined.

Burials

The first burial, an adolescent of approximately 15 years of age was uncovered in capa 13 (PD 74, level 23, Feature 1) corresponding to piso 6. The burial was found at approximately 127cm below the ground surface, within a small oval pit. The body was positioned at a north-south orientation with the head positioned south and facing to the west. The body was oriented tilting slightly to the west, with the limbs flexed and the hands positioned near the face (with all limbs facing west, except the right hand flexed towards the east). A small piece of textile was located under the body and five non-diagnostic ceramic sherds were associated with the burial.

A second burial was recovered in capa 15 (PD 79, Feature 1) as a round-shaped grave approximately 70cm long, 45cm wide, and 139cm below the ground surface. This individual appears to be a child of approximately five-years of age. The body was found in a flexed sitting position with the head tilted as though looking down at the torso facing at an eastward direction. The hands were crossed and the lower limbs were flexed with the feet positioned near the pelvis. There were only three diagnostic ceramic sherds associated with the burial.