SOCIAL ORGANIZATION AND RESOURCE SHARING AT BUEN SUCESO BASED ON THE ANALYSIS OF SUBADULT SKELETAL REMAINS

by

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ABSTRACT

MOZELLE BOWERS. Social Organization and Resource Sharing at Buen Suceso Based on the Analysis of Subadult Remains (Under the direction of DR. SARA JUENGST)

The study of children in the past provides bioarchaeologists with the opportunity to understand not only the health and wellbeing of a society, but various forms of identity and power structures. In this study, I will present findings on subadult remains from the Ecuadorian Early Formative Valdivian Buen Suceso site, to gain a deeper understanding of the health and nutrition of the subadult remains in relation to underlying power structures. Thus, in this study I evaluate non-specific signs of stress, demographic information (age), and the burial of children in special contexts. This has led to further insights into the lived experience of subadult remains at Buen Suceso, as the ubiquity of lesions across this sample showcases that these individuals suffered from long term low-grade stress and were clearly buried in special contexts.

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DEDICATION

I dedicate this thesis to Amy Christoff, Joseph Bowers, Atley Christoff, Kane Pashalieff, and Howard Bowers. To the people who always knew I could.

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LIST OF ABBREVIATIONS

ENSO: El Niño Southern Oscillation

DOHaD: Developmental Origins of Health and Disease

LEH: Linear Enamel Hypoplasia

CO: Cribra Orbitalia

PNBF: Periosteal New Bone Formation

OA: Osteoarthritis

SES: Serpens Endocranial Symmetrica

CHAPTER 1: INTRODUCTION

Children in antiquity provide bioarchaeologists with a window into the past, as they embody the environment and culture around them (Halcrow and Tayles, 2011). Due to subadults' sensitivity to biocultural factors, they are excellent indicators of the nutrition of a society (Beauchesne and Agarwal, 2019). In the past, bioarchaeologists have relied heavily on subadults to answer questions about the health of societies. However, there is now a push to incorporate broader bioarchaeological questions into the study of children, health, and stress in antiquity (Beauchesne and Agarwal, 2019). Thus, the goal of my research is to further this line of thought, by evaluating the social complexity of the Buen Suceso site by examining the subadult population for signs of skeletally manifested stress.

The Early Formative Period is marked in coastal Ecuador by increasing sedentism, maize and manioc agriculture, polished stone tools, and iconographic figures (Zeidler, 2008). By examining the 100 plus Valdivia sites, archaeologists have identified ceramics, faunal remains, structures, and food stuffs to gain a deeper understanding of the Early Formative Valdivia peoples. Real Alto is characterized as an Early Formative Valdivia site (although its occupation pre-dated this time period), and was occupied from 4400 BCE to 1800 BCE (Zeidler and McEwan, 2021). Throughout Real Alto's occupation, structures, such as ceremonial mounds and charnel houses (burial places), indicate that the site became more socially hierarchical through Middle Valdivia (phase 3). Buen Suceso is a Valdivia site in Santa Elena province in coastal Ecuador (Rowe and Duke, 2020). This site is particularly intriguing, as it appears to have stayed structurally and spatially consistent throughout its entire 2,300 years occupation from 3750 BC

to 1425 BC (Rowe and Duke, 2020). Thus, the question remains how did people living at Buen Suceso experience social and economic transformations over time?

To address this question, I examined the subadult remains excavated from Buen Suceso in order to investigate the social organization of the community. I assessed each set of remains for lesions including cribra orbitalia, linear enamel hypoplasia, and periosteal new bone formation in order to assess stress for subadults, as an overall reflection of stress, access to resources, and the population's relationship to power. If these markers are found endemically across the subadult population, it could point to equal access to resources, indicating a heterarchical, rather than hierarchical society (Becker and Juengst, 2020).

CHAPTER 2: SOCIAL COMPLEXITY AND ARCHAEOLOGY

Social complexity is a broad concept that focuses on hierarchical development of social, political, and economic entities that go beyond household or immediate kin constructions of labor and production (Klaus et al., 2017). In general, social complexity can include a variety of cultural aspects, such as language or art and how they fit into the idea of complexity. However, archaeologists have continuously been focused on complex societies as "a phenomenon expressed in socioeconomic and political terms" (Klaus et al., 2017:2). Klaus et al. (2017) has used the following to evaluate social complexity:

> 1) Settlement patterns, including estimations of community size and degrees of population nucleation; 2) mortuary patterns; 3) comparative distribution of utilitarian and high-value exotic goods; 4) development of regional and centralized economic systems with internally specialized mechanisms; 5) centralization of religious and leadership systems; 6) size, differentiation, labor investment, and quality of construction materials used in built spaces from corporate architecture to sites of craft production, domestic occupation, and cemeteries, and; 6) cultural constructions of landscapes and territory (3).

Bioarchaeology is also employed to investigate social complexity by using skeletal remains, as they provide an important insight into the entanglement of culture and biology (Becker and Juengst, 2020a; Juengst 2020b; Klaus et al., 2017). Skeletal remains are excellent indicators of social complexity because social constructs, such as power, are reflected in the body. For example, individuals of high rank within a society will often have access to greater resources, resulting in better "health" than lower ranking individuals. Skeletally, social complexity is

manifested through enamel hypoplasia, trauma, metabolic diseases, and genetics (to name a few) in one or more segments of society. These indicators, in addition to cultural ideologies, intersect to provide insight into access to resources and power (Becker and Juengst 2020; Juengst 2020b; Klaus et al., 2017).

2.1 Hierarchy:

Hierarchy can be defined as the vertical movement of power, as individuals are typically in status ranked positions of power which affect access to material goods, food sources, and resources (Crumley, 1995; Becker and Juengst, 2020; Juengst, 2020b; Klaus et al., 2017). Power is often associated with a top-down approach, as individuals at the top have access to greater resources while individuals at the bottom have less or restricted access to resources. Restricted access to resources can create social differentiation, causing noticeable skeletal variation amongst a population. Thus, bioarchaeologists are able to assess hierarchy through ranked social status, centralization, and access to resources (Crumley, 1995; Becker and Juengst, 2020; Juengst 2020b; Klaus et al., 2017).

2.2 Heterarchy:

Heterarchy is a power structure, in which societies lack a formal (hierarchical) ranking system, as power is constructed in various unranked ways (Crumley, 1995). Crumley (1995) argues that power changes to meet the needs of individuals and communities, resulting "in the continual reranking of priorities" (3). Thus, heterarchy allows one to view societies in flux, as some societies may not fit into a permanently ranked hierarchical structure (Crumley, 1995). Becker and Juengst (2020) illuminate how skeletal patterns of trauma, labor, and stress, such as cribra orbitalia (CO) and porotic hyperostosis (PH), can also be indicative of heterarchy. For

example, CO and PH were found endemically across the adult population at the Black Mesa site (located in northeastern Arizona), indicating that societal activities were equal, and suggestive of a heterarchical model (Ralston and Martin, 2020). Heterarchy allows one to see socially complex differences between individuals and groups outside of the typical top-down hierarchical approach (Crumley, 1995; Becker and Juengst, 2020).

2.3 Anarchy:

Anarchism is a theory in which power organization is examined as equitable, egalitarian, or resistant to domination (Angelbeck et al., 2019; Borake, 2019; Flexner and Gonzalez-Tennant, 2019). Anarchy provides archaeologists with an alternative way to examine power structures and organizations, which can be applied to past societies, community engagement, cultural resource management, and field schools (Angelbeck et al., 2019; Flexner and Gonzalez-Tennant, 2019). Within this framework, societies are defined through the lack of centralized power, in which they are engaging in forms of mutual exchange or cooperation (Angelbeck et al., 2019). Thus, anarchist societies rely on the altruistic principles of individual and group autonomy, reciprocity, and communal decision making; all of which are forms of resistance to domination. Additionally, anarchist theorists argue the importance of "horizontal" power versus "vertical" power, as horizontal power incorporates a "bottom up" approach, which is rooted in the formation of alliances, such as unions, marches, and grassroot social movements (Angelbeck et al., 2019). Alternatively, vertical power is recognized as domination or power over individual/s. Angelbeck et al., (2019) notes "[a]narchist argue that an emphasis in our language usage upon vertical forms of power can be disenfranchising and marginalizing" (5). Thus, using an anarchical framework allows one to evaluate forms of power that lie outside of typical

hierarchical and socially complex societal models (Angelbeck et al., 2019; Angelbeck and Grier, 2012; Borake, 2019; Flexner and Gonzalez-Tennant, 2019).

For example, Angelbeck and Grier (2012) use the anarchical framework to evaluate the changing power structure in Coast Salish society of the Pacific Northwest North America. They argue that the ethnographic work of this society's social structure "reflects a long period of social interactions and negotiations in which inequality was repeatedly constructed and challenged" (Angelbeck and Grier, 2012:566). For example, there were phases, in which the Salish society had elites, aspiring elites, and commoners, with a centralized authority and other times where there was an increase in autonomy and resistance to centralized power. This is further reflected in the autonomy of Coast Salish housing structures, as people were free to identify with their matriarchal or patriarchal sides and were given equal say in decisions regarding the home.

Bioarchaeologically, cranial deformation over time has been interpreted as a marker of social complexity, including status, ethnicity, and identity. Angelbeck and Grier (2012) argue that the frequency of Coast Salish cranial deformation changed over time, showcasing the shift in their sociopolitical organization. The amount of cranial deformation amongst the elites increased over time, as the number of individuals joining that class expanded throughout time. Thus, the bioarchaeological and ethnographic evidence of this society can be interpreted through an anarchical framework, in which alternative forms of societal power are evaluated (Angelbeck and Grier, 2012).

The relationship between power and social complexity viewed through a bioarchaeological lens provides insight into the lived experience of humans, including their interaction within their communities (Becker and Juengst, 2020). Anarchy, hierarchy, and heterarchy, discussed above, provide a further breakdown of power, in which skeletal markers

reflect the communities "daily lives, access to resources, mobility, cultural identities, and social interactions" (Becker and Juengst, 2020:892). Additionally, power is deeply situated within social status, which is correlated with trauma and disease. The correlation between existing and non-existing social status and disease/trauma (or lack thereof) is why bioarchaeological questions regarding social complexity are fascinating, as these questions allow bioarchaeologists to determine how power influenced the treatment of varying groups of people (Becker and Juengst, 2020).

CHAPTER 3: COASTAL ECUADOR AND THE FORMATIVE PERIOD

The Formative Period in coastal Ecuador is characterized by an increasingly sedentary lifestyle, ceramic production, maize and manioc agriculture, polished stone tool production, and figurine ideology (Zeidler, 2008). Originally, the Formative Period was said to have occurred strictly on the Ecuadorian coast, as all early ceramic sites were found near the shore (Meggers et al., 1965; Marcos, 2003). However, upon further investigation, archaeological surveys found evidence of Early Formative Period sites inland, indicating its coastal and inland location. Meggers et al., (1965) used environmental characteristics, such as vegetation and weather patterns to define the Early Formative Period. Additionally, they worked to create a sequence of Valdivia ceramics by examining characteristics of Valdivia culture, such as subsistence patterns, settlement patterns, and housing constructions (Meggers et al., 1965; Marcos, 2003). While Meggers et al. (1965) were on the right track, it is through the variation of the 100 plus Valdivia sites over time and space today that archaeologists have gained a deeper understanding of the Early Formative Period of coastal Ecuador (Lunniss, 2020; Rowe and Duke, 2020; Marcos, 2003).

3.1 Weather Patterns: Humboldt Current and ENSO

The Humboldt Current and El Niño Southern Oscillation (ENSO) are environmental phenomena that affect the coast of Ecuador (Staller, 2013; Taylor, 2015). The Humboldt Current is a flow of cold water flowing north from Antarctica along the west coast of South America that causes the formation of low-lying clouds when the cool water meets the warm tropical air in Peru and Ecuador). The combination of low-lying clouds and fog moves east across the coastal hills and foothills of the Cordillera of coastal Ecuador. The low-lying clouds eventually dissipate

when they hit the coastal hills in the Southwest and reemerge around the western edge of the Andean Cordillera. Upon their reemergence, the clouds release moisture, creating precipitation that feeds into the waterways and is absorbed as groundwater. This creates an ideal environment for human adaptation and population density due to the flourishing of vegetation and access to water sources (Staller, 2013).

However, the Humboldt Current is affected during periods of ENSO, as the cold water is replaced by the warm equatorial current flowing eastward across the Pacific from Indonesia. ENSO is the "general warming of surface sea temperatures along the Eastern Pacific, and a lessening or reversing of northeast trade winds, bringing warm humid air over coastal South America" (Staller, 2013). This causes the upwelling of cold water to subside, resulting in a period of climatic change, which affects the littoral, terrestrial flora and fauna, and human adaptation. Usually lasting for a year or so, ENSO events are characterized by increased rainfall and resulting mudslides and can cause unpredictable weather conditions for the coast overall (Staller, 2013).

Taylor (2015) argues that the individuals that lived along the Zarumilla River (which boarders coastal Ecuador and Peru) suffered from Mega and smaller El Niño events, specifically at the El Dornajo site. This is seen through the shift in subsistence patterns, as the consumption of oysters and shellfish decreases at El Dornajo by 44% from the Early Formative Period (~2500 BC) to the Regional Development Period (~300 AD). While it is unclear if this shift was quick or gradual, the decline in consumption of shellfish and oysters, specifically from 2500 BC to 600 BC overlaps with a Mega El Niño event. Thus, the rising water levels, (brought on by the Mega El Nino event) would have disturbed the access to and abundance of oysters, directly affecting the population's ability to use and subsist off oyster and shellfish (2015).

This change in subsistence pattern not only affects what the population could eat but had the potential to affect social complexity and power structures, as access to resources could have varied amongst the population and new power structures could have emerged (Taylor, 2015). For example, Juengst (2020a) argues that environmental phenomena, such as ENSO affected the water levels of the Titicaca Basin, resulting in periods of shoreline change and erosion. The effect of ENSO combined with social and economic changes overtime created challenges in accessing and maintaining resources that were essential to daily life, which can be used to investigate violence and social change. Bioarchaeologically, violence, social change, and environmental stress can be evaluated skeletally, through the examination of accidental and intentional trauma (Juengst, 2020a).

3.2 Valdivia Tradition

Valdivia tradition refers to the style of ceramics, cultivation of staple crops, agriculture, and increasing sedentism, all of which encompass the Early Formative Period, and spanned from the western lowlands to the coastal region of Ecuador (Evans and Meggers, 1958; Marcos, 2003; Rowe, 2016; Zeidler, 2008). Valdivia culture was first identified in 1954 by Emilio Estrada (1956, 1958), who excavated the Chorrera site located on the Rio Babahoyo in Guayas (Evans and Meggers, 1958). Estrada later discovered additional Valdivia culture material further up the coast of Guayas Province, naming the site Valdivia, and establishing a link between his findings of Valdivia culture in the Early Formative Period in Peru to Ecuador. In 1956, Evans and Meggers joined Estrada in excavation at the Valdivia site, where they worked to identify the limits of the Early Formative Period occupation and collect ceramics for comparative analysis.

The Valdivia site, also known as type-site G-31 (Figure 1), is located at the mouth of the Valdivia River valley (Zeidler, 2008).

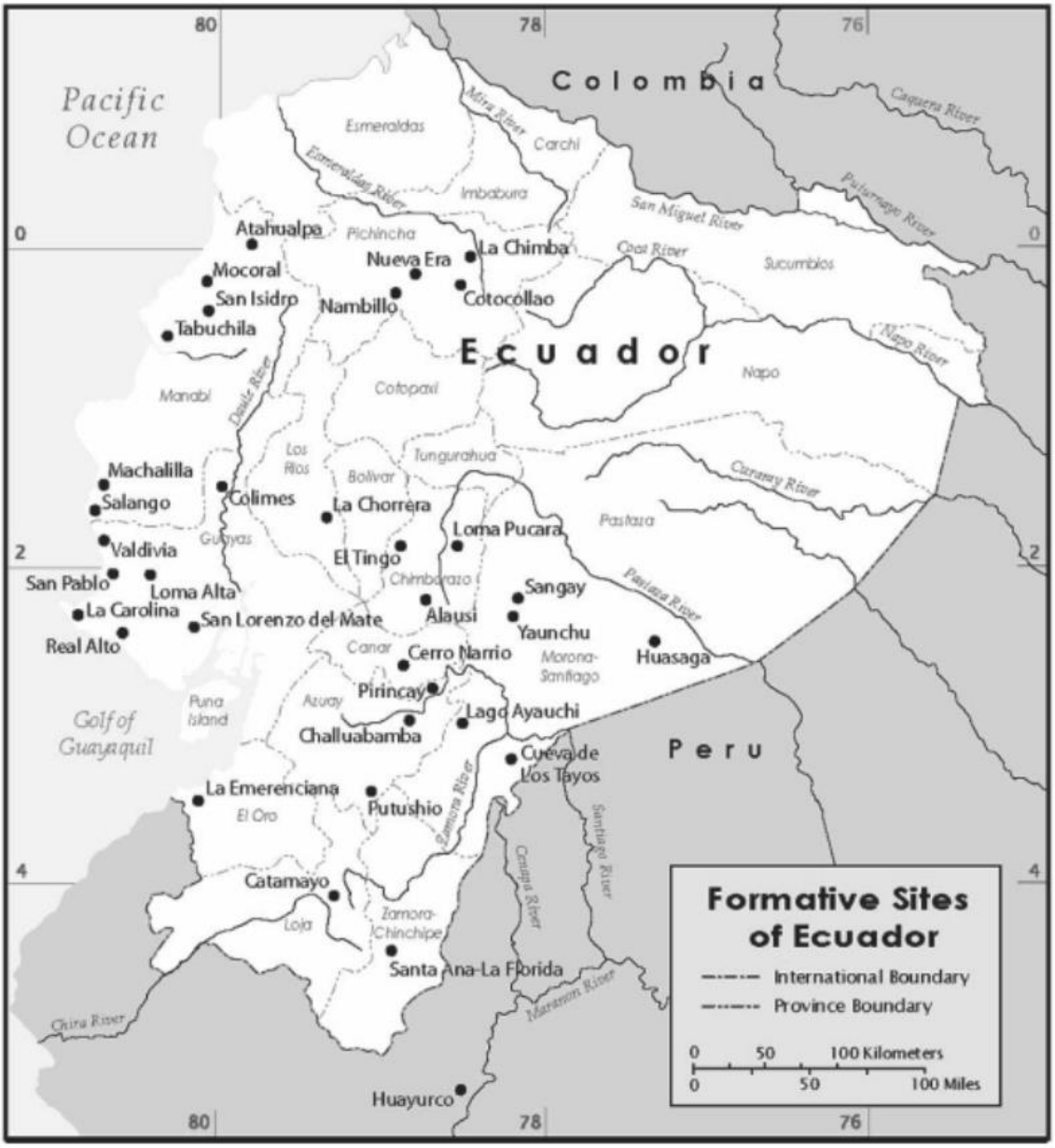

Figure 1: Map of Early Formative Sites (Zeidler, 2008).

In 1961, further excavations at the Valdivia type-site were conducted, revealing an abundance of Valdivia ceramics, including: “venus figurines, chipped stone artifacts, fire-modified rocks, and faunal material of terrestrial, fish, and shell species” (Zeidler, 2008:462). Based upon their ceramic finds, four initial phases of Valdivia culture were established (A-D) to show the change over time. The first phase, known as A, was originally thought to reflect the earliest ceramic ware of the New World, causing archaeologists to question its origin. However, concern was expressed after the publication of Meggers et al. (1965) that they excavated in arbitrary levels on a slope, essentially combining multiple and varying stratigraphic levels into a single temporal unit (Lyon 1972-1974).

Initially, it was hypothesized by Estrada (1961) and later, Meggers et al., (1965), that the ceramics were the result of a “trans-Pacific diffusion from the Middle Jomon forager/collector culture (3500-2500 B.C.) from the Kyushu region of Japan” (Zeidler, 2008:462). This hypothesis was later disproven, as Valdivia ceramics found at the Loma Alta and the Real Alto site pre-date Evan and Meggers (1958) phases and date from 4400-3300 BC. Thus, Valdivia ceramics could not have originated from the Middle Jomon culture, as this new dating would place them in the latter half of the Early Jomon Period (5300-3500 BC) (Zeidler, 2008). Other archaeologists, such as Damp (1984), refuted Evan and Meggers early on, as they believed that Valdivia ceramics were a product of northwestern South America’s agriculture. While this hypothesis was more accurate, Zeidler (2008) and Marcos (2003) argue that Valdivia ceramics were produced autochthonously, in which early trade and domestication of plants would have spread the creation of ceramics.

3.3 Subsistence Patterns of the Formative Period

Pearsall (2003) argues that the Ecuadorian Formative Period was characteristic of agriculturally based subsistence patterns. However, this statement mostly applies to the later part of the Formative Period, as charred phytolith samples from the early Formative period make it difficult to provide a definitive subsistence pattern. This is furthered by the lack of manioc remains from the coast, "which makes it difficult to assess the full extent to which root crops were used with the tree fruits, jack beans, maize, and achira and arrowroot remains that do occur in the record" (Pearsall, 2003:233). Therefore, to gain a better understanding of the subsistence patterns of the Early Formative and for a more definitive case of agricultural subsistence, there needs to be a more clear taxa of charred bits of root/tuber tissue from coastal sites. However, Pearsall (2003) argues that site locations provide the best argument for agricultural subsistence patterns in the early Formative, as Formative sites often have easy access to alluvial and land suitable for agricultural production.

Isotopic analysis of skeletal remains from the coastal sites of Real Alto and Loma Alto reveal a diet that was composed of vegetation, terrestrial animals, and maritime animals (fish and invertebrates) (Pearsall, 2003). Additionally, collagen values revealed that maize was not the basis of subsistence for the above sites. Therefore, the early Formative coastal populations appear to have subsisted off of root crops (listed above), maritime and terrestrial animals, and some maize, indicating agricultural practices. Pearsall (2003) states that the "[i]t seems reasonable to propose, however, that a shift to increased reliance on cultivated plants occurred prior to the emergence of maize as a dominant dietary component" (236). Thus, it appears that the early Formative peoples subsisted off of an agriculturally based diet, in which maize agriculture came later (Pearsall, 2003).

3.4 Real Alto: Social Complexity and Community

Real Alto was occupied throughout almost the entire Valdivia period (Zeidler and McEwan, 2021). Today, the site is shaped in an elliptical ring enclosing the remains of two plazas, about 2m in depth. In total, the site covers about 400 m (northwest-southwest) to 300 m (northeast-southwest). Occupation at Real Alto began during the Valdivia 1A period, which was about 4400 BCE and lasted until 1700 BCE, ending at the end of the Valdivia 7 Period. Throughout the various Valdivia periods, Real Alto has undergone several changes to its spatial and internal complexity. In Phase 1, the site was circular/elliptical shaped, composed of smaller domestic huts that were situated around a plaza (Zeidler and McEwan, 2021). During this first phase, it is estimated that the population consisted of about fifty to sixty people. In Phase 2A, Real Alto more than doubled in size, as the estimated population was about 150 to 250 people and there were added structures, such as a ceremonial building and trench walls surrounding domestic structures.

During the transition from Phase 2B into Phase 3, Real Alto became more of a town than a village, as the population quadrupled in size. Towards the end of Phase 2b, it is estimated that Real Alto had 90 to 100 domestic structures, which housed about 600 to 1,100 people. The number of individuals occupying Real Alto during Phase 3 increased to about 1,800 people. In addition to increased occupation, there were:

> three organizational principles [that] remained constant from Valdivia 3 through 7: 1) a tripartite division of village space into concentric areas with markedly different social connotations; 2) dual opposition of ceremonial space and quadripartite division of village space across these concentric areas; and 3) intercardinal orientation of domestic and ceremonial architecture, with a predominant northeast-southwest orientation (Zeidler and McEwan, 2021:347).

Thus, this organization showcases the intentionality behind building structures that reinforce their cosmology. The similarity in village layout may have also allowed people to move between villages while still providing familiarity with social roles and norms (Raymond, 1993). This could have facilitated the movement of people when hierarchy increased or they were dissatisfied with current trends in power (Raymond, 1993).

3.5 Foodways at Real Alto

Pearsall et al (2020) discuss the use of foodways in Middle Valdivia at Real Alto and how this reflects community relationships and economics through discussing access to resources, which would indicate status differentiation. They analyzed archaeobotanical and faunal remains recovered from excavations in 1974-1975 and sieved samples from Damp's excavations were analyzed (Pearsall et al., 2020). In this analysis, maize, canna, arrow root, squash/gourd, cotton, and jack beans were identified as economic plants in the macrobotanical and phytolith records in Early to Middle Valdivia (Pearsall et al, 2020:125). Additionally, vertebrate and invertebrate faunal remains were recovered from Middle Valdivia contexts, including a variety of fish, white-tail deer, ark shell, thorny oyster, horn shell, and turn shell. These remains showcase the use of intertidal resources, as past individuals used a spectrum of maritime resources, spanning from mangroves to shallow tidal regions, and finally to deeper water. Additionally, microfossil remains found on tools, ceramics, domestic household structures, and dental calculus samples all aid in establishing the Early Formative Valdivia culture at Real Alto as an agricultural society.

Microfossil remains were examined from three Phase 3 floor deposits (Pearsall et al, 2020). These floor deposits, which were about 20-25 cm thick, included a variety of artifacts, such as "ceramic sherds, chipped stone and debitage, ground and polished stone fragments, and faunal remains" (Pearsall et al, 2020:127). Within the domestic structures, evidence from

phytoliths on stone tools found residues from the previously mentioned economic plants and maize. Microfossils found in ceremonial structures also found evidence of economic plants and maize. Additionally, dental calculus observed in all dentitions found evidence of preserved gelatinized starch, which indicates that individuals were consuming cooked food, left behind in silicified tissue wedged into the gum line. Thus, edible portions of food, such as "rooty and fruity transport tissue, Fabaceae seed parenchyma and fibers, Calathea/Maranta rhizome spindles, and Zingiberales spheres" could be preserved after the consumption of cooked or raw food, causing it to manifest into dental calculus (Pearsall et al, 2020:134). The investigation of phytoliths on stone tools indicate that there was a diverse cuisine, as inedible foods, such as: "maize cobbs, squash rinds, and yuca peels" were preserved alongside edible foods, "such as maize, root-tubers, and fruits" (Pearsall et al, 2020:134). These findings indicate that individuals were eating and preparing similar substances at Real Alto, suggesting equal access to foodstuffs.

Pearsall et al. (2020) also investigated how access to labor affected Valdivia agriculture, as the differences in the domestic structure size suggests there was a form of economic inequality, in which some households had access to more labor than others. To evaluate this, the cultivation of longer-season crops, such as yuca, arrowroot, and llerén was compared to the cultivation of short-season crops, such as maize. Due to Real Alto's location near the Chanduy estuary, the population would have had access to the alluvial lands, which were prime agricultural areas. Additionally, the rainfall in this area was seasonal and limited, reifying the importance of cultivation in alluvial areas, as these areas provided a reliable agricultural system during the dry seasons. In fact, based on coring samples, "core Ch-045 documented that farmers planted maize and other crops near the Chaundry estuary during the Early Valdivia, when Real Alto was a village; they continued to do so as it became a town and for long afterward" (Pearsall

et al., 2020:137). Therefore, the use of alluvial land for cultivation and the combination of seasonal rain was enough to successfully cultivate short-season crops, such as maize and yuca.

However, for long-term crops, such as arrowroot or llerén, alternative cultivation practices, such as hand watering or possible extended growing periods occurred. In either case, there would be an increase in labor "in terms of time spent watering or planting fields for every-other-year production -and multiyear access to plots and paintings" (Pearsall et al., 2020:138). Thus, within the household, there would need to be a certain number of individuals to produce and cultivate crops. This furthers the work of Zeidler (1991), who believed that larger household sizes at Real Alto were related to scheduling requirements for subsistence strategies.

Lastly, Pearsall et al. (2020) reinforce early thoughts on Valdivia culture, by agreeing that Valdivian peoples' subsistence pattern consisted of the cultivation of maize, which was "tropical forest in origin, and represented emergent social and political complexity" (139). These findings highlight the diverse diet of this population, as the cultivation of maize and other crops showcased the equality of access to food resources. Additionally, the cultivation practices showcase the move from village to town during Middle Valdivia. This is important, as it shows the beginning of becoming more socially complex, in that there was a growing population and change in settlement layouts. Thus, the agricultural subsistence patterns can be credited with the transformation of society at Real Alto, as "(a)ccess to more labor-to grow more maize and to maintain long-season plantings- was likely a key element supporting status differences" (Pearsall et al., 2020:139).

3.6 Mortuary Practices at Real Alto

The spatial organization of Real Alto during Phase 3 allows one to further examine the evolution of its social complexity, as the site consisted of "two centrally located, opposing

mound constructions within an inner and outer plaza, the whole of which was surrounded by an elliptical or slightly D-shaped ring of large domestic structures, human burials, pits, and midden accumulation oriented along a northwest-southeast axis" (Zeidler and McEwan, 2021:348-349). The presence of ceremonial and mortuary/charnel houses are especially significant, as mortuary features often reflect social status. For example, at Real Alto, the charnel houses are "a highly specialized burial facility and enclosed structure with a prominent stone-lined crypt and high-status female burial at its entryway, the charnel house suggests a significant advance in social complexity, collective mortuary behavior, and ancestor worship" (Zeidler and McEwan, 2021:350). The high-status female burial is key, as mortuary patterns and iconography at Real Alto indicate that women embodied political and religious roles within Valdivia society (Zeidler, 2000; Zeidler and McEwan, 2021).

The mortuary patterns of subadult remains are indicative of ascribed rank or status, as they are often buried in close relation to the high-status female remains (Zeidler and McEwan, 2021). For example, a subadult female was found to have grave goods and goods that were associated with shamanism (Zeidler, 2000). While these remains were from a Phase 8 satellite community of San Isidro, the presence of the female subadult remains reifies females achieving high rank through ascribed (rather than achieved) status during the Valdivia period at Real Alto. Additionally, within the charnel house, about half of the internments were subadult remains, in which four were accompanied by grave goods, which indicate a high social status (Zeidler and McEwan, 2021). Additional subadult and infant burials dated to Valdivia Phase 3 have been found with assorted grave goods, such as female figurines, potsherds, stone adze, a unifacial blade, and a belt made from fourteen spondylus beads. However, due to the variation in age of the subadult and adult remains in the charnel house, it appears that these remains represent a

family dynamic, rather than a specific gender or age. Thus, the remains found at the charnel house may represent a lineage of high-ranking individuals, which is reinforced through its central placement within the community (Zeidler and McEwan, 2021).

3.7 Investigating community and inequality for Valdivia

While Real Alto and surrounding sites suggest the emergence of ranked lineages, the impact for the larger Valdivia culture remains unclear. Rowe (2016) uses community as a framework to evaluate Valdivia social hierarchy through ceramics. The use of community as an interpretive lens allows one to examine social relationships, power dynamics, and identity politics (Rowe, 2016). Ceramics can provide important insights into the community, as variation amongst the size, shape, and decoration would reflect the various needs of the population. Four Valdivia sites were included in Rowe's analysis, all of which provide ceramic evidence of the Late Valdivia phases. Buen Suceso, San Pablo, Rio Perdido, and Real Alto provided 505 rim sherds to evaluate, which were further divided into categories that would affect ceramic variation, and include: geographic position, site size, and time. Additionally, the ceramics are categorized by vessel form, vessel size, surface finish, and decorative elements. The form of the vessels found throughout these Valdivia sites indicates various activities. For example, cooking pots, containers for liquid, and serving vessels were found at Real Alto, which correlate to similar vessels found at San Pablo and Buen Suceso; each of these sites have evidence of vessels used to serve food, hold liquids, and display food (Rowe, 2016).

Four types of vessels were considered statistically significant, including: Everted Flare Rim Jars, Small Flare Rim Jars, Open Bowls, and Incurving Bowls (Rowe, 2016). These vessels reflected each community's needs, as they varied across the sites and Valdivia phases. For example, Buen Suceso Phase 6 had a large quantity of smaller Everted Flare Rim Jars, which

were utilized for food preparation and storage. However, at Real Alto, the Everted Flare Rim Jars were larger, indicating that their vessels needed to hold greater amounts of food than the ones at Buen Suceso, to meet the needs of their community. Thus, the examination of rim sherds from across the four sites indicate that vessel "variation is shaped by localized community practices, rather than temporal styles or regional interaction networks" (Rowe, 2016:76).

Decoration and surface finish of the vessels also varied across all four sites, with the finish consisting of plain, polished, or red slipped. The finishes of the vessels are important, as they correlate to their use and role within that society. For example, the red slip finish is associated with ceremonial activities, polished is indicative of food presentation, and plain represents food storage or production. At Real Alto, the presence of red slipped vessels indicates the use of the Fiesta House Mound, which was the main structure for ceremonial activities. Interestingly, while Buen Suceso exhibited lower ceremonial rankings based on frequency of red slip, polished, and plain vessels during Phase 6, there was an increase in ceremonialism in Phase 7 due to the increase in "display, presentation, and sharing of prepared foods due to the incidence of Open Bowls" (Rowe, 2016:78). This differed from Real Alto, which showed signs of decreasing ceremonialism in the later phase due to the transformation of the site, in which there could have been changes to their mound practices (Rowe, 2016).

Lastly, Rowe (2016) notes that the examination of vessels across these Valdivia sites showcased that these communities were using these vessels for communal eating. While Real Alto vessel use was restricted by group, the smaller vessels found most frequently at Buen Suceso indicates a larger community use of these vessels, which could include the group at large or smaller subsets of the community. Thus, "these ceramic assemblages may represent materialized differences between top-down and bottom-up strategies of community and relate to

expanding or rejecting hierarchical social organizations. This not only emphasizes the negotiated nature of communities but suggests that a heterarchical model may be more appropriate than a hierarchical one for characterizing late Valdivia society" (Rowe, 2016:81). Thus, combining this analysis with mortuary, ceramic, and botanical data on the social transformation of the Real Alto site through the Valdivia phases, the picture of social hierarchy during the Formative becomes murkier.

3.8 Buen Suceso

The Buen Suceso site is located in the Santa Elena province in costal Ecuador, near the Chongon-Colonche hills, and is associated with Valdivia material culture (Rowe and Duke, 2020). Excavations at Buen Suceso demonstrate the site's long occupation, which according to radiocarbon and ceramic dating, began in Early Valdivia Phase 1 (3750 BC) and continued until Terminal Valdivia Phase 8b (1425 BC). Due to the longevity of occupation at Buen Suceso and the endurance of early spatial organization, Rowe and Duke (2020) argue that this site "was a rare, multicomponent Valdivia site" (2). The site itself (Figure 2) is a raised circular shaped-midden, which is surrounded by a cleared plaza, and measures 130x100 m, generally characteristic of the Early Valdivia sites. It is located about 70 km to the north of Real Alto, 20 km to the north of the Valdivia type-site, and 12 km to the north of Loma Alta, all of which are well studied Valdivia sites.

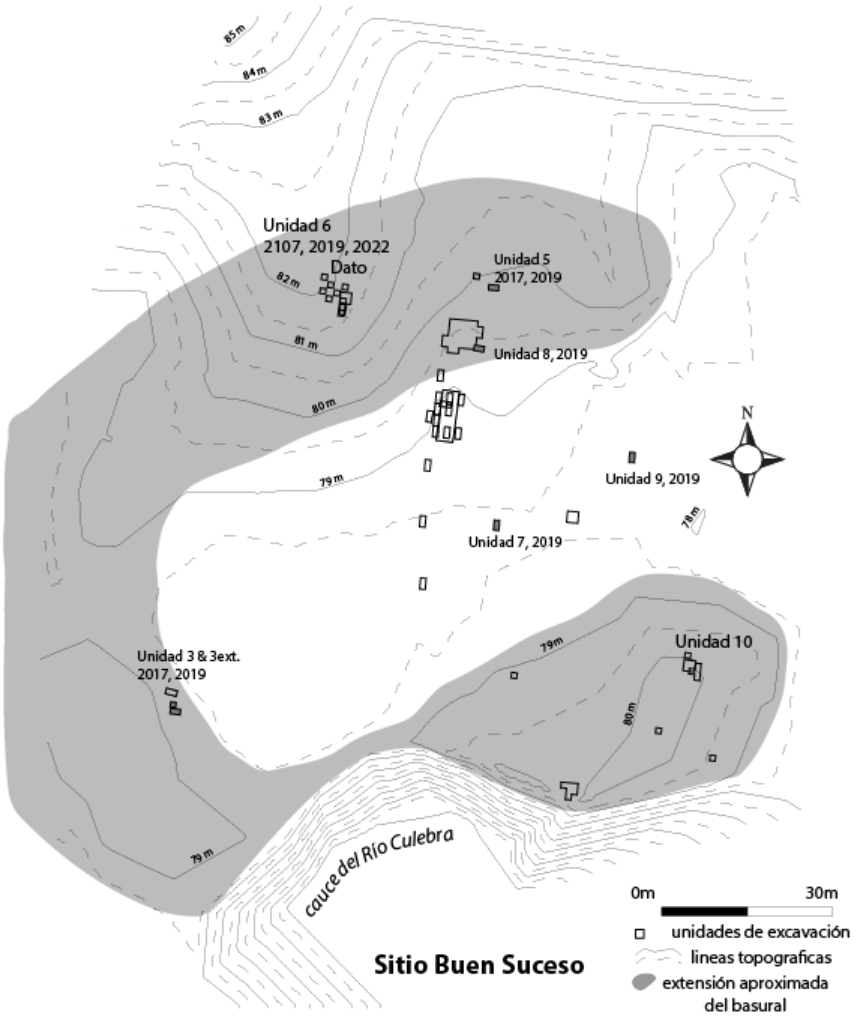

Figure 2: Map of previous excavations at Buen Suceso (Map created by Sarah Rowe)

The excavations of Rowe and Duke (2020) in 2009 and 2017 have "recovered portions of three structures and numerous midden deposits" (2). To date the site, excavations on the northern arm of the midden ring, show that the earliest dates were found in Units 5 and 6 in 2017 (Figure 2). Carbon dating of Unit 6 Level 4 showed occupation of the site as early as the Early Valdivia period, Phase 1 and the dating of Level 5 indicated occupation in Early Valdivia, Phase 2a/2b. In Unit 5, Level 3 carbon dating shows evidence of occupation during the Early Valdivia Period, Phase 2a/2b and Level 5 indicating occupation in Early Valdivia, Phase 1. Additionally, there is

evidence of Middle Valdivia occupation in Unit 2 and Feature 1, through sampling of cobblestone in Unit 2, Level 4 and through excavation of Feature 1's cobblestone floor, revealing a dedicatory deposit of "two stacked and inverted vessel bases, a figurine fragment, and a charcoal sample" (Rowe and Duke, 2020:3). Feature 1 dated to the Middle Valdivia Period, Phase 2b/3 in 2009, which was later confirmed by radiocarbon dating of the base of a large posthole in 2017. Rowe and Duke (2020) found evidence of the Late Valdivia Period during the 2009 excavations of the south arm midden. Rowe and Duke (2020) identified Phases 5,6,7 based on radiocarbon dating of charcoal that was found in a pit feature "which contained two ceramic sherds and a few lithic artifacts" (5). Lastly, Terminal Valdivia Period was identified in Unit 3, Level 3 during 2017 excavations, dating to Phase 8b. This was a fascinating archaeological find, as Terminal Valdivia was not previously found along the central Ecuadorian coast. Thus, the radiocarbon dating of these units and features showcases the perseverance of the site, through Early Valdivia and ending during the Terminal Valdivia Period.

While more excavation needs to be done at this site, the Real Alto Valdivia site is an excellent resource for comparison to processes at Buen Suceso, as the archaeology at Real Alto has revealed similar periods of occupation. However, Real Alto experienced a change in spatial reorganization during the Middle Valdivia Period, as it transformed into a regional center. This differed from Buen Suceso, as it exhibited "a remarkable degree of continuity throughout the 2,300 years of Valdivia occupation" (Rowe and Duke, 2020:5). Thus, the difference in occupation between Buen Suceso and Real Alto indicates that there were differing forms of social complexity occurring across Valdivia culture, which requires further investigation of the Buen Suceso site (Rowe and Duke, 2020).

CHAPTER 4: BIOARCHAEOLOGY OF SOCIAL (IN)EQUALITY AND ORGANIZATION

Bioarchaeology provides tools to answer some of the remaining questions about the form of social complexity of the Buen Suceso site. Lived experience, which refers to the various activities that are embodied in the skeleton, provides an insight into an individual's life (Sofaer 2006). Differences within lived experiences, such as power and stress can manifest skeletally, as access to resources and experiences of trauma vary based on social status (Juengst 2020; Klaus et al. 2017). Children are in a unique position to illuminate the differences in social structure, as they are particularly vulnerable to their environment (Beauchesne and Agarwal, 2018).

4.1 Children in Archaeology and Bioarchaeology

The study of children in archaeology is relatively new in the discipline, as past scholars overlooked the importance of studying the roles of children through an anthropological lens (Halcrow and Tayles, 2016; Beauchesne and Agarwal, 2018). In bioarchaeology and archaeology, there used to be a notion that children had no impact on social life, as they could not exert any control over the adults in their communities (Beauchesne and Agarwal, 2018). However, this perception no longer holds, as many anthropologists have worked to publish on the importance of children in antiquity; starting with the first publication about children in archaeology by Lillehammer (1989). This publication was important because it brought attention to centering archaeological studies around children in antiquity, rather than using them as a tool to understand society at large (Beauchesne and Agarwal, 2018).

Since the publication of Lillehammer (1989), many archaeologists and bioarchaeologists have theorized about why children were excluded from past studies. First, children and

childhood were often examined through a western approach, meaning there was an assumption "that childhood is a natural and universal experience" (Baxter, 2008:161). Childhood was treated as a contemporary western subject, constructed through themes related to adulthood, maturity, and the life cycle. Often, it is thought that children spend their childhood preparing for adulthood, which "stems from a relatively recent and historically traceable phenomenon that grew around the bourgeois notions of family, home, individuality, and privacy" (Baxter 2008:161). Additionally, the westernized approach to childhood emphasizes the human lifecycle, as personhood can be divided into "infant, toddler, child, adolescent, young adult, adult, and elderly" (Baxter, 2008:161). This division undermines the fact that childhood varies cross-culturally, as children take on various roles in society.

Secondly, children were considered invisible due to the lack of "preservation" of juvenile skeletal remains in mortuary contexts (Beauchesne and Agarwal, 2018), through misinterpretation of material goods associated with childhood, and based on the marginalization of "women's work" in archaeology. While children's bones are undeniably fragile, juvenile remains were often excavated improperly, causing their skeletal remains to be absent or misidentified (due to lack of knowledge on juvenile osteology) in the field. Baxter (2008) notes that early in archaeology, children were used to obtain information on archaeological materials that were considered uninterpretable, such as "miniature objects or other objects thought to be toys" (162). Additionally, children interacted differently with material culture than adults did, confusing early archaeologists, as the behaviors and roles of children in society were largely unknown.

Lastly, the invisibility of children can be directly linked with the invisibility and marginalization of women, as feminist scholars have argued that the lack of children in early

archaeology is due to their relationship with women (Baxter, 2008; Beauchesne and Agarwal, 2019). Women and children were both considered to be inferior to men, with children aligning closer with femininity, and thus embodying the same disempowerment as women (Baxter, 2008). This disempowerment has caused archaeologists to further the discussion of gender in archaeology and how it can be included in the conversation around children and childhood in antiquity. Thus, children in antiquity provide evidence of the lived experience of past communities, which is furthered by their sensitivity to environmental influences.

In bioarchaeology, the study of children provides an important insight into lived experiences of past communities, "as they are the most demographically variable and sensitive indicators of biocultural change" (Halcrow and Tayles, 2011:336). This means that children embody both cultural and biological factors skeletally, which is reflected in the physical growth and development that occurs throughout childhood. In the past, bioarchaeologists have relied heavily on children of antiquity to answer questions about stress and health, as growth and development has allowed "us to explore the interplay of the genome with the environment and how that relationship changes cross-culturally and within an individual's life" (Beauchesne and Agarwal, 2019:6). While studying stress and health has contributed to the literature and created a platform for studying children in antiquity, there has been a recent drive to incorporate the above factors into broader bioarchaeological questions. For example, social changes, such as the mark of new life stages, can be examined through subadult skeletal markers of stress and physical activity (Beauchesne and Agarwal, 2019).

4.2 Life Course Theories: Life History and DOHaD Hypothesis

Life course theory is an umbrella term used to define frameworks that deal with growth and development of an individual overtime (Agarwal, 2016). Early life, when growth and

development occur, is inherently plastic, meaning the body is easily influenced by environmental and genetic factors. In bioarchaeology, the interest lies within the relationship between environmental and genetic factors, and how this affects phenotypic variation. For example, human stature is a genetically heritable trait, but it can be influenced by environmental factors, such as malnutrition, disease, or social stress. If one was to undergo any of the previously listed forms of non-specific stress, there could be growth stunting or slowing, which would be the result of rerouting nutritional resources to larger energetic areas, such as the brain. Thus, "the examination of stature derived from long bone length, and other nonspecific indicators of stress, have been used to examine early life stress and their link to morbidity and mortality in skeletal populations" (Agarwal, 2016:133).

Therefore, plasticity in growth and development is focused on biological tradeoffs, that are seen through variation in human phenotypes. These biological tradeoffs are the root of the life history approach, in which the allocation of energy is key; as investment in one area such as growth, decreases investment in the other areas of development and maintenance (Agarwal, 2016; Worthman and Kuzara, 2005). Thus, if an individual has regular access to adequate nutrition, provisioning, and good maternal health, the cost of maintenance will be reduced with an increase of energy to allocate to an acceleration of growth or reproduction. Under these conditions, the body will send signals stating that "resource availability is reliably good and that mortality risk is low" (Worthman and Kuzara, 2005:97). Therefore, the use of life history in studying stress in the bioarchaeological record illuminates how energy sources, such as nutrition are rerouted in times of stress, causing growth stunting and other skeletal markers to be left behind.

Similarly, the developmental origins of health and disease (DOHaD) framework highlights the importance of environmental exposures in skeletal plasticity, through epigenetic impact on phenotypic variation (Gowland, 2015). Exposure to inadequate nutrition and harsh environments in early childhood is known to affect the health of individuals in adulthood, as intrauterine and post-natal environments directly affect developmental trajectories. Sensitivity to the surrounding environment can cause episodes of stress, such as manifestations of disease or malnutrition, that can alter one's phenotypic expression over their lifetime (Gowland, 2015; Beauchesne and Agarwal, 2019). The expression of these manifestations can be constructed through the bioarchaeological record, as "skeletal evidence can be used to construct osteobiographies of health due to the known chronological parameters of the developing bones and teeth" (Gowland, 2015:532). The disruption of growth at age specific markers often correlates with social life course events, such as weaning or labor roles. Life course events, such as weaning, place children in a vulnerable state as they are exposed to new pathogens. These pathogens could elevate their immune system's response, causing an energetic life history trade-off, resulting in growth stunting. Thus, osteobiographies can be used to examine skeletal parameters of early childhood stressors and their permanent effect on adult morbidity.

However, early environmental exposure goes beyond the child, as the intrauterine environment plays an important role in child and adult health. The intrauterine environment is important because it is a direct reflection of the mother's health, who is in turn a product of their own childhood environment. Thus, if a pregnant individual experienced periods of socioeconomic stress in their childhood, their children's growth is likely to be impacted regardless of their current socioeconomic status. In the bioarchaeological record, subadult remains provide insight into the health and nutritional status of their mothers, as "pathological

lesions observed on infant bones provide important proxies for the study of past maternal health" (Gowland, 2015:533). During times of stress, the pregnant body will divert nutrition from the mother to the fetus. Therefore, the infant is not only an indicator of its own health, but the health of its mother and grandmother, playing into intergenerational epigenetic inheritance. Intergenerational epigenetic inheritance is the ability to influence the health and well-being of one's children and grandchildren through one's own environmental stressors (Gowland, 2015). This allows bioarchaeologists to examine phenotypic expressions more broadly, as pathologies can be the result of intergenerational social and biological events rather than isolated ones. Thus, the DoHAD hypothesis uses early life adversity, mother-infant nexus, and intergenerational epigenetics to evaluate stressors of poor health and nutrition in adult and subadult skeletal remains (Gowland, 2015).

4.3 Stress in Bioarchaeology

Traditionally, bioarchaeologists have defined stress as any deviation from homeostasis (Klaus, 2014; Temple and Goodman, 2014). This basic definition of stress has changed over time and is now used to identify intersections "with underlying biology, diet, ecology, and sociopolitical structures", which inevitably leave behind skeletal markers (Klaus, 2014: 295). These skeletal markers stem from the inability of bone at the molecular level to heal. While the lack of healing can manifest in many ways, it is the osteoblasts and osteoclasts (the microstructures responsible for the production and destruction of bone) that control the degree of bone production and resorption. On the molecular level, there are varying proteins, such as RANK and RANKL, that are responsible for activating signals for osteoblasts and osteoclasts. Additionally, osteoblasts are controlled by a group of proteins called Wnt, which targets the creation of new bone formation through "the canonical pathway, as it activates gene expression

in cell nuclei" (Klaus, 2014:297). Hormones are another mechanism that regulate osteoblasts, as hormones are often released in response to inflammation and high stress. This hormone release inhibits the osteoblasts ability to form new bone in certain areas. However, the osteoblasts' ability to create new bone does not cease. For example, the parathyroid hormone is responsible for creating a stable calcium environment but can send signals that affect new bone formation and resorption. Thus, the signaling for new bone formation and resorption at the molecular level is imperative to understanding stress, as the proteins and hormones discussed above are responsible for reacting to inflammation and infection.

4.4 Subadult stress

In subadult remains, stress manifests in three major ways: linear enamel hypoplasia (LEH), cribra orbitalia (CO), and periosteal new bone formation (PNBF) (Halcrow and Tayles, 2011). Often, these are referred to as non-specific stress indicators, as they are the result of many biocultural factors, such as socioeconomic status, infection, climate, or weaning. LEH is characterized by its horizontal grooves or furrows in enamel that act as a response to physiological stress (Temple, 2018). These grooves are excellent indicators of nutritional stress, "Because tooth enamel is produced incrementally and does not remodel, LEH provides an indelible record of growth disturbances that are possible to estimate in terms of age-at-defect formation" (240). Thus, linear enamel hypoplasia's relationship to age allows bioarchaeologists to examine stress in relation to enamel formation.

Cribra orbitalia, like LEH, is a manifestation of stress that is associated with childhood events. Cribra orbitalia are porous lesions that are found on the orbital roof and cranial vault of the cranium (Brickley, 2018). In the past, cribra/porotic lesions were often associated with scurvy, which excluded a large range of pathologies, such as hemorrhaging or tumors that caused

similar lesions (McFadden and Oxenham, 2020). However, CO is now believed to be closely associated with anemia, as the expansion of red blood cells creates porous lesions (Brickley, 2018). Additionally, the expansion of red blood cells plays an important role in erythroid hypoplasia, which only affects the cranial bones of children (McFadden and Oxenham, 2020). Thus, the porotic lesions of cribra orbitalia would only actively manifest in subadult remains, but adults could still exhibit porosity due to lack of energy for bone remodeling.

Alternatively, Walker et al (2009) argue that CO is not the result of iron-deficiency anemia, as the bodies reaction to iron-deficiency anemia is to limit red blood cell production, rather than increase it. Therefore, iron-deficiency anemia cannot be the cause of CO due to the lack of marrow expansion. However, they argue that CO is likely the result of a megaloblastic anemia, which is acquired "by nursing infants through the synergistic effects of depleted maternal vitamin B12 reserves and unsanitary living conditions that are conducive to additional nutrient losses from gastrointestinal infections around the time of weaning" (Walker et al, 2009:119). Lastly, they argue that CO and porotic hyperostosis is the result of a Vitamin B_{12} deficient diet.

Periosteal new bone formation is another well-known pathological lesion that has been observed frequently in the past. The periosteum is a thin layer of membrane that covers the bone, which can be affected by many different stressors, such as infection and trauma. These stressors cause the production of osteoblasts, who produce "new, reactive pathological bone" (Klaus, 2014:296). Infection causes mononuclear leukocytes, neutrophils, and fibroblasts to create an accumulation of pus. This pus can create pressure between the bone and periosteum, causing an inflammation response due to hematoma formation. In subadults, new bone formation is more common due to the loosely attached periosteum membrane that is prone to tearing and

inflammation. Periosteal new bone formation is found most frequently on “the ilium, scapula, and tibia”, but varies depending on disease (Klaus, 2014:296). Furthermore, it is through the presence of PNBF that health, stress, and community stress can be identified in subadult populations.

CHAPTER 5: SAMPLE AND METHODS

My data collection took place from June 12th to July 16th, 2022, at the Buen Suceso site near Dos Mangas, coastal Ecuador. Burials were previously excavated by Rowe between 2009 and 2019 and are from Units 2, 5, 6, 7, and10.5D/10.6D (Figure 3). Burials were excavated carefully, using arbitrary 10cm levels to control for depth and context. Burials were mapped *in situ* and removed carefully for analysis in the lab. Charcoal fragments, even from the screen, were collected as these have yielded identifiable macrobotanical remains and viable materials for radiocarbon dates.

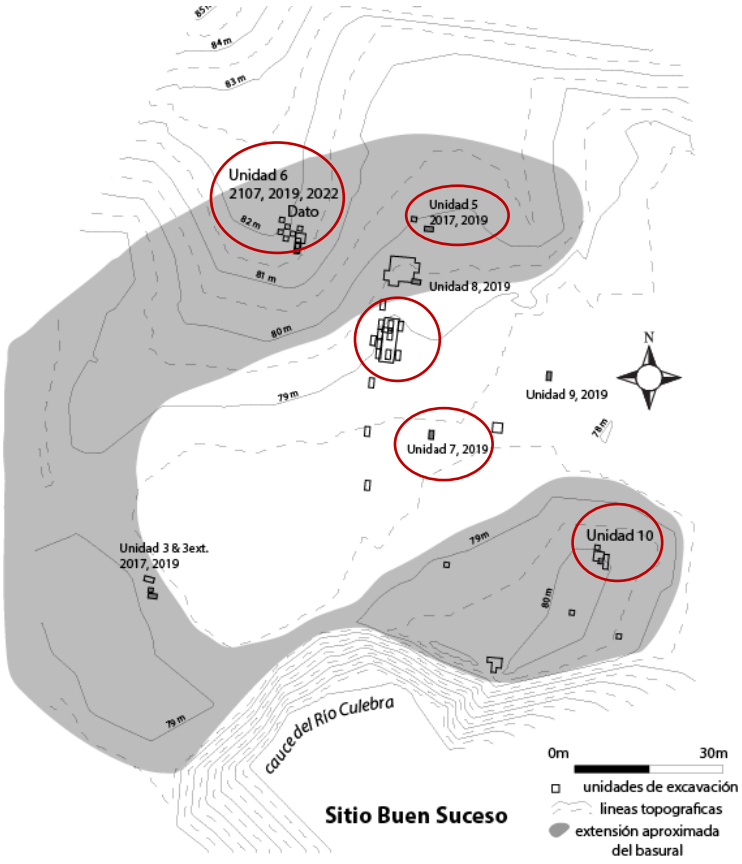

Figure 3: Buen Suceso with circles around burial excavation areas (Map created by Sarah Rowe)

I analyzed six semi-complete subadult remains (n=6) and nine isolated remains (n=9), in which the semi-complete individuals are all from the Valdivia tradition and a majority of the isolated remains are Valdivia, with the possibility of a few of the isolated remains (Unit 7 and Unit 10/2009 tarp, respectively) to be from the later Manteño (750-1532 CE) site occupation. Demographic data (age) was collected for each individual. Sex was not estimated given the subadult nature of all the individuals. Bioarchaeological indicators for stress (linear enamel hypoplasia (LEH), periosteal new bone (PNB) osteoarthritis (OA), and proliferative reactions) were recorded following standard methods, detailed below.

Subadult remains were subdivided into the following age categories: infant (birth-2 years of age), juvenile (3-12 years of age), and adolescent (12-20 years of age) following standards established by Dr. Sara Juengst at the site. These age categories mark moments of biological transition (weaning and puberty) that are often associated with important social transitions as well. Age was estimated using standards from Buikstra and Ubelaker (1994), including the use of epiphyses and dental eruption. Union of epiphyses were documented through the scoring system of blank=unobservable, 0=open (epiphysis and diaphysis completely separate; no bony union), 1=partial union, and 2=complete union (Buikstra and Ubelaker, 1994). Dental eruption was documented by using the standard chart which shows the formation of teeth from five months in utero to 35 years of age (Buikstra and Ubelaker, 1994).

Linear enamel hypoplasia (LEH) are the lines or grooves that appear on teeth when individuals undergo a stressful event, such as dietary deficiencies, infectious disease, or febrile disease (Temple, 2020). They form upon recovery from stress events, indicating survival and resilience. These events are visible on all teeth that were in the process of forming (Temple, 2020). LEH were documented based on the presence or absence of the above markers. With

0=absence, 1=linear grooves, 2=vertical grooves, and 3=linear horizontal pits, 4=nonlinear arrays of pits, and 5=single pits (Buikstra and Ubelaker, 1994).

Cribra orbitalia is the porosity that occurs on the orbital roof and cranial vault (Brickley, 2018). CO was documented based on the presence or absence of porosity, location of porosity on skeletal element, and severity of porosity; with consideration of the osteological paradox, as the presence of these lesions could indicate whether a population underwent severe health problems or survived these health problems long enough to manifest skeletally (McFadden and Oxenham, 2020).

Periosteal new bone formation is inflammation or infection (Roberts, 2019). PNBF was documented based on presence or absence of PNBF, skeletal element, and right or left (both) sides, following the standards outlined in Buikstra and Ubelaker (1994). Healing of these lesions will be recorded as well, as a measure of resilience and recovery from stress or trauma.

CHAPTER 6: RESULTS

Six semi-complete subadult skeletal remains were categorized as infant (birth to two years), juvenile (three to twelve years), and adolescent (twelve to twenty years) (Figure 4, Table 1. One out of six individuals (16.67%) fall into the birth to infant category. Three out of six individuals (50%) fall into the juvenile category. Two out of six individuals (16.67%) fall into the adolescent category.

Type of Remains	Infant (0-2)	Juvenile (3-12)	Adolescent (12-20)	Total
Semi-complete	1	3	2	6
Isolated	5	2	2	9
Total	6	5	4	15

Table 1: Ages of Semi-complete and Isolated Remains

An additional nine fragmented isolated remains were categorized as subadult and three as adult (Figure 4; Table 1). This included five infants (birth to two years), two juveniles (three to twelve years), and two adolescents (twelve to twenty years). Five out of the nine individuals (55.55%) fall into the infant category. One out of the nine individuals (11.11%) fall into the juvenile category. Lastly, two out of nine individuals (22.22%) fall into the adolescent category.

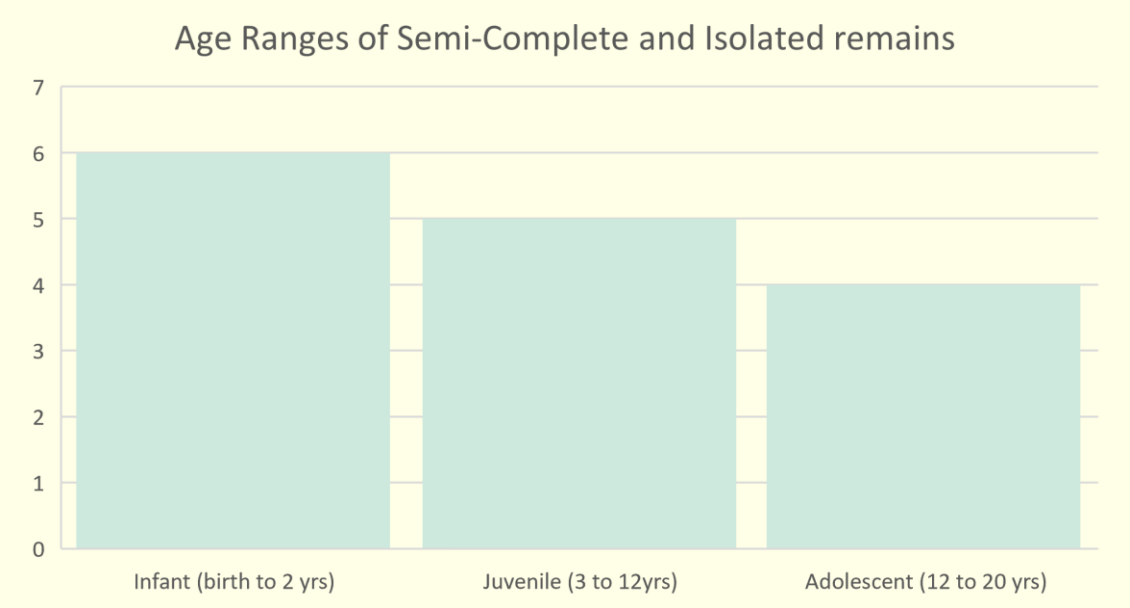

Figure 4: Age Distribution of Sub-Adult Semi-complete and Isolated Remains

The types of pathology present amongst my sample (n=15) includes: periostitis, linear enamel hypoplasia, proliferative reactions, lytic lesions, porotic hyperostosis, and serpens endocranial symmetrica (Figure 5, Tables 2,3). The most common pathology found among my sample is periostitis, as four out of the fifteen (26.66%) individuals had active woven reactions. Interestingly, the estimated age for the individuals who had periostitis ranged from juvenile (3-12 years) to adolescent (12-20 years), with two of the individuals (Burial 6 and 8) around the six to eight year age range. While occurring less frequently across the population, proliferative reactions, linear enamel hypoplasia, and lytic lesions occurred on two out of fifteen (13.3%) individuals and osteoarthritis, porotic hyperostosis, and serpens endocranial symmetrica, on one out of fifteen (6.66%) individuals. No individuals presented evidence of cribra orbitalia.

The individuals (burial 11 and isolated remains Unit 10/2009 tarp) with proliferative reactions fall into the adolescent category, with their age ranges between twelve to twenty.

Additionally, linear enamel hypoplasia was only present on two individuals (Burial 4 and isolated remains from under the 2009 tarp) in the same age category of juvenile. Lytic lesions were found on two individuals (Burial 8 and isolated remains from Unit 6.6F) in two different age categories, infant and juvenile, in which the ages range from zero to two and eight. Lastly, there is one individual with osteoarthritis (Burial 11) who was estimated to be an adolescent (12-19 years of age) and one individual (isolated remains from Unit 7) with serpens endocranial symmetrica, estimated to be an infant (birth – 2 years of age).

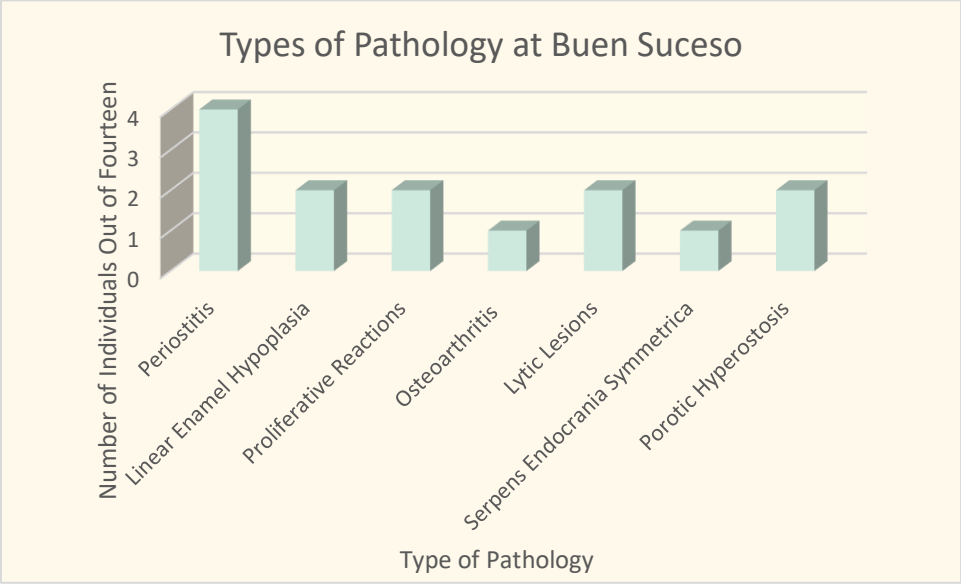

Figure 5: Pathologies Present Amongst Semi-complete and Isolated Remains

The subadult remains with periostitis (N=4) were classified into the age categories of juvenile and adolescent. Many of these individuals had reactions across multiple bones. Woven reactions occurred on the following bones across the five individuals, including: femur, humerus, ulna, radius, fibula, and ilium, and possible periostitis was recorded on ribs. Burial 6, had active woven reactions present on the right femur, left and right humeri, ulnae, radii, and fibulae

(Figure 6). Burial 7 had possible periostitis on femur fragments, with active woven reactions on the ilium between the acetabulum and sacro-iliac joint, with the most concentration around the middle of sacro-iliac joint (Figure 7). Burial 8 exhibited periosteal and lytic lesions on the radial head, specifically proximal, between the head and shaft (Figure 8). Burial 11 had possible periosteal reactions on the left rib fragments (Figure 9A, 9B, and 9C).

Burial 4, who was between the ages of four and five at the time of death, was the only semi-complete subadult who had the presence of LEH. These lesions were multiple bands, recorded on both maxillary central incisors, the right maxillary lateral incisors, and the right maxillary canine. There were areas of enamel disturbance on the left maxillary canine and left mandibular second molar, and on two deciduous teeth the right maxillary central incisor and the right maxillary canine (Figure 10A, 10B, and 10C). There was an additional LEH present on the left maxillary lateral second incisor. Additionally, Burial 4 had an incised horizontal grove across the labial surface on the right first deciduous maxillary incisor (Figure 10B) – while not pathological, this dental modification may provide insight into the social status of these children and is one of the earliest documented examples of dental modification in coastal Ecuador.

Proliferative reactions were present on Burial 11, with reactions on the ribs, proximal, medial, and distal phalanx, and patella. This subadult not only had proliferative reactions, but they also had possible periostitis on their ribs, observation of which was slightly precluded due to the fragmentation. Finally, osteoarthritis was present on their fourth metacarpal (Figure 9A).

There was possible presence of cranial pathology for Burial 2, who was estimated to be six to nine months of age at the time of death (Figure 11A, 11B, and llC). Due to the fragmentation of the cranial bones and the age of the individual, it is difficult to say if the porosity is due to lesions or general bone growth.

Within the isolated remains, the individual from Unit 5 Level 4 had a resorbed root on their deciduous left maxillary canine (Figure 12). The resorbed root indicates that this individual was in the process of losing teeth and making room for their permanent teeth. The isolated remains included in Unit 7 (came from a very mixed context and is potentially Manteño), Levels 5, 6, and 7 exhibited possible serpens endocrania symmetrica (SES) on interior cranial fragments with additional fragments exhibiting taphonomic folding and cracking (Figure 13A, 13B, and 13C). The remains found in Unit 10.5D/10.6D, under the tarp associated with the excavations in 2009 included at least two individuals (which are potentially Manteño): a juvenile and an adolescent. They exhibited healed porotic hyperostosis (PH) on one parietal cranial fragment, a proliferative reaction on a fibular fragment (which shows indication of healing by its smoothed surface), and the presence of LEH on a deciduous maxillary first incisor (Figure 14A and 14B). The remains from Unit U6.6F, Level 4 included one individual, an infant, who had lytic lesions on the left distal humerus (Figure 15) . Lastly, three isolated remains without pathology includes: Unit 5 Level four (with only the presence of deciduous upper left canine), Unit 6A Level 7 (with only the presence of upper left molar one), and Plaza N01/02 9 (with the presence of cranial and long bone fragments) (Figure 16A, 16B, and 16C).

The isolated remains of Burial 3, Unit N5/6 01 exhibited OA on their C2 vertebra (Figure 17). The remains found in Unit N9/10 01 was a lower left pre-molar, with a pinpoint carie on the occlusal surface (Figure 18). Lastly, a young adult from Unit U6.6F had pillowing on a vertebral body (Figure 19).

Age categories	Periostitis	PH	LEH	OA	P.R.	L.L.	S.E.S	R.R.	P.V.
Infant	0	1	0	0	0	0	0	0	0
Juvenile	3	0	1	0	0	1	0	0	0
Adolescent	1	0	0	1	1	0	0	0	0
TOTAL	4/6	2/6	2/6	1/6	1/6	1/6	0/6	0/6	0/6

Table 2: Pathology Present amongst Semi-complete Burials. Note: P.R.= proliferative reactions, L.L.= Lytic Lesions, R.R.= Resorbed Root, and P.V.= Pillowing Vertebra

Age categories	Periostitis	PH	LEH	OA	P.R.	L.L.	S.E.S	R.R.	P.V.
Infant	0	0	0	0	0	1	1	1	0
Juvenile	0	1	1	0	0	0	0	0	0
Adolescent	0	0	0	1	1	0	0	0	1
TOTAL	0/9	1/9	1/9	1/9	1/9	1/9	0/9	1/9	1/9

Table 3: Pathology Present amongst Isolated Remains. Note P.R.= proliferative reactions, L.L.= Lytic Lesions, R.R.= Resorbed Root, and P.V.= Pillowing Vertebra

CHAPTER 7: DISCUSSION

7.1 The Health of Buen Suceso Compared to Other Ecuadorian Sites

Based on the type of pathologies present and the lack of severity amongst the population, it appears that these individuals had long-term but low-grade levels of stress. While evidence of pathology was ubiquitous, the children survived long enough for the stress to show on remains. Given the Osteological Paradox, in which lesions can be interpreted as either resilient or frail depending on if the individual survived long enough to recover from the disease or not, we can thus assume that biological stress was chronic and low-grade rather than acute and severe. Thus, strengthening the idea of alternative power at Buen Suceso, as it appears that these individuals all had equal access to food resources. Lastly, it is possible that the sedentary nature of the site, with or without a reliance on agricultural products (as the reliance of these individuals on agriculture is unclear) could have created micronutrient deficiencies and/or common encounters with pathogens that contributed to this pattern.

The presence of the above pathologies across my sample aligns closely with pathologies found across other coastal and highland Ecuadorian sites. Ubelaker (1992) argues that porotic hyperostosis, linear enamel hypoplasia, periosteal new bone formation, and subadult mortality are correlated in coastal Ecuador. In particular, he found that PH in Ecuadorian samples was predominantly the result of anemia due to increases in sedentism and population density. The sample Ubelaker (1992) studied came from a variety of sites that collectively spanned over 8000 years from the Las Vegas culture and the shift from hunter gatherer to horticulture (Sta Elena), to later agricultural subsistence at Ayalán and Agua Blanca, basically encompassing the whole pre-Hispanic Ecuadorian chronology. Throughout this period, archaeological evidence shows various

increases in sedentism and shifts in population size, and an increased reliance on agriculture over time and space; Ubelaker (1992) argues these shifts "seem to be correlated with changing patterns of skeletal manifestations of chronic anemia, as evidenced by the frequency of porotic hyperostosis" (205). Therefore, porotic hyperostosis in Ecuador appears to be correlated with disease and sedentism through non-specific stress markers (periosteal new bone formation and linear enamel hypoplasia), rather than diet and reliance on maize agriculture (Ubelaker, 1992).

Sixteen out of the 906 skeletons examined (2%) by Ubelaker (1992) had PH on the cranial vault and/or in the orbits. These individuals were all from the Guangala site (OGSE-MA-172), including individuals from the Ayalán sample, and the Jama-coaque cranium from Manabí. This data shows that lesions on the cranial vault were a little bit more present (13 individuals) than within orbits (7 individuals). Additionally, 13 of the individuals had active lesions, with remodeled lesions present only on the cranial vaults of adults. Lastly, a majority of the individuals with PH were children, in which 11 were under the age of five and one was under the age of 10. Spatially, it appears that PH are found at relatively recent coastal sites, as none of the 192 individuals at the earlier Santa Elena site had PH. Additionally, there was no PH found in the samples at the coastal sites of La Libertad, La Tolita, and Agua Blanca. With the absence of PH throughout the above sites, it appears that the cause of PH at OSGE-MA-172 is not exclusively linked to maize agriculture, but some other non-dietary component, like disease. This is because the above sites were subsisting off maize agriculture like the rest of the sites within this sample. Thus, indicating that the individual at the OSGE-MA-172 were suffering from something beyond the scope of diet (Ubelaker, 1992).

Periosteal new bone formation is a common indicator of disease amongst the Ecuadorian sample studied by Ubelaker, typically present on the long bones, the tibia or fibula. While the

type of disease that an individual suffered from is rarely defined, the frequency of PNBF can provide an important perspective on morbidity. Ubelaker (1992) argues that overtime, in Ecuador, there has been an increase in infant and child mortality, as infant life expectancy decreases with the increase of adult longevity and life expectancy. The decrease in child life expectancy is the result of infectious disease, the increase in sedentism, and population density. Additionally, the rate of enamel hypoplasia has increased over time, as lower levels were observed from 6000 BC to 500 BC, with an increase in 550 BC, followed by periods of rapid decrease and increase. Thus, it appears that stress lesions of many types (PH, periosteal lesions, LEH) all increased over time particularly at coastal sites in pre-Hispanic Ecuador (Ubelaker 1992).

Kent (1986) argues that the correlation of the above factors reflects disease stemming from increased sedentism and aggregation. While the cause of porotic hyperostosis has often been linked to a heavily maize-based, agricultural diet, Kent (1986) argues that some children still suffer from anemia even with access to a diet high in iron and protein. Thus, PH is more likely to occur due to disease that is brought on by sedentism rather than diet because children under the age of five are more susceptible to diarrheal, bacterial, viral, and parasitic disease. While the effect of diarrheal disease on an individual in Western countries is often overlooked, due to lack of severity and treatability, in non-Western countries it severely impacts individuals, especially children, and often leads to death.

Parasitism can also cause diarrheal disease and direct blood loss, both of which can cause anemia, and thus manifest skeletally as porotic hyperostosis (Ubelaker, 1992). In Ecuador, there are two species of hookworms that are known to cause blood loss: *Necator americanus* (most common) and *Ancylostoma duodenale*, both of which thrive in the heat and moisture of the

coastal environment. Interestingly, hookworm in modern day Ecuador is a common health issue amongst the coastal populations, but there are no reports of hookworms in the highlands. Thus, parasitism may play a role in coastal Ecuadorian porotic hyperostosis, as Ubelaker (1992) notes the absence of PH from individuals at the highland site Cotocollao.

Blom et al. (2005) provide a regional survey of anemia in the western lowland area of Peru, in which the physical manifestation of porotic hyperostosis is discussed in relation to environmental and social contexts, including childhood anemia. The sample included the examination of 512 Peruvian individuals from the Field Museum of Natural History in Chicago and 953 individuals from "systematically excavated contexts from Moquegua, Peru" (Blom et al., 2005:154). Within this sample, CO and PH were most common amongst the subadult population, especially between the ages of zero and ten. Notably, these lesions varied geographically, as individuals from the South Coastal Valley had more lesions than individuals from the Central Coastal Valley.

Additionally, it appears that the relationship between childhood mortality and anemia increases as one moves away from the coast. Blom et al., (2005) argues that iron-deficiencies are likely the cause of the marrow hyperplasia amongst the coastal populations. Additionally, polycythemia which is caused by high-altitude hypoxia could have affected the highland individuals and coastal individuals who were originally from the highlands. Lastly, like Ubelaker (1992), anemia amongst this population likely stems from multiple etiologies, such as disease, parasites, varying diet, infection, and lifecycle changes (Blom et al., 2005).

Compared to Buen Suceso, the frequency of PH and CO are significantly lower than the populations in Ubelaker (1992) and Blom et al. (2005), as there is only one isolated set of remains that has evidence of PH at Buen Suceso. This is at least partially the result of poor

preservation, as my sample is mostly isolated remains with little to no cranial fragments. However, geographically, Buen Suceso coastal location and lesions aligns closely with the remains of individuals at other Ecuadorian sites, as environmentally, the heat and moisture of the region could have provided the perfect conditions for parasitism and disease (Ubelaker, 1992) Additionally, while there was no discussion of other nonspecific stress lesions amongst the Peruvian sample, the attribution of anemia (PH and CO) to multiple etiologies (including disease and infection) aligns with the findings of Ubelaker (1992) and is likely the cause of the skeletal manifestation of the Buen Suceso site.

The varying ages of the individuals in the Buen Suceso sample indicates that children were surviving into later stages of life (juvenile, adolescents, and adult), in which they would have played a role in their community. Thus, while a majority of the individuals at Buen Suceso fall into the infant category (Figure 4), when combined, more than half of the sample is in the juvenile and adolescent category (Figure 4). The survivorship of individuals throughout childhood could provide insight into the intergenerational health of the community, as the DOHaD hypothesis reminds one that childhood health is impacted by not just the immediate environment, but their maternal environment (Gowland, 2015). Therefore, these individuals could not only reflect the health of themselves, but could reflect the larger intergenerational health, in which the health of the community could be representative of prolonged stress, rather than an isolated event (Gowland, 2015).

The roles of biological age (which is estimated from biological changes in the body) and social age (which is based on cultural constructions of behaviors and status of individuals for specific ages) is important for evaluating mortality patterns, as age categories allows one to see patterns in the severity of lesions (Halcrow and Tayles, 2011 Lewis, 2002). At Buen Suceso,

while the division of social age is less clear, due to lack of information about identity and societal life phases, the inclusion of individuals in later childhood provides one with opportunity to find patterns related to the health, nutrition, and status of this population. For example, amongst the semi-complete burials (N=6), juveniles were the most affected by periostitis (Table 2, Appendix A) and were the only age group to have linear enamel hypoplasia. The only semi-complete adolescent, Burial 11, had possible periostitis, proliferative reactions, and osteoarthritis (Table 2, Appendix A). Lastly, in the infant category, one individual had periostitis and the other had possible porotic hyperostosis (Tables 2, Appendix A).

Amongst the isolated remains population, the pattern across the age categories is more complex, as the lack of remains and comingled context makes it more difficult to define a pattern (Tables 3, Appendix A). However, a majority of the remains fall into the infant category (N=5), in which individuals either had no pathology present, had possible SES, or lytic lesions (Tables 2,4). In the juvenile category (N=2), individuals had no pathology present or healed PH and LEH (Table 2,4). Lastly, in the adolescent category (N=2), there was either no pathology present or pillowing on the vertebra (Table 3, Appendix A). While the pattern of lesions amongst the isolated remains age categories is more varied, the presence of LEH and healed PH on the individual in the juvenile category aligns with the semi-complete remains, in which that age category appears to have the most severe lesions. Thus, this could indicate that children who survived past infancy at Buen Suceso were experiencing higher rates of disease/infection/comorbidities during their juvenile and adolescent years, in which they were unable to recover. In which, this could be the result of their immediate environment or that there was some form of intergenerational health across the community at play (Halcrow and Tayles, 2011).

In regard to power structures, the ubiquity of lesions across this sample could imply an alternative form of power. As noted previously, the presence of non-specific stress lesions endemically across a population could be indicative of heterarchy, in which there is no formal power structure (Crumley, 1995; Becker and Juengst, 2020). The fact that a majority of the population at Buen Suceso has some indication (rather than varying levels of stress/severity of lesion which could indicate hierarchy) of stress could mean that these individuals existed in a society in which there was no formal power structure or there was a shifting power structure (Anarchical), in which there were phases of cooperation and mutual exchange (Crumley, 1995; Angelbeck and Grier, 2012). While there is a lack of temporal comparison to be done across this sample (due to need for further excavation), the consistency of lesions combined with the frequency of similar lesions (i.e. proliferative, LEH, and periostitis) could indicate that there was some form of alternative power at play, in which children had access to equitable resources and participated in communal exchange and/or cooperation (Angelbeck and Grier, 2012).

7.2 Mortuary Practices at Buen Suceso

The use of mortuary monuments in the prehistoric Andean past showcases that "[f]ormal transformations of the built environment are created by humans to channel social activities, to establish categories, and to promote emotions and meanings" (Isbell, 1997:14). The interaction with the built environment allows communities to construct and reconstruct community culture, identity, and power. Thus, the construction of mortuary monuments in special contexts can reflect the emphasis that humans place on the importance of space and how space can be used as an indicator of human relations and authority (Isbell, 1997). Moore (1996) argues that ritual space is distinguished from other built environments based on the fact that these spaces are public, special, and unique. Ritual spaces as public entities are designed to be interacted with by

varying sizes of groups and are marked as special and unique due to their ability to uphold political processes. As "[c]hanges in the size, function, and organization of monumental constructions reflect- at least dimly - changes in the nature of social power" (Moore, 1996:139).

Current excavation at Buen Suceso has revealed key ritual/public/ceremonial spaces: the plaza and the mound. Unit 2 (located in the plaza) is a rectangular shape that measures three meters by six meters, in which the long access is oriented slightly NE-SW (Rowe et al., 2023). In addition to the plaza area, the mound (Unit 6, Figure 3) has been partially excavated (Rowe et al., 2023). This mound has yielded some of the earliest dates for the site and has undergone changes throughout its Middle and Terminal Valdivia occupations. Both of these spaces included artifactual evidence of ritual. For example, the overall construction of the plaza floor was made to be visible, with a raised surface. The mound as a ritual space is less clear, due to limited and fragmented artifacts found in its caliche floor. However, the care in the deconstruction of the mound could indicate that this structure held some sort of importance throughout its use. Additionally, the burial of subadult remains within the plaza floor and in the mound indicate that these spaces could have been ritually special.

The burial of the subadult remains at Buen Suceso were concentrated around these spaces, as Burial 6 was excavated from the northern edge of the plaza, from a shallow depression. Right outside of the plaza, another individual was found, the isolated remains labeled Plaza N0l/02, which are associated with the plaza floor (Figure 20). At the mound, in the wall trench, the remains of two subadults were excavated (Figure 21). Burial 2, a six-month-old infant, was found lying on its side, its head facing south. The second individual, Burial 11, a 10–12-year-old juvenile, was found adjacent to the southern wall of the structure (Rowe et al.,

2023). Lastly, Burial 4, a 4-5 year old juvenile is associated with the isolated remains of an very incomplete adult, Burial 3, who are both located near the plaza.

The burial of these children resonates with Moore (1996) and Isbell (1997), as the burial of these individuals in visible community spaces would have given the people at Buen Suceso the ability to establish community culture, power, and identity. Therefore, the burial of children (and an adult) in the plaza and mound indicates a special space, which is reinforced through the reconstruction of these spaces (specifically the mound) overtime (Moore, 1996; Isbell, 1997). The addition of the adult in this space is interesting, as it could represent a form of familial burial of ascribed status, as Burial 4 does have dental modification. However, it could also represent alternative power, due to the plaza's structures as an open and community-based space rather than an enclosed mortuary monument.

7.3 Mortuary Practices at Nearby Ecuadorian Sites and The Andes

The burial of children in architecture and ritual spaces is common across the Andes and at the nearby site of Real Alto. As stated previously, Real Alto had two ceremonial mounds throughout its occupation, one of which had the Charnal Houses, where elite females, subadults, and men were interned (Zeidler, 2000). Additionally, at another nearby site Salango, the ceremonial buildings underwent successive reconstruction which involved the inclusion of burials of adults, children, and animals. For example, the remains of three neonates, one infant, and one adult were excavated from an area related to the structure entrance (Lunniss, 2020). The three neonates were found in the back of the ceremonial structure and were associated with a string of white shell beads and a red spondylus bead. The infant was located outside and behind the structure along the central axis and was associated with a single red bead. Clearly, the placement of the neonates and subadult remains was significant, especially regarding ritual and

power, as the placement of the infant outside of the house and the neonates nearby added power to the central axis of the structure and liminal zone. This contrasts with the burial of the adult inside the structure, which may have indicated a statement of ownership (Lunniss, 2020).

Looking at the Andes more broadly, children in various parts of Peru have been buried in special contexts (Baitzel, 2018). For example, at the Choquepukio site, located in Cuzco Valley (Figure 22), the remains of six juveniles from the Early Intermediate Period (400 BC-AD 450) were found protruding through the floor and back wall of a building (Andrushko et al., 2011). Interestingly, these remains were a primary internment, unlike the adult burials, who had a secondary burial location. The subadult remains were buried with an elaborate assemblage, including gold and other highly valued artifacts (Andrushko et al., 2011:324). In addition to the group burial, one additional subadult was found about 3m away with the most elaborate artifact (Andrushko et al., 2011), a silver figure, about 25cm in height with a spondylus shell headdress and fragments of cloth. This figurine had male genitalia, hands across the chest, and the figurine was accompanied by other small "gold, silver, and spondylus figurines of human males and llamas, with even more rich offerings found nearby, including miniature silver and gold headdress ornaments, gold and silver llama figurines, spondylus shell male human figures, a miniature bracelet, and pieces of gold foil" (Andrushko et al., 2011:325). Clearly these children were honored in death, creating networks of power for the living.

This trend can be seen throughout the Andes and along the west coast of South America. On the north coast of Peru, the remains of children and juvenile llamas were regularly associated with ritual and sacrifice (Millaire, 2015; Prieto et al. 2019). For example, at the Huaca Santa Clara located in the Middle Valley (Figure 23), archaeologists uncovered the remains of a young girl, bundled in textiles and "accompanied by five young retainers and twenty-eight sacrificed

llamas" (Millaire, 2015:58). Subadult remains from the same temple building, but in different pits, were also wrapped in textiles and accompanied by juvenile llama remains (Millaire, 2015). The many subadults sacrificed and interred at Huanchaquito-Las Llamas exemplify the power of dead children in these contexts, where hundreds of children were buried perhaps as part of a ritual to appease and control an ENSO event (Prieto et al. 2019).

Compared to other Ecuadorian and Andean sites, Buen Suceso is similar in that children are clearly interred in special contexts. Like the ceremonial structure at Salango, the reconstruction events related to sacred spaces may have included the addition of burials, particularly of subadult (Lunniss, 2020, Rowe et al., 2023). However, the lack of mortuary goods at Buen Suceso is unusual, as the subadult remains at neighboring sites Real Alto and Salango were buried with figurines, beads, and spondylus. More broadly across the Andes, subadults were buried with even more elaborate grave goods, including gold and silver figurines, spondylus, beads, and llama remains. While the lack of mortuary goods bolsters the argument for alternative power at Buen Suceso, the burial of children at special places aligns with the overarching burial practices of the Andes. Thus, indicating that children could have been purposefully placed as an offering or as part of a ritual, like the subadult remains at Salango or the Peruvian sites.

Lastly, Burial 4, from unit N5/6 01 level 9 in the plaza, has dental modification on their deciduous maxillary central incisor (figure 10), indicating that there could be elite identity at play at the Buen Suceso site. Dental modification allows one to further explore a community's identity, social organization, and ethnicity (Juengst et al, 2021). For example, in the pre-Hispanic Americas, dental modification was practiced as a form of aesthetics and as a marker of cultural, ethnic, familial, or status affiliation. In Mesomerica, dental modification was common amongst

elite Mayan burials, in which their teeth were modified with dental inlays (Tiesler et al. 2017). In Ecuador, dental modifications have occurred across cultures and time periods, with varying styles, including: dental inlays, incised lines, filing, and dental avulsion (Juengst et al. 2021). While the most common style of dental modification in Ecuador is the dental inlays, Burial 4 from Buen Suceso and an individual from Manabí have incised lines.

An adult individual from Manabí, has incised diagonal lines on their maxillary anterior teeth and one incised line on their mandibular incisor (Ubelaker, 1987; Juengst et al., 2021). This individual was from the Jama-Coaque culture and directly dated to 1049-1021 AD (RC dates from Juengst et al. 2021). Thus, while this individual was from a different time period and culture, the single incised line found on Burial 4 (Figure 10) is similar to the multiple incised lines found on the Jama-Coaque individual and could indicate a special identity. However, the absence of the majority of Burial 4's deciduous teeth and the teeth of the other subadult burials makes it difficult to state whether this was practiced across the population or if this is an indication of elite identity for this particular individual.

CHAPTER 8: CONCLUSION

While excavations still need to be done at the Buen Suceso site, the presence of children at this site has provided an insight into the lives of the Early Formative Valdivia peoples. The frequency and types of pathology present amongst the subadult remains indicates that these individuals suffered from long-term low grade stress, which was likely caused by sedentism and aggregation (Kent, 1986). Alternatively, their manifestation of stress could be due to intergenerational health, in which their mother's and grandmother's environment played a role in establishing stress (Gowland, 2015). Lastly, the semi-complete juvenile remains in this sample had the highest rate of periostitis and was the only age group to have LEH. This could indicate that some stressful event/s, potentially related to social age, occurred during the biological age range of the juveniles at Buen Suceso. Due to the ubiquity of lesions amongst the sample, the Buen Suceso population may have engaged in alternative forms of power, as the entirety of the semi-complete and a majority of the isolated subadults at this site suffered from some form of pathology. This is bolstered by the lack of mortuary goods found associated with the subadult remains, as elite and hierarchical societies are often buried with special grave goods.

However, all of the semi-complete subadult remains were found in communally visible and special places, while the isolated remains were found in either close proximity or in a completely different context. For example, a majority of the isolated remains came from Unit 5, 6, and 7 (which had potentially, Manteño/Valdivia remains) in which Units 5 and 6 are close by. However, Unit 7 is in the middle of the site and Unit 10 (which had potentially Manteño/Valdivia remains) is in the eastern part of the site, further away from the mound and plaza areas. Additionally, Burial 4 did have dental modification and was associated with adult

remains, suggesting potential elite status and familial burial. Thus, future excavations and isotopic analysis will hopefully reveal a more concrete burial pattern and time period for the(isolated) subadult remains.

Lastly, future work should address the question: Where did all the adults go? The lack of complete adult remains at the Buen Suceso site is unusual, as neighboring Valdivian sites have complete remains of their adults, often in association with children. Whether or not further excavations reveal the presence or absence of more adults, it is important to think about what the lack of future adult remains could mean for the Buen Suceso site and how this plays into the power, social organization, and the identity of children at the Buen Suceso site. Alternatively, if further excavations locate more complete adult remains, it could provide further insight into the power, social organization, and health and nutrition at Buen Suceso.

For example, if there were elite identities amongst the adults (since there is one adult who is in association with Burial 4), this could indicate that elite children/family ascribed rank or lineages. Additionally, some of the adults could be buried in a different part of the site, and/or have a different type of burial practice, indicating an alternative or ranked power structure. Lastly, if further excavations reveal more adults, examination of these remains could reveal signs of healed childhood stress, disease, or trauma. Thus, while there are still many questions surrounding children and childhood at the Buen Suceso site, it appears that children at the very least were buried in special places and suffered from some form of long-term, low-grade stress, which could be the result of intergenerational health, sedentism and aggregation, social organization (in which hierarchical or alternative power could be at play) or a combination of them all.

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APPENDIX A: TABLES

Extended Semi-complete Burials and Pathology Present. Note* see end of the following table for abbreviations.

Unit, Nivel, Rasgo	BURIAL #	Age Category	% Complete	Cranial	Dental	Post Cranial	Pathology/Region of Pathology
U.2.2a N. 3 R. 8	6	Juvenile 10-12 yrs	<25	N	N	Y	Periostitis Woven reaction present on R femur, L &R humerus, L&R ulna, L&R radius, L&R fibula
U.N5/6 O1 N. 9 R. X	4	Juvenile 4-5 yrs	<5	N	Y	N	Linear Enamel Hypoplasia URI1; URI2; URC1; ULI1; ULI2(Possible);ULC(area of disturbance);LLM2(area of disturbance); udri1; urdc(area of disturbance)
U.6A N. 8 R. X	2	Infant 6-9 months	<25	Y	N	N	Possible Porotic Hyperostosis possible path on cranial fragments
N10-09-N2; N10-010-N4; N10-011-N4; N10-011-N5; N11-010-N3 R. X	7	Juvenile 2-3 yrs	<5	N	N	Y	Periostitis some porosity on the femur frags and porosity on the ilium between the acetabulum and sacro-iliac joint (with most concentration around the middle of sacro-iliac joint)
N10-09-N2; N10-010-N4; N10-011-N4; N10-011-N5; N11-010-N3 R. X	8	Juvenile 8+- yrs	<25	N	N	Y	Periostitis and Lytic Lesions Periosteal and lytic lesions on the radius head, specifically proximal between head and shaft
U.6.4F N. 3 R. X	11	Adolescent 12-19 yrs	<25	N	N	Y	Possible Periostitis, Proliferative Reactions, and Osteoarthritis proliferative reactions present on ribs, proximal, medial, and distal phalanx, patella; every bone exhibits bone growth; Possible periosteal reaction on rib frags. On the left side; OA on metacarpal 4

Extended Isolated Remains and Pathology Present

Unit, Nivel, MNI	Age	Cranial	Dental	Post Cranial	Pathology/Region of Pathology
U.N9/10 O1 N.4, 7 MNI=2	1 Infant (<2), 1 Ad (35+)	N	Y	N	LLPM, with pinpoint carie on occ surface, very worn
U.5 N.4 MNI=4	Infant 10 +/- 30mos	N	Y	N	resorbed root dLc
U.6 N.5 MNI=1	Infant (4+/- 10mos)	N	N	N	
U.6A N.7 MNI=1	Adolescent 17-25	N	N	N	
U.7 N.6 MNI=1	Infant(0-2)	Y	N	N	Possible SES possible SES on interior cranial frags
U.7 N.7 MNI=1	Infant(0-2)	N	N	N	
U.7 N.5 MNI=1	Infant (0-2)	Y	N	N	possible SES on interior cranial fragments
U10.5D/10.6D N.2009 tarp MNI=2	Juvenile (6-10); YA (17-25)	Y	Y	Y	Porotic Hyperostosis, Linear Enamel Hypoplasia, and Proliferative reactions
U.6.6F N.4 MNI=2	Infant (0-2); Ad/YA	N	N	Y	pillowing on vertebral body, frag with lytic lesions (Infant)

Abbreviations: L&R= Left and Right, URI1= permanent upper right incisor 1, URI2= permanent upper right incisor 2, URC= permanent upper right canine, ULI1= permanent upper left incisor 1, ULI2= permanent upper left incisor 2, ULC= permanent upper left canine, LLM2= permanent lower left molar 2, udril= upper deciduous right incisor 1, and urdc= upper right deciduous canine. LLPM= permanent lower left pre-molar, dulc= deciduous upper left canine, and SES= serpens endocrania symmetrica

APPENDIX B: FIGURES

Figure 6: Burial 6

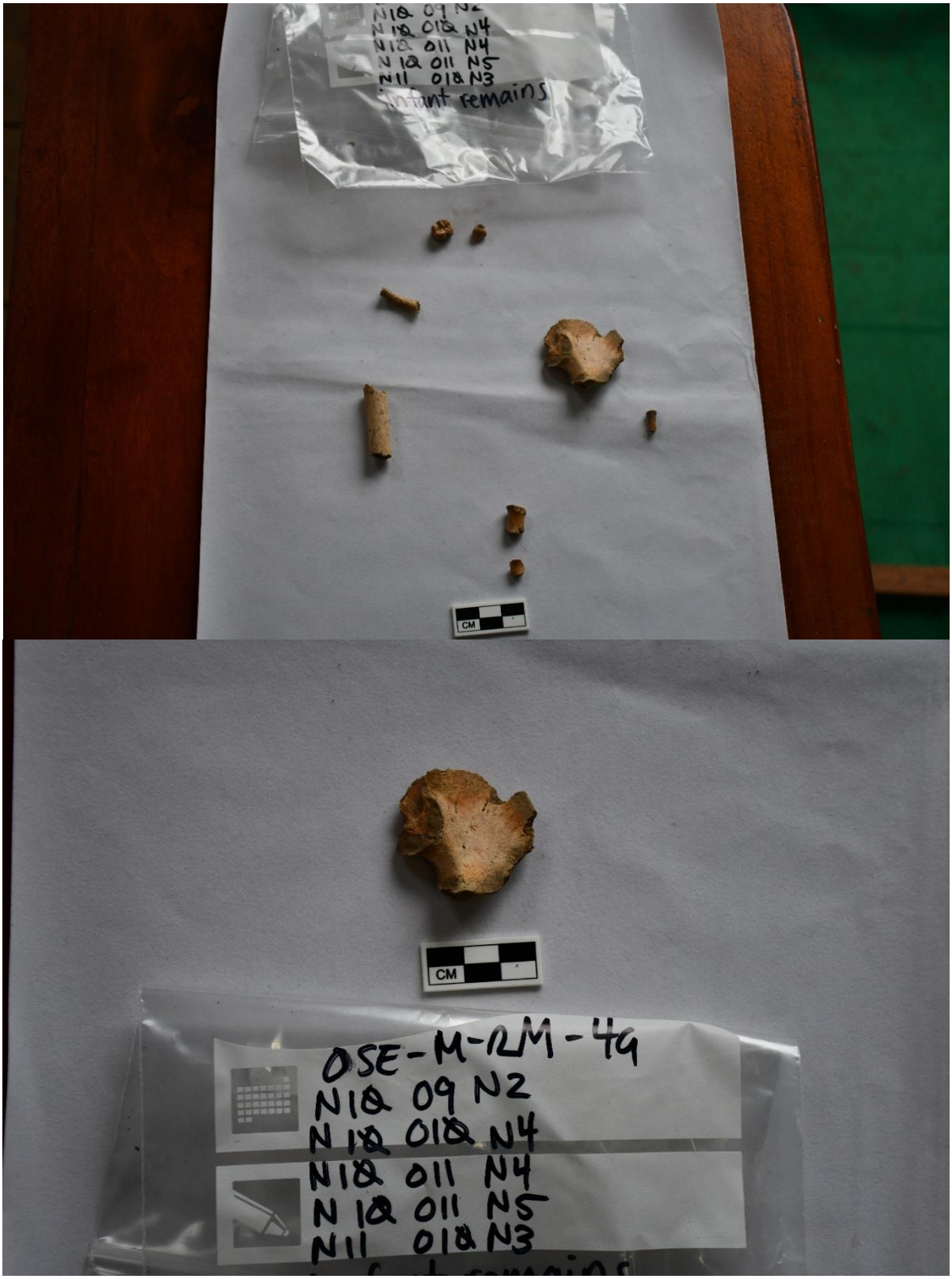

Figure 7: Burial 7 with Periostitis

Figure 8: Burial 8 Radial Head with Periosteal and Lytic Lesion

Figure 9: Burial 11, A) Top Photo: Individual Laid Out; B) Bottom Left: Rib Fragment; C) Bottom right: OA on Fourth Phalanx

Figure 10: Burial 4, A) Top Photo: Individal's Teeth; B) Bottom Left: Permanent Upper Central Incisor with LEH Bands; C) Bottom Right: Dental Modification of Decidious Upper Central Incisor with Incised Line

Figure 11: Burial 2, A) Left Photo: Individual Laid Out; B) Top Right Photo: Possible Presence of Cranial Porosity; C) Bottom Right Photo: Possible Presence of Cranial Porosity

Figure 12: Unit 5 Level 4 Isolated Remains Upper Lower Molar 1 Crown

Figure 13: A) Top Right Photo: Isolated Remains from Unit 7 Level 5, B) Top Left Photo: Isolated Remains from Unit 7 Level 6, C) Bottom Photo: Isolated Remains from Unit 7 Level 7 all Display SES and Taphonomic Folding/Crackling

Figure 14:.A) Top Photo: Unit 10.5D Lower Molar 1 with Wear , B) Bottom Photo: Isolated Remains from 10.6D

Figure 15: Unit 6.6F Level 4, Distal Humerus with Lytic Lesions

Figure 16: Isolated Remains with No Presence of Pathology. Top Photo= A) Plaza N01/02 9; Middle Photo= B) Unit 6A Level 7, and Bottom Photo: C) Unit 5 Level 1

Figure 17: Burial 3

Figure 18: N9/10 01 Isolated remains and LLPM with Pinpoint Carie

Figure 19: Unit 6.6F Level 4, Pillowing on Adult Vertebra

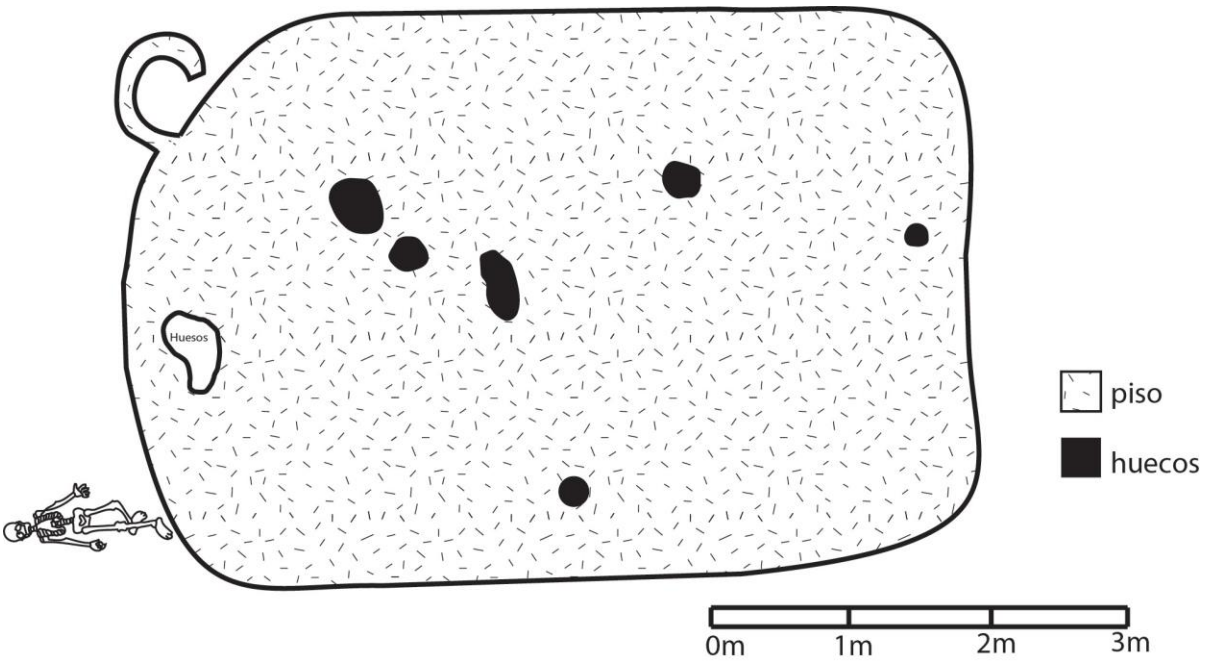

Figure 20: Plaza Burial Map by Sarah Rowe

Figure 21: Burials at the Mound

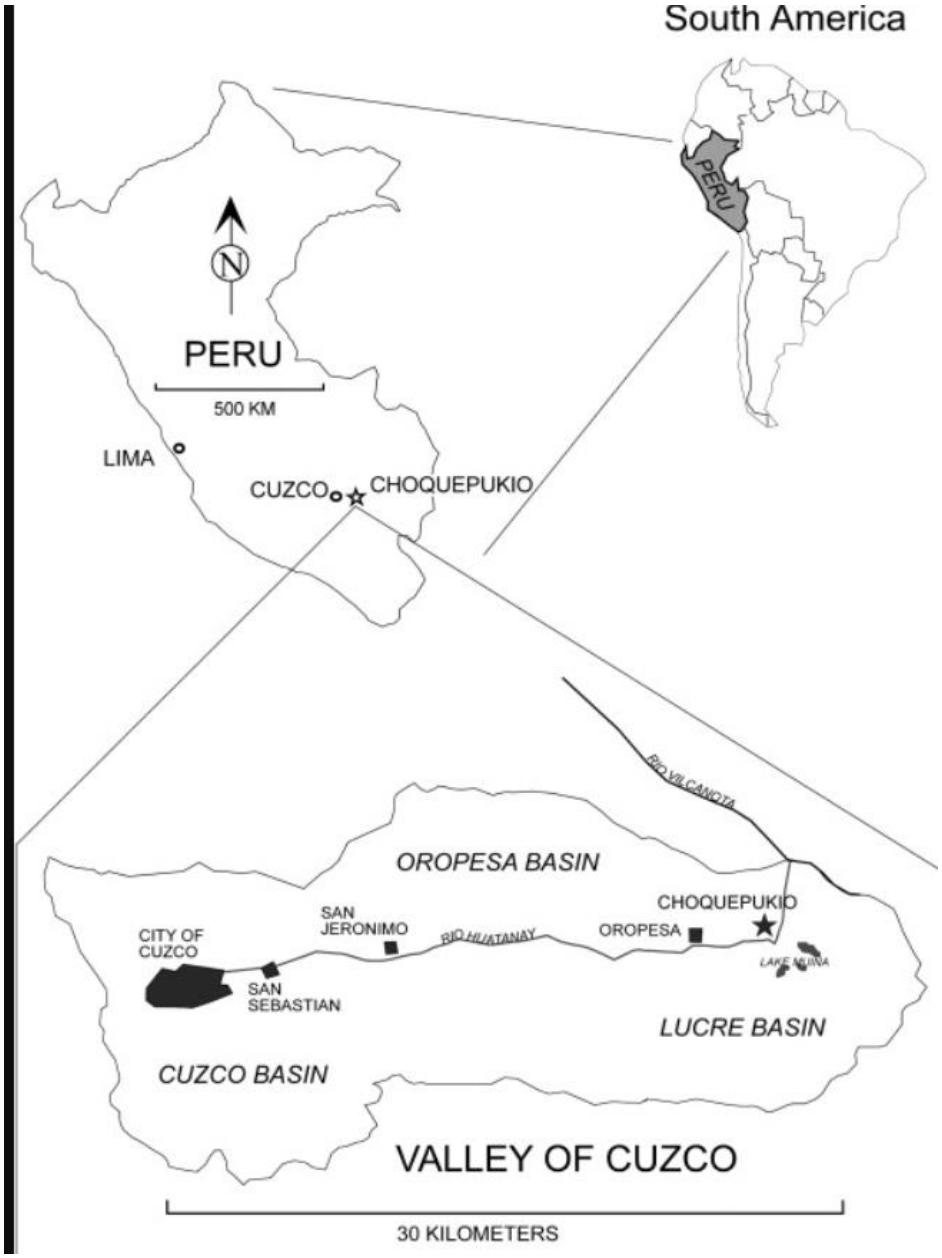

Figure 22: Map of the Valley of Cuzco (Andrushko et al. 2011)

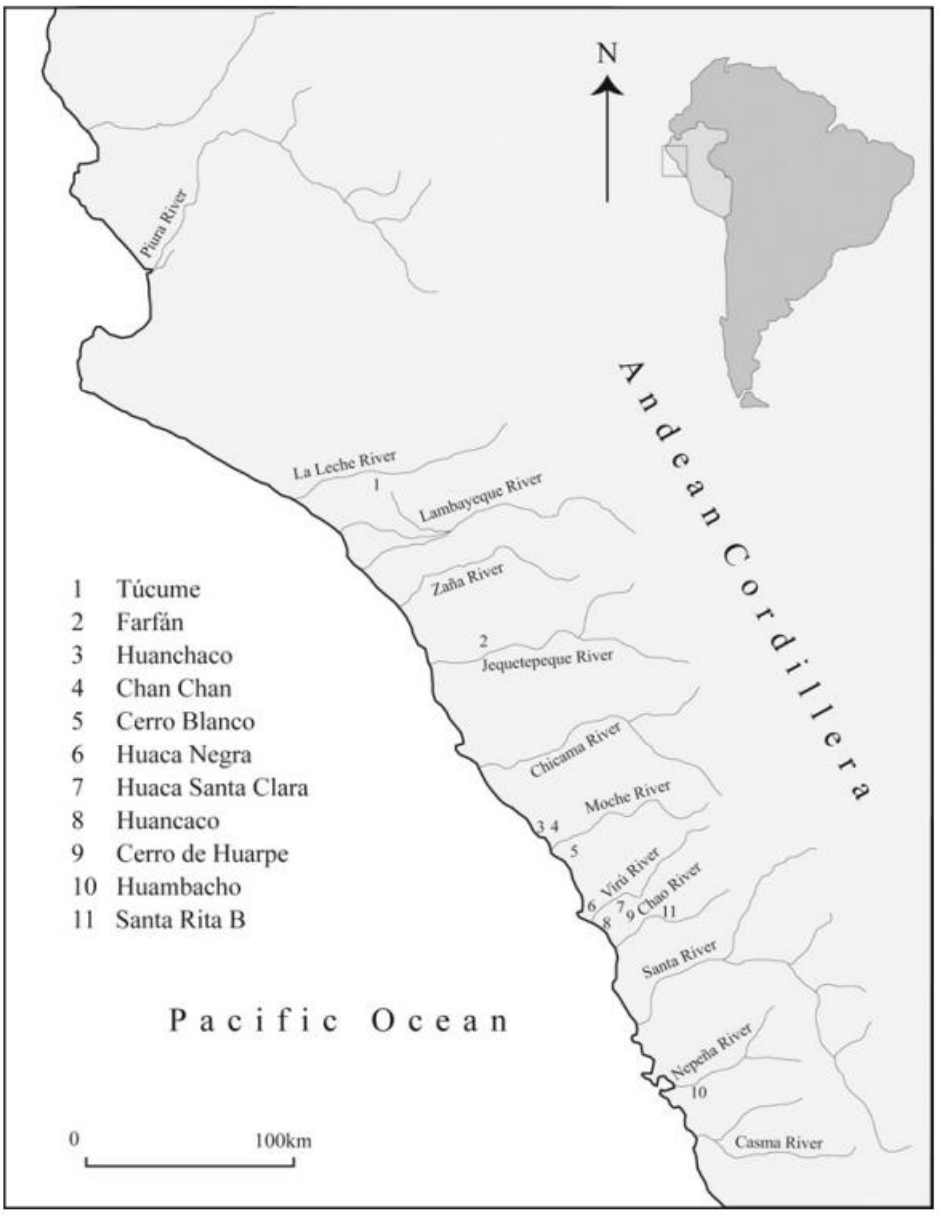

FIGURE 1.1. Map of the study region with settlements mentioned in the text.

Figure 23: Map of Coastal Peru Sites (Millaire, 2015)