DID THEY BELONG: A PRELIMINARY STUDY ON STRONTIUM ISOTOPIC ANALYSIS OF THE GUANGALA CULTURE LOCATED AT SALANGO, ECUADOR

by

Zindy Y. Cruz

A thesis submitted to the faculty of
The University of North Carolina at Charlotte
in partial fulfillment of the requirements
for the degree of Master of Arts in
Anthropology

Charlotte

2022

Approved by:

____
Dr. Sara L. Juengst

____
Dr. Richard Lunniss

____
Dr. Dennis Ogburn

ABSTRACT

ZINDY CRUZ. Did they Belong: A Preliminary Study on Strontium Isotopic Analysis of the Guangala Culture Located at Salango, Ecuador. (Under the direction of DR. SARA JUENGST)

Due to advancements in technology, questions once thought of as unanswerable concerning migration and mobility have become possible to address. Strontium isotopic analysis has begun to bring about a change in how bioarchaeologists apply migration theories and broader sociopolitical questions can now be explored. In the Andes, many researchers have applied these techniques, but little to no research has been done in Ecuador. For this study, I analyzed 29 strontium samples to better understand the Guangala culture at Salango, Ecuador (100 BCE- 800 CE). I calculated a “social” baseline range of $^{86}Sr/^{87}Sr$ = 0.70760 - 0.70850 with 27 of 29 (93%) samples falling within that range. A local baseline was estimated to be $^{86}Sr/^{87}Sr$ = 0.70832-0.70923, with 26 of 29 (89%) falling below that range. The most significant findings were between the samples that came from the same individuals, showing that mobility did occur with three individuals. By applying this technique, I was able to infer different views and treatment of foreigners caused by different lived experiences between Very Early Guangala individuals and Early Guangala individuals.

ACKNOWLEDGEMENTS

Acquiring a master's degree would not have been possible without the support of my committee chair, Dr. Sara Juengst, and committee members, Dr. Dennis Ogburn and Dr. Richard Lunniss. I want to thank you all for the guidance, patience, and knowledge you have provided me throughout my graduate career. I will take all the advice given to me for these past two years and keep it at the forefront of my mind for not only have you all taught me to be a better anthropologists and archaeologists, but you have all taught me to be a better person. I will always strive to achieve the standards you hold me to and continue to work on decolonizing this profession to the best of my abilities.

My research was possible due to the Geology Department at UNC-Chapel Hill and for that I am very grateful. Thank you for allowing me to use your lab space. A special thank you to the lab assistant that helped me through the process, thank you for taking the time to help me with my research while the end of the semester was happening.

Being able to complete the schoolwork and motivation to do better is thanks to all the people in my life. Firstly, I'd like to thank my wife, Karla Cruz, for putting up with my long notes to myself in our chats about things she doesn't understand. Your understanding and ability to help me when I am stressed beyond normal kept me afloat. Secondly, I'd like to thank my brother, Alexander Cruz, and cousins, Uriel Suarez and Joanna Torrez, for being supportive no matter how insufferable I was being due to being stressed, listening to me, and believing in me. Lastly, I'd like to thank my dad, Enedino Cruz, and mom, Anabeli Osejo, for always believing in me and never doubting I would fail even when I didn't believe I could make it.

I have been blessed with a great support system of not just family, but my grad cohort, professors, college friends, and work colleagues. So, thank you to everyone who encouraged me to do better and believed in me. I do not have enough words of gratitude for being so understanding and supportive through my graduate program. I would not have been able to complete this degree without everyone. I must also say a special thanks to my pets, who have put up with my crazy snuggle times even when they did not want to snuggle. Each and everyone of them has either forced me to get out of bed when I felt it was impossible, gave me those eyes of encouragement that are only filled with love, and they have all at least once, tried to help me type this thesis. For that, they deserve the best snacks.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

RDP: Regional Developmental Period

VEG: Very Early Guangala

EG: Early Guangala

Sr: Strontium

O: Oxygen

CHAPTER 1: INTRODUCTION

Migration and mobility as topics in archaeology have lost their momentum until recently. With the emergence and refinement of new technologies, these theories have come back into focus within the archaeological community. Migration in archaeology, before new technologies, focused on cultural change through "...grand narratives, such as the spread of civilization, or in universalizing models used, for example, to explain the spread of farming" (Hakenbeck, 2008, pág. 10). With newer specialized methods, we can move away from the "grand narratives" and address other questions, such as individual mobility.

Ongoing research on migration and mobility in South American archaeology has focused on pre-Hispanic coastal regions of Peru and the Andes in part due to the long history of excavation of these areas and availability of excavated sites, burials, and other material remains. However, while the focus has been on Peru, there are many active archaeological sites in South America where inquiry into migration and mobility would answer important questions about pre-Columbian lifeways. This research addresses possible mobility patterns through the isotopic analysis of strontium (Sr). I investigate individual migration patterns of individuals buried at Salango, and discuss social theories of identity and belonging. I suggest acquiring biological samples of locations around Salango, including Salango Island, to establish a clear baseline of local Sr signatures to capture a better understanding of origins for individuals.

People have lived at Salango, Ecuador, for approximately 5500 years (Lunniss, 2019). Over that time, many cultures have flourished at the site, leaving behind evidence of who they were. While many of these pre-Hispanic populations have been studied, there are some cultures that still require research. In particular, the cultures in the Regional Developmental Period (RDP) have yet to be fully explored. Beginning at around 100 B.C., according to ceramic typology, the Guangala chiefdom culture thrived at Salango until 600/800 CE (Lunniss, 2019; Stothert, 1995). It is believed this site holds religious significance (Lunniss, 2001; 2016; 2017; 2019). Being a point of convergence between two cultures, Lunniss (2019) believes that "...the sacred value of the site in part served in the mediation of sociopolitical relationships between two groups of the two regions" (54). Thus, understanding who came to Salango and was subsequently buried there is important to our larger ideas about the site.

Lunniss (2016) hypothesized that some of the people buried at this site were transported there to establish a form of sociopolitical claim to the land in order to partake in the area's sacredness. However, it remains unclear if these people lived locally or were moved there after death, particularly because different cultures used this site for burial. By taking advantage of the geochemical analysis of Sr isotopes, we can investigate where the people buried at Salango lived during childhood and adulthood, which will further our knowledge of the Regional Development Period and use of Salango more broadly. Isotopes are different variations of the same element or alternative forms of the elements (Brown & Brown, 2011). Because this variation is linked to different geological and environmental zones, isotopic analysis has become very useful in archaeology by providing evidence into the daily lives of past cultures, particularly with regard to diet, health, mobility, and migration (Brown & Brown, 2011). Isotopic analysis of strontium (Sr) has been very useful for investigations of migration and mobility because this isotope varies based on age of local geology (Arienzo et al., 2020; Brown & Brown, 2011; Price et al., 2008).

For this research, I analyzed 29 samples of human bone and tooth samples, 27 of which I prepped, for Sr isotope levels in order to answer questions about the homelands and geographic origins of individuals buried at Salango, Ecuador during the Regional Development Period. As a part of this, I also established a strontium baseline for future studies of coastal Ecuador. In addition, I sent two samples to the DirectAMS Laboratories of radiocarbon dating to confirm the temporal period of these burials. This research is funded by SAA Historically Underrepresented Groups Scholarship (HUGS) and the DirectAMS Carbon-14 date award.

1.1 Positionality Statement

While I am extremely lucky to be a part of the knowledge being gathered in pre-Hispanic Ecuador, I feel it is important to state my identity and position in this project. I am of Hispanic descent from Central America and have no known ties to that of South America, Ecuador, nor connection to the native populations of South America. I can form ties with current populations in Ecuador through language and include more research done by scholars in Ecuador regardless of the researcher's original language. As a scholar, I am coming at this research with an American (United States of America) taught mindset and with training from American institutions with little to no diversity in professors throughout my undergraduate and graduate career. With this research, I have gained a different perspective in anthropological research and I hope to present a different perspective in anthropology in an institutional setting with little diversity.

CHAPTER 2: MOBILITY IN ARCHAEOLOGY

Migration and mobility studies have started to proliferate with the advancement of technology in biogeochemical analysis. Hakenbeck (2008) states that "(s)cientific methods appear to provide answers to questions that previously seemed unanswerable, such as 'how can we identify migrations in the archaeological record' or, more specifically, 'what was the impact of the migrations of X into the area of Y?" (9). These questions were previously thought to be unanswerable due to the limited evidence archaeological materials provided. Traditional methods in explaining migration were based on population movements and cultural change (Hakenbeck, 2008; Hrnčíř & Laffoon, 2019; Van Dommelen, 2014). Burmeister (2000) used archaeological artifacts of cultural materialism such as pottery (Burmeister, 2000; Adams et al., 1978). Hakenbeck (2008) and Van Dommelen (2014), in summarizing the history of migration in archaeology, argue that migration theories have been tied to archaeology since the beginning. Adams et al. (1978) states that "migrationism was and is the only explanation for culture change" (484).

It was not until the 1970's that theories on migration started to get criticized to the point of unpopularity and eventually an 'immobilist' criticism grew (Hakenbeck, 2008). Burmeister (2000) states that "(i)t is an essential concern of archaeological research on migration to provide proof that migration has occurred" (553). Yet, critics argued that archaeological evidence is too ambiguous to do so (Burmeister, 2000). Early migration theories also included racist undertones in physical anthropology. In an excerpt taken from Adam et al. (1978), the use of morphology to contribute to migration theory is part of the reason for the retreat from migrationism:

> "...where theories of migration prevailed (whether from ethnology or archaeology), the skull became a principal source of historical analysis. The structural complexity of human crania provided a wealth of morphological criteria from which types and intermediate categories could be abstracted. If the spatial (and temporal) distribution of cranial types could be assumed to result from the movement of culturally and biologically distinct peoples, both biological and cultural history could be reconstructed from similarities and differences in cranial morphology. In this sense there has been great concordance between theories of biological and of cultural change" (513).

Adam et al. (1978) attributes this retreat to the changes in the analysis of cranial remains, yet continues the racist narrative by stating that the most hindered by this are physical anthropologists, especially those who "abjured typological studies altogether" (526). Though an 'immobilist' view came to be more popular, some archaeologists held on to migration theories and Adam et al. (1978) states that, "few of them (archaeologists) are attempting to give it scientific rehabilitation by placing migration within a framework of causal explanation, though so far only a small beginning has been made in this direction" (526).

Gregoricka (2021) highlights the relevance of migration in contemporary archaeology alongside the new focus on mobility. To better understand the concepts, it is important to define both terms for they seem to be used interchangeably (Ortega Muñoz, 2014). Oretega Muñoz (2014) defines both terms in the following way: "(m)obility is understood as the capacity of the population to move within a given territory, and migration as the movement of an individual from one region to another" (60). Even with these definitions, there are still issues that arise such as the concepts of boundaries and scale (Gregoricka, 2021).

Gregoricka (2021) attributes these issues to the simplified terminology used for the concepts of migration and mobility and states that "boundary-driven assessments largely ignore the dynamic nature of human social organization and the numerous modes of production that typically contribute to the structure of a single community" (583). Archaeologists study migration and mobility based on the scope of movement, or scale, which is defined as time and distance traveled (Gregoricka, 2021). Mobility is seen as the short time travel, typically, but not limited to, within the borders of their own culture, whereas the migration of individuals tends to cross boundaries and travel for longer distances as well as time. Boundaries, defined by Tsuda et. al. (2015), "separate different environmental, cultural, linguistic, economic, or political areas or zones and generally permit more flexible movement across them" (20). Whereas borders are politically enforced between cultures and languages (Tsuda, et al., 2015).

Until recent theoretical shifts, migration had been the focus for movement, but mobility has started to gain popularity as it can answer questions more closely related to the individual. Hakenbeck (2008) states that the focus on mobility came about in the 1990s, around the same time that biogeochemical analysis started to gain popularity (Scaffidi & Knudson, 2020). Some criticism has arisen that there is too much Western focus on mobility of the individual and bioarchaeologists should instead recognize social or community identities when interpreting their research (Gregoricka, 2021). However, in

South American archaeology, bioarchaeologists are already integrating mobility of the community into the studies, as explored below.

The study of migration and mobility is popular in South American archaeology, especially for Andean cultures in Peru. Many researchers have published their findings using isotopic analysis on Sr on cultures in the Andes like the Tiwanaku by Kelly Knudson and colleagues (Knudson, 2008; Knudson, et al., 2004), the Wari by Slovak et al. (2009), Nasca culture by Conlee et al. (2009), and Inka culture by multiple researchers (Slovak & Paytan, 2012; Turner, et al., 2009). When interpreting their results on mobility and migration, researchers have been able to answer “broader socio-cultural questions pertaining to imperial strategies and colonization, marital residence patterns, ethnicity and identity, and violence and warfare” (Slovak & Paytan, 2012, p. 755) and could potentially go beyond that to find out identities of marginalized groups (Gregoricka, 2021). Despite this new focus on mobility, little to no research has occurred in coastal Ecuador and any inferences of migration and mobility come from traditional methods like artifacts in burials (Lunniss, 2016).

CHAPTER 3: AN INTRODUCTION TO THE HUACA: SALANGO, ECUADOR DURING THE REGIONAL DEVELOPMENT PERIOD

Salango, Ecuador, located centrally on the Ecuadorian coast (Fig. 1 below), was an important sacred center for a span of at least 1200 years starting from 600 BC to AD 600 (Lunniss, 2019). In the Andes, sacred spaces, such as Salango, are known as huacas. Defined to be a sacred place or thing (Tantaleán, 2019), huacas can include "burial places, shrines, mountain peaks, holy lakes – essentially extending to any place associated with indigenous concepts of the sacred" (Moore, 2010, p. 404). The most important and significant aspect of Salango is "its role as a place where contact could be made with the spirit world" (Lunniss, 2019, p. 51) but another part of the importance for Salango is its location, which Lunniss (2019) describes as a "particular point of convergence" (54). Being a huaca, Lunniss (2019) writes that during the Regional Development Period, Salango served as a sociopolitical middle ground for two

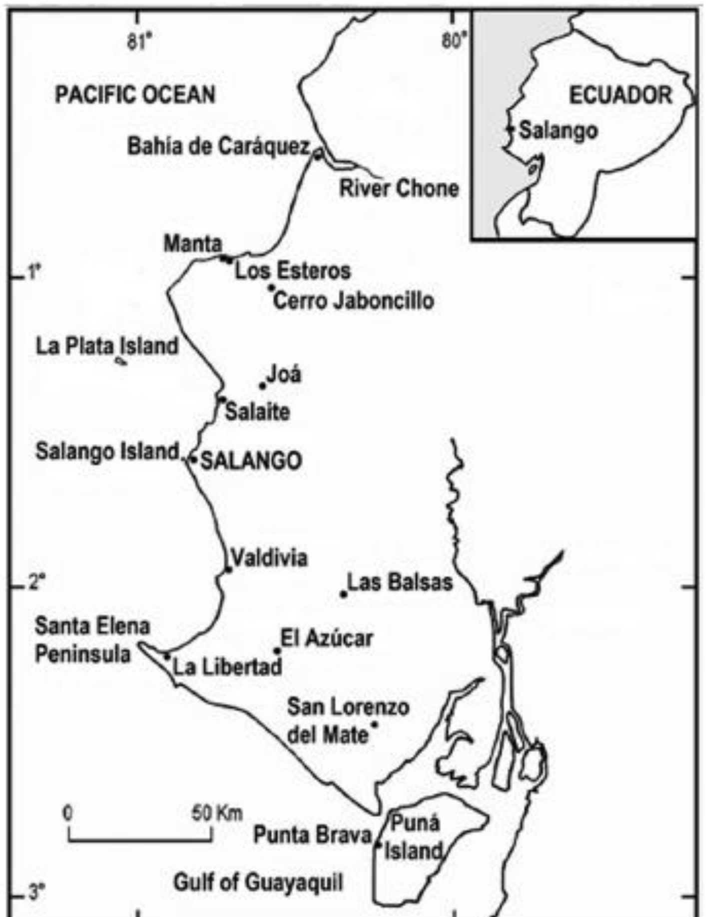

Figure 1: Map from Lunniss (2017) showing location of Salango, Ecuador

groups between the regions. To the north of Salango, there is Cabo San Lorenzo and Manta, two sites known for Phases I and II of Bahia, and to the south, the Santa Elena Peninsula and La Libertad which is known for Engoroy in earlier times and the Guangala culture (Lunniss, 2019). The site of Salango is located in the northern Guangala region, but evidence shows that a group or groups associated with Bahia culture controlled the central enclosure (Lunniss, 2017).

Lunniss (2019) defines the four different archaeological phases when Salango was used as a Huaca. Starting in the Ecuadorian Late Formative and ending in the Regional Development period, we see three main cultures that used the site, including the Engoroy, Guangala, and Bahía. In the Ecuadorian Late Formative period, the Engoroy culture thrived from 600 BC to 100 BC and was split into Middle (600–300 BC) and Late (300–100 BC) Engoroy based on changes to ceramic typology. During the Regional Development Period, Bahia II and Early Guangala 8 cultures used the space from around 100 BC to 300 AD. Ending the Regional Development Period, Salango was occupied by the Middle Guangala culture from 300 to 600 AD.

3.1 Exploring the Regional Development Period

The Regional Development Period (RDP), as named, is a time of cultural change where six cultures located in the same vicinity diverged in ceramic styles, social transformation and stratification, and trade (Masucci, 2008; Meggers, 1966; Uribe Taborda, 2016). This time period is understudied and there are gaps in the chronology (Uribe Taborda, 2016). Masucci (2008) describes the six cultures of the RDP as the "Tolita-Tumaco and Tiaone of Esmeraldas Province; Jama-Coaque I and II of northern Manabí and Esmeraldas provinces; Bahía of central Manabí; Guangala of southern

Manabí and coastal Guayas Province; Tejar-Daule of the Guayas river basin; and Jambelí of El Oro Province" (p. 490) At Salango, there is ceramic and artifactual evidence that both the Guangala and Bahia II cultures used the site during this time period.

The pottery of the RDP multiplied in vessel shapes (Meggers, 1966, p. 68). Compared to previous pottery styles, the RDP shows changes in the base, going from a low ring base of the Chorrera Phase bowls into pedestal bases with different sizes, and leg forms, ranging in sizes, type, and complexity (Meggers, 1966, p. 63). Meggers (1966) also describes that most jars had "globular bodies with strongly everted rims" (68). This is suggestive of feasting assemblages (Masucci, 2008, p. 497). Some of the most significant changes to ceramics were figurines decorated with elaborate head attire and slip of multiple colors (Masucci, 2008). Massucci (2008) notes that Guangala figurines were decorative, "hinting at aspects of daily life such as costume and body decoration as well as ritual life" (497) and engraved with motifs, suggesting tattooing or body painting. There is evidence of whistles shaped as birds (Meggers, 1966) and of ceramics used for presentation as well as functionality with "sets of bowls and plates on multiple legs or pedestals accompanied by a suite of hemispherical bowls" (Masucci, 2008, p. 491). This is important as it implies an emphasis on elite craftsmanship, social inequality, and feasting (Masucci, 2008).

While the RDP is known for changes in technology and artistic applications, Meggers (1966, p. 68) states that "not all regions attained an equal level of complexity." Regionally, the central and northern coastal cultures show evidence of social stratification with their figurines and building structures; whereas in the southern coastal region, the cultures of Guangala, Tejar, Daule, and Jambeli are "described as lacking key indicators of the development of social stratification" (Masucci, 2008, p. 490; Martin, 2010). Among many reasons, Meggers (1966, p. 70) states two main factors between the differences of complexity: (1) environmental factors of goods for exploitation and (2) the accessibility of outside influences of art, religion, and technology from other regions. "It is during this period that the diversity of Ecuadorian geography and the multiplicity of natural land and water routes most obviously exert their influence" (Meggers, 1966, p. 70). Massucci (2008) attributes the lack of hierarchical society to the social factors instead of environmental settings.

It is believed that production and trade of shell, highly valued for ritual and symbolic needs, "explain the development of hierarchical social structures in coastal Ecuador" (Martin, 2010 p. 40). However, there is not much evidence for shell working during this time which could be due to the infancy of trade with northern Peru or other factors (Martin, 2010). While there is not enough evidence of traded goods during this time period in southern Manabí, other cultures in Ecuador started exploiting terrestrial resources and creating "goods necessary for daily life in the local community" which led to the beginning of hierarchical societies (Martin, 2010 p. 49). Massucci (2000, 2008) states that Guangala fineware suggests trade or gifting due to the compositional analysis of the bichrome and polychrome ceramics which indicate being produced in multiple locations and also do not correlate with where they were found.

3.2 The archaeology of Salango, Ecuador

While this research primarily focused on the Guangala culture focusing on Very Early Guangala (VEG) and Early Guangala (EG), it is important to briefly mention the archaeological findings in the Ecuadorian Late Formative because of the overlapping usage of certain buildings and cemeteries. The Engoroy culture at Salango helps define the site as a sacred center. Archaeological evidence of burials shows the sacred value of Salango through burial goods and positionings of the graves. In the Middle Engoroy phase, a ceremonial house was converted into a founding Ancestor Home by the burial of a religious leader and others (Lunniss 2019). Lunniss (2019) states that “the burial there of the religious leader would have imbued the place with the extraordinary attributes for which that person had been recognized as a spiritual authority” (57). In total, there were five primary human burials, four of which were infants, which Lunniss (2019) suggests to be offerings due to spatial association. Some of the artifacts found represent a binary division of male and female and a division of solar and terrestrial (Lunniss, 2019), and the arrangement of them “also underlay and supported the entire sequence of architecture and ritual of the next millennium and more” (Lunniss, 2019, p. 56). With multiple uses throughout the years, the house later served as a burial ground and eventually replaced by a platform that continued the sacredness of the site.

Starting in the Regional Development Period, Salango expanded its territory for human burials (Lunniss, 2019). There were three main burial sites, a central site that was remodeled multiple times, and two other locations which correlated to the central burial location (Lunniss, 2019). The central burial site was on top of a Late Engoroy platform; 70 burials were enclosed in this area (Lunniss, 2019). With an entrance at the northeast side, the burial grounds were surrounded by a clay wall which was rebuilt with each episode of site use (Lunniss, 2019). In two of the episodes, we see a continuation of the dualistic nature first represented in the Middle Engoroy phase through artifact type, iconography, and placement. Large pots aligned the side walls, and on the landward southeast half were several grinding stones. Notably, to the seaside of the northwest half, there were anchors for balsa rafts, complementing the grinding stones (Lunniss, 2019). Lunniss (2019) suggested that "the enclosure then can be read as a built symbol of dualistic structure, in which the grinding stones represented maize, farmers, and the land, while the anchors symbolized the fruits of the sea, the men who worked the sea, and the ocean itself" (63). The placement of human burials suggested that the place of the dead was in the southwest. They sat facing the entrance of the enclosure a distance away from it (Lunniss, 2019).

There were two significant burials at the entrance of the burial grounds accompanied by the standard burial goods, but different in the fact that the graves were boot-shaped, leading to a chamber on the southwest side. Additionally, they were facing the other graves to the southwest and southeast, away from the entrance. These burials "seem to have represented the principle division of the main group" (Lunniss, 2019, p. 63) for one of them was oriented in a crossed legged seated position and the other was flexed upright in a seated position. The artifacts found with the burials included pottery vessels with depictions of a powerful spirit being. The pottery vessels were of multiple origins, but heavily influenced by Bahía II pottery which depicted the religious vision of Salaite, a funerary center nearby (Lunniss, 2019). It is important to note that no Guangala images are present in the central burial grounds (Lunniss, 2019).

The other two burial sites are north of the central funerary enclosure (Lunniss, 2019). Lunniss (2019) believes that these two burial sites are other large groups, but neither site is enclosed. Both show evidence of Guangala artifacts indicating that they are in the northern limits of direct Guangala influence. The two burial sites run north of the enclosed funerary grounds; one is approximately 50m from the entrance and is called Sector 141C. This area included 16 adult primary burials and two secondary child burials. The other area is 100m north of the central enclosed funerary grounds and was called Calle 22 Trenches 1 and 2. This mound included seven individuals: two adults, one adolescent, a juvenile, and three infants. All three burial grounds show similarities in the seated position of the burials, pottery vessels accompanying the individuals, and that some of the individuals are seated on top of Guangala pedestaled plates (Lunniss, 2019). In Calle 22, there are two individuals seated on top of the Guangala pedestal plates. These burials are similar to the central enclosed funerary grounds, which had three individuals on top of the pedestaled plates (notably not Guangala), as well as an individual in sector 141C (Lunniss, 2019).

3.3 A Snapshot of the Guangala Culture

The Guangala culture lived on the southwest coast of Ecuador from 100 BC to 800 CE (Stothert, 1995). Named after the village where G. H. S. Bushnell first identified the culture (Stothert, 1995), the Guangala culture is essential to our understanding of the RDP. According to archaeologist Erick Lopez, quoted by (Friedl, 2013) during an in-person interview, the importance of the Guangala culture represents "una transición entre Engoroy y Huancavilca entre teocracia y el estado" (7)[1]. The changes that occurred within the Guangala culture were the precursors of the future state society of the Huancavilce; these were changes from the religious government of the Engoroy into a central government that were ruled by men (Friedl, 2019).

---

[1] Translates to, "a transition between Engoroy and Huancavilca, between theocracy and state." Translation by Cruz 2022

While the Guangala culture has little evidence of social hierarchy, they can be distinguished through their ceramic work in both utilitarian use and artwork (Masucci, 2008; Stothert, 1995; Bruhns, 1994). Their ceramics works included, “stamps, seals, and musical instruments: whistles and ocarinas” (Bruhns, 1994 p. 201). The Guangala culture also worked in metallurgy as other cultures in Ecuador did (Bruhns 1994, Vargas Benavides & Romero Guerrero, 2015) though little to no Guangala metallurgy has been found in the Salango burials (S. Juengst, personal communication, April 6, 2022).

Masucci (2008, p. 497) stated that the differences of Guangala culture compared to other coastal cultures could suggest either “unique aesthetics or different socio-cultural principles or structures.” With Chorrera origins (Friedl, 2019; Masucci, 2008; Stothert, 1995; Uribe Taborda, 2016) the unique ceramics of the Guangala culture “has been interpreted as less differentiated and hierarchical than some of the neighboring ethnic groups in the Regional Developmental period” (Stothert, 2008, p. 527). Masucci (2008) describes the change in Guangala ceramic style from smudged vessels into more complex forms with two or three colors, which potentially suggests social hierarchy due to the high production costs of the vessels. While the ceramic bowls do get more complex, the lack of settlement hierarchy, wealthy burials, or figurines with symbols of power or status for individuals suggests a lack of social hierarchy overall. Masucci (2008) describes the ceramic figurines lacking “elaborate apparel and adornments” (p. 497) as compared to northern cultures.

3.4 Is there a difference: Very Early Guangala vs. Early Guangala populations at Salango

Until recently, the Guangala culture was split between Early, Middle, and Late Guangala. With the recent evidence, it is now necessary to separate Early Guangala culture into VEG and EG due to the different lived experiences caused by environmental factors. Lunniss (2021) describes the eruption of a volcano in Ecuador that happened around two-thousand years ago. An enormous cloud of volcanic ash traveled west to the Pacific coast, affecting the groups of people in Salango. This catastrophic event caused "malas cosechas, desnutrición, y enfermedades" (Lunniss, 2021, p. 1).[2]

Recent bioarchaeological studies done by the University of North Carolina Charlotte Anthropology department under the direction of Dr. Sara Juengst (Bythell, 2019; Cobb, 2021) have explored the lived experiences of early Guangala peoples at Salango. These studies suggested that there is a distinction between Very Early Guangala (VEG) and Early Guangala (EG) individuals in terms of disease load (Bythell 2019) and diet (Cobb 2020). Bythell's (2019) research found that VEG burials were mostly infants compared to EG which had a wider range of "young, middle, and indeterminate aged adults" (p. 35). This significant difference might be attributed to what Lunniss (2021) describes the response to the environmental condition and effects caused by the volcanic eruption. In EG individuals, there is evidence of healed periosteal reactions and osteomyelitis on the long bones which could likely mean they had a higher survivorship capacity (Bythell 2019; DeWitte, 2014). Other evidence of pathological healing occurs in EG whereas VEG "showed high levels of all chronic stress markers" (Bythell, 2019, p. 38).

---

[2] Translates to, "crop failure, malnutrition, and disease."

Dietary isotopic analysis done by Cobb (2020) also suggests a difference in diet styles between the two. Cobb (2020) suggests that the VEG had a more varied diet than EG individuals. They theorize this difference through a variety of scenarios. One of the theories goes alongside the volcanic event and suggests that VEG individuals had to find alternative sources than what they normally consumed due to crop failure. Another explanation could be that EG individuals had stricter rules for food access for it is hypothesized that "Guangala sites were organized in chiefdoms but did not have a highly stratified social hierarchy," though the dietary isotopes do not suggest social stratification (Cobb, 2020, p. 33).

3.5 Mortuary changes at Salango

VEG individuals had similar mortuary activity continuing the Late Engoroy burial posture and grave goods reflected in the center burial site at Salango (Bythell 2019; Juengst et. al., 2019). While there were some similarities, differences in mortuary rituals and placement of artifacts for sub-adults is significant, which Lunniss (2021) attributed to the changes in mortuary practice "(p)ara restaurar el orden cósmico y social" (p. 1)[3] caused by the volcanic eruption. He hypothesized that ritual leaders thought that the cause of the volcanic ash falling was due to a disruption from their ancestral ties and that they perceived "que habían perdido contacto con las fuerzas ancestrales de las que había surgido la existencia anterior" (p. 11).[4] It was then of utmost importance to re-establish that lost connection (Lunniss, 2021). It is thought that the VEG individuals tried to re-establish the connection by the changes in mortuary practices.

[3] Translates to, "to restore the cosmic and social order"
[4] Translates to, "they had lost contact with their ancestral powers that surged their prior existence"

The sub-adult burials show a unique mortuary practice not seen in Salango or anywhere else (Juengst et. al., 2019). Two of the VEG infants wore modified cranial helmets made of other sub-adults which Juengst et. al. (2019) suggests that it could "represent an attempt to ensure the protection of these "presocial and wild" souls" (p. 854). Lunniss (2021) states that the religious leaders would bury individuals "utilizando técnicas rituales desarrolladas en respuesta a las condiciones y efectos específicos del desastre" (p. 1).[5] Another sub-adult burial of importance during the EG period is that of the sub-adult found in a place of importance, something not seen in other Guangala burial sites (Lunniss, 2019).

The bioarchaeology that has been done at Salango has added to the collective knowledge of the RDP. By studying the individuals' biological profiles, we were able to understand the differences of the lived experiences between VEG and EG individuals (Bythell, 2019). This narrative was further developed by Cobb (2021) in showing that, albeit slight, there were differences in diet between these two phases. It is also noteworthy to point out the infants with helmets of other children (Juengst 2019) as a unique mortuary practice, likely reflecting social, political, and ritual changes in reaction to environmental distress. The uniqueness of this mortuary practice alone incites curiosity into the Guangala. While these studies have provided great insight into changes at Salango during the VEG and EG, questions still remain about the origins of these burials. Investigating strontium isotopes will allow us to understand the mobility of Guangala peoples and their origins on the landscape prior to burial at Salango.

---

[5] Translates to, "utilizing specific ritual techniques in response to the conditions and effects caused by the disaster"

CHAPTER 4: STRONTIUM ISOTOPIC ANALYSIS

Isotopic analysis is one of the four major revolutions in bioarchaeology (Larsen, 2018). Applying strontium (Sr) isotopic analysis to prehistoric populations allows archaeologists to study mobility and migration from an individual perspective. There are four natural strontium isotopes: ^{84}Sr, ^{86}Sr, ^{87}Sr, and ^{88}Sr (Scaffidi & Knudson, 2020; Slovak & Paytan, 2012); importantly, ^{87}Sr is radiogenic, while ^{86}Sr is the stable isotope of this element. Radiogenic isotopes are made through the decay of other radioactive isotopes; in this case, Rubidium (Rb) 87 decays into ^{87}Sr. This process occurs in the bedrock where older sources of bedrock will contain higher levels of ^{87}Rb that will decay into ^{87}Sr giving the bedrock unique signatures around the world (Knudson, et al. 2010; Scaffidi & Knudson, 2020).

Archaeologists then use the ratio of $^{86}Sr/^{87}Sr$ to determine residential migration and mobility amongst other uses (Brown & Brown, 2011; Hrnčíř & Laffoon, 2019; Slovak & Paytan, 2012; Arienzo, 2020) The ratio, as Hrnčíř (2019, p. 5302) says, is important to archaeologists because it provides a geochemical signature. Strontium exists in rocks, plants, water sources, and animals, creating unique signatures geographically depending on the type and age of the bedrock (Hrnčíř & Laffoon, 2019; Knudson et al., 2010; Knudson & Price, 2007; Slovak et al., 2009; Slovak & Paytan, 2012). These unique signatures allow researchers to compare the $^{86}Sr/^{87}Sr$ values of a specific place to the ratio in humans and animals. Knudson (2010, p. 2353) states that "... $^{86}Sr/^{87}Sr$ values in the plants and animals in a given region, and the humans that consume those resources, reflect the $^{86}Sr/^{87}Sr$ values in the bedrock in that region.” This is what Hrnčíř and Laffoon (2019) meant by a “geochemical signature.”

While most places will provide a unique signature, a downfall or challenge of this method occurs when two geographic locations are similar in $^{86}Sr/^{87}Sr$ ratios (Hrnčíř & Laffoon, 2019). Hrnčíř and Laffoon (2019, p. 5302) states that “it is not possible... to identify migrations that have occurred within an isotopically homogenous area nor those that occurred between two geographically distinct but isotopically similar locations.” Another issue that (bio)archaeologists using isotopes face is that Sr baselines have yet to be established in many places, including Ecuador. Scaffidi and Knudson (2020, stated that “(n)otwithstanding the promise of these analytical techniques, our ability to identify non-locals and their likely places of origin relies entirely on accurate characterization of local ranges, through statistical parsing of archaeological samples, and establishing local baselines by testing modern proxy materials” (1).

Although no baselines have been established for Ecuador using Sr isotopic analysis, geologist and archaeologists have made predictions and models of likely Sr isotopic levels. Knudson et. al. (2013) determined a baseline for Peru using modern Peruvian agricultural soils. They found that the $^{86}Sr/^{87}Sr$ values ranged from 0.70202 to 0.71894; using this data Scaffidi and Knudson (2020) established the first predicted values of Sr isotopes in prehistoric Andes through “a spatial meta-analysis of $^{86}Sr/^{87}Sr$ values from archaeological human, faunal, and artifact samples” (1). Yet further comparisons should be done to determine if their predicted values are accurate for Ecuador. Preliminary data from museum samples show that the predicted values do not match the results from the museum collection, which while lacking a specific provenience, were certainly from coastal Ecuador (Juengst personal communication, October 19, 2021; Juengst, et al., 2021). This may be due to the differences in underlying geology and volcanic activity.

Salango, Ecuador sits on bedrock consisting of Neogene and Paleogene sediments and is surrounded to the north and east by primarily Cretaceous sediments that include the Piñon formation (Reyanoud et al. 1999). DePaolo (1986) suggests that the Sr ranges of the Neogene and Paleogene sediments are between $^{86}Sr/^{87}Sr$ = 0.708320-0.709234 and with this information, we can suggest general models of a baseline for this region. The Cretaceous sediments around Salango have lower Sr levels and range from $^{86}Sr/^{87}Sr$ = 0.7034-0.70466 (Reynaud et al. 1999). Using this information, we can narrow the range predicted by Scaffidi and Knudson (2020) mentioned before to a focused area of ranges.

CHAPTER 5: MATERIALS AND METHODSIALS AND METHODS

The samples for this research project were excavated as part of a rescue attempt after human remains were uncovered during construction (Lunniss, 2016). Since Ecuador is known for its rich cultural heritage, Lunniss (2016) found it surprising that no effort was made to do a survey before underground infrastructure construction started back in 2014. During the salvage excavations, various burials were located that showed a mix of different cultures reusing burial grounds from the Late Engoroy period (600-100 BC) and creating new ones as well (Juengst et al., 2019; Lunniss, 2001, 2016). Prior strontium analysis of samples run before my research is also used. Those samples come from the same context as mine and therefore will add valuable insight to my findings.

5.1 Sample Population

The samples collected for this research come from two phases of occupation. Zanja[6] 2 consists of two mounds located near the north perimeter of the sanctuary where VEG individuals are represented. Calle[7] 22 burials represent the EG individuals which came from subsequent use of the same area after the accumulation of 60 cm of soil deposits. While the samples mainly derive from the two phases mentioned above, there are 4 samples that come from nearby areas. Sample P18 came from a likely guardian burial near the entrance to the sanctuary. Sample P12 came from c 80 m to the south down Calle Larga[8] and Sample P7 came from c 100 m to the south. The east end of Zanja 2 provided the samples of P7 (Lunniss, personal communication, 21 Nov. 9, 2021). Both

---

[6] Translates to, “Trench”
[7] Translates to, “Street”
[8] Translates to, “Long Street”

mounds were found in the trench originally made for underground tubing and because of the salvage excavations, many methods for excavating were used and documentation of the site is rushed (Lunniss, 2016). Lunniss (2016) details the difficulties during excavations due to limited space, time, and weather conditions, but even so, this salvage excavation has provided valuable information on the Guangala culture during the Regional Development Period that before recent efforts, was understudied (Friedl, 2019; Lunniss, 2016; Uribe Taborda, 2016).

In Table 1 (VEG) and Table 2 (EG), the samples taken by Juengst in 2018 for this research are included with information on the time period, age estimation, possible sex of the individual, the location of the sample taken, and isotopic analysis (oxygen and strontium) that has been done. A total of 29 strontium samples were selected (including

Period	IND	Age	age cat	Sex	Sample type	d18O (‰, vs VPDB) Rounded	$^{86}Sr/^{87}Sr$
VEG	460	30-46 yr.	MA	M	rib	-2.6	0.708209
					mandPM1	\	0.708095
VEG	359	30-34 yr.	MA	F	maxM1	-2.2	0.708129
					rib	-2	0.708015
VEG?	511/522	26-44 yr.	MA	PF	MT2	-2.4	0.708392
VEGs	363	12-14 yr.	AD	SA	mandI	-1.9	0.708187
					ft phal	-3.1	0.708505
VEG	341	18mo-2 yr.	I	SA	maxdm2	\	0.708008
VEG	436	1-2 yr.	I	SA	\	\	\
VEG	375	1 yr.-18 mo.	I	SA	rib	-2	0.708178
VEG	403	1 yr.-18 mo.	I	SA	rib	-1.3	0.708237
VEG	177/175	2-3 yr.	J	SA	manddm2	\	0.708018
VEG	166	Infant <2 yr.	I	SA	\	\	\
VEG	370	18 mo.	I	F	maxc	\	0.707963
VEG	370A	2-6 yr.	J	SA	parietal	\	0.708005
VEG	369	6-9 mo.	I	SA	MC	\	0.708249
VEG	352	2-4 yr.	J	SA	\	\	\
VEG	339	6-9 mos	I	SA	MT	\	\
					maxc	\	0.708191
VEG	346	1-4 yr.	J	SA	parietal	\	0.708044

Table 1: List of VEG individuals including age, sex, sample type, Oxygen Isotope levels, and Strontium Isotope levels

some from the same individual to compare childhood and adulthood), 16 of 29 samples were from VEG burials, 11 from EG contexts, one Manteño period sample, and one

Bahía II style burial. There was a total of 13 subadults and 14 adults with four females, one probable female, two males, four probable males, and 13 indeterminate

Period	IND	Age	Sex	Sample type	d18O (‰, vs VPDB) Rounded	$^{86}Sr/^{87}Sr$
EG	424	39-57 yr.	PM	rib	-2.5	0.708016
				maxM2	\	0.707739
EG	P14 Esq.5	35-46 yr.	PM	MT	-2.3	0.708229
				maxM2	\	failed
EG?	1020	30-34 yr.	I	\	\	\
EG	141	25-29 yr.	PM	maxM3	\	failed
				rib	\	0.707977
EG	P12	25+	I	\	\	\
EG	427/430	25+	I	rib	-2.9	0.707989
				mandM1	\	0.707918
EG?	P18 1001	25+	I	\	\	\
EG	168/166	25+	I	\	\	\
EG	P13 Esq. 1	25+	I	\	\	\
EG	P14 E6/7	25+	I	rib	-2.3	0.707898
EG	P14 other	25+	I	Fem	-2.6	0.707996
EG	P14 E4	8-10Y	SA	\	\	\
EG	174/176	16-18	F	maxM3	\	0.707315
				cunei	-2	0.70845
EG	P12	0-1	SA	rib	-2.4	0.707852
Bahia II	P18 1005	4-5Y	SA	maxM1	-1.9	failed
IP	P6	25+	I	hand phal	-2.6	0.707907
				mandM2		0.707867

Table 2. EG individuals showing age, sex, sample type, oxygen isotopic levels, and strontium isotopic levels.

individuals.

5.2 Strontium Methods

While the samples were collected by Juengst in Ecuador, I first prepared the samples for analysis at the bioarchaeology laboratory at the University of North Carolina Charlotte then learned how to prepare the columns needed to run the samples through the isotope mass spectrometer (VG Sector 54 TIMS) with the help of the Geology department at the University of Chapel Hill, shortened to Chapel Hill for the purpose of this thesis. To prep the samples, I took the teeth and bone samples and cleaned them as much as possible by either using a Dremel drill or taking off any excessive dirt from bone 22 samples. Then I used a mortar and pestle to grind down the enamel and bone samples into a powder. After repeating this process with all the samples that still needed to be powdered down, as some samples had already been powdered due to previous preparation for other isotopic analysis (Cobb 2020), I then packaged the samples and left them ready to mail into Chapel Hill Geology department for prior preparation to my arrival.

Once at Chapel Hill, the first half of the samples were dissolved in ~550 µL 3.5M HNO3 by Chapel Hill's lab assistant and the second half was done by me with the supervision of the lab assistant. For this process, we first weighed the empty beaker and took down that weight in g, then tared the scale and added the sample and ~550 µL 3.5M HNO3 and took down the weight. Once the sample was prepared, we left it overnight to completely dissolve. This process took the time span of two days; the first day I ran columns of the already dissolved samples from the first batch and dissolved the second half of the samples, and then on the second day I finished running the columns.

Once the samples were completely dissolved, we started the process of running Sr-Spec columns to get the Sr from the sample. First, we acquired short, "skinny," WR columns on Teflon tabs and rinsed them three times with MilliQ water. Once rinsed, we filled the stem with water and added a few drops to reservoir Load resin (Sr Spec) from dropper bottle and filled it until just below the base of reservoir. While we waited for the resin to set, we poured the dissolved samples into centrifuge tubes and centrifuged the samples. Once the resin set, we cleaned the resin two times by adding water and letting it run through completely. After this, we preconditioned the resin by adding 2 drops, then 13 drops, of ~450 µl 3.5 N HNO3. We let this drain then added the sample and let that drain completely. We then did three sets of dropwise sample rinse by adding one drop of 30 µl 3.5N HNO3, letting that drain completely, then adding 23 the next drop. After the dropwise sample rinse, we then did a bulk sample rinse using ~360 µl 3.5 N HNO3. For this step, we added 13 to 14 drops of the solution and let it completely drain for a total of four sets.

The beakers used to dissolve the samples were cleaned out and later used to place elute Sr sample with ~450 µl H2O by first adding 2 drops, letting that drain completely, then adding another 13 drops. Once that drained completely, another 15 drops were added and allowed to drain. In the beaker with the samples, a drop of H3PO4 was added directly into the beaker and then placed on a hotplate with the temperature ranging from 130°-140° C. Once this step was complete, I input my data into the program used by the department and set the samples in the waiting area to be run in the Mass Spectrometer.

5.3 Understanding the Values: Acquiring a baseline and statistical analysis

As mentioned before, a baseline for Sr levels in Ecuador has yet to be established. First, establishing a local baseline is best done by collecting local samples of small wildlife, excluding fish, and soil and processing them through the Mass Spec to determine $^{86}Sr/^{87}Sr$ levels of the area. In theory, the $^{86}Sr/^{87}Sr$ levels reflected in these samples would reflect the $^{86}Sr/^{87}Sr$ levels in the bedrock. However, animal samples were not exported to the US at the time of this research. Thus, in order to create a local baseline, I used two alternate methods. First, we reviewed prior geological research for the area and created ranges for the region based on the age of local geology and strontium inclusions in these sediments, described more below. The second alternative method used to establish $^{86}Sr/^{87}Sr$ population range was done using the samples themselves. Using this method, I compared the population with each other to determine who lived together versus further apart, whether or not that baseline was necessarily geographically local to Salango, also described below.

I established the local baseline from geological research done on the bedrock themselves. First, I needed to understand and identify the type of bedrock that laid beneath the site. Using Reyanoud et al. (1999), it was determined that the bedrock under Salango consists mostly of Paleogene rock sediments with some Neogene (Fig. 2). Then, using DePaolo's (1986) $^{86}Sr/^{87}Sr$ ranges for the Neogene and Paleogene rock sediments, it was possible to determine $^{86}Sr/^{87}Sr$ range of Salango. This resulted in local geological ranges of $^{86}Sr/^{87}Sr = 0.70832$-$0.70923$.

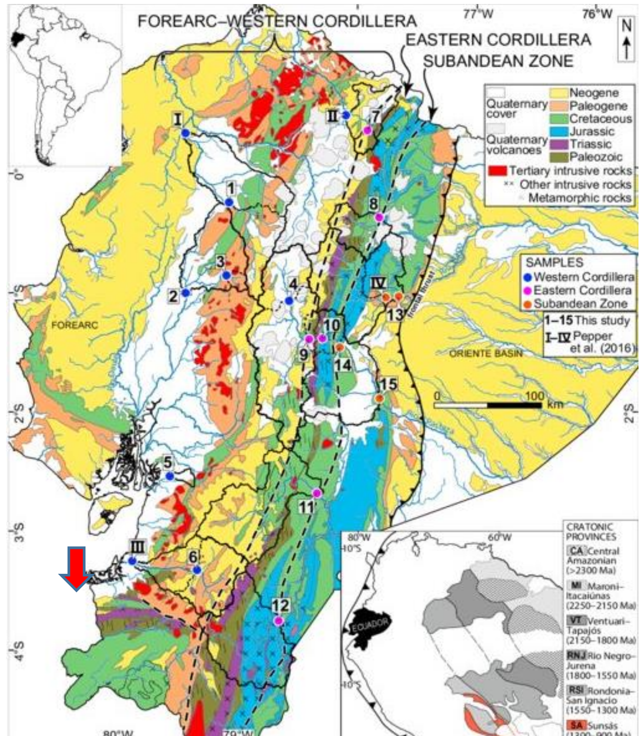

Fig. 2 shows the types of bedrock in Ecuador. Salango is located by an arrow (Jackson, et al., 2019)

The second method to acquire a baseline was done once the values of $^{86}Sr/^{87}Sr$ for my samples were acquired. For this method, I turned to statistics to find a range using the standard deviation of two places above and below the mean. To find the mean values of my samples, I used the following equation:

$$mean = \frac{\sum_{i=1}^{n} x_i}{n}$$

Afterwards, to determine the standard deviation (σ), I used the following equation to calculate the values where x is an individual value; μ is the mean/expected value; N is the total i number of values:

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}$$

Once I found the σ of my data set, I then multiplied it by two and added and subtracted that value from the mean to determine a range. This resulted in a local "social" range of 86Sr/87Sr=0.70760 - 0.70850.

5.4 Understanding the Values: Tooth vs. Bone Samples:

For this research, there are two types of samples chosen: enamel samples from teeth, and samples from bone. A total of seven individuals out of 34 individuals had two samples taken from them, one of tooth and the other of bone. By doing this, it is possible to determine individual mobility by noting any differences of $^{86}Sr/^{87}Sr$ values between the two. Enamel absorbs the Sr during development and does not change composition over time. Due to this, we can determine the $^{86}Sr/^{87}Sr$ values during the development stages of the individual, i.e., during gestation, infancy, and childhood. Budd et. al (2000) states that, "(e)namel is not remodeled after formation so that its Sr is retained throughout life" (688). Strontium in bone, however, is continually incorporated into skeletal tissue, as bone remodels throughout the life course (Bentley, 2006). Thus, by sampling an individual's bone, it is possible to see the $^{86}Sr/^{87}Sr$ values of the bone of the few years prior to death. Trabecular bone is best to use because this bone remodels every few years, reflecting $^{86}Sr/^{87}Sr$ values of the local area they resided in before death (Bentley, 2006; Price et al., 2002). Comparing both, the enamel and bone $^{86}Sr/^{87}Sr$ values of an individual, allows bioarchaeologists to determine mobility (Budd et al., 2000; Price et al., 2002; Bentley, 2006).

Chapter 6: Results

The overall range of strontium values returned was $^{86}Sr/^{87}Sr$ = 0.70732- 0.70851 (Appendix 1). This created a "social" baseline range of $^{86}Sr/^{87}Sr$ = 0.70760 - 0.70850 (mean $^{86}Sr/^{87}Sr$ = 0.70805, σ= 0.00023, 2σ= 0.00045), with 27 of 29 (93%) falling within that range (Note: Out of the 27 samples I prepped, three failed to give viable results.). Figure 3 shows all the strontium values from each of the samples in ascending order with a total of twenty-nine samples. Note the breaks between the lowest and highest values. Two individuals are outliers based on two standard deviations from the group mean. It is important to state that

Individual 363, with highest strontium value of 0.70851, is an adolescent from VEG for whom sex was not determined due to age. Two samples were taken from Ind. 363: a mandibular incisor and a foot phalanx. The foot phalanx returned the highest Sr value. Individual 174/176 has a strontium value of 0.70732 and is the lowest value in the population. Ind. 174/176 is an EG adolescent female which two samples were taken from: the 3rd maxillary molar and cuneiform, where the molar sample has the lowest Sr

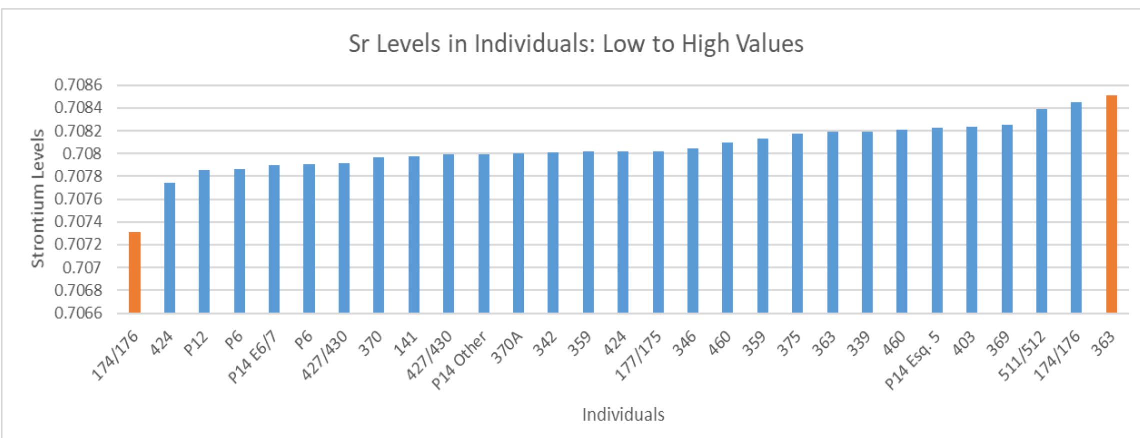

Fig. 3. $^{86}Sr/^{87}Sr$ ratios from lowest (Ind. 174/176) to highest (Ind. 363).

levels. Note that Ind. 174/176 cuneiform sample is the second highest Sr level, much higher than their molar sample.

The local baseline range based on the bedrock is $^{86}Sr/^{87}Sr$ = 0.70832-0.70923 (DePaolo, 1986) and while 26 of 29 (89%) samples are lower than the expected range using exact values, only one is significantly different: Individual 424. Ind. 424 has $^{86}Sr/^{87}Sr$ value of -2σ be 0.70824, lower than the expected range. This individual is a mature, probable male adult dated to EG. When comparing the samples to the Cretaceous bedrock range values that surround most of Salango, $^{86}Sr/^{87}Sr$ =0.7034-0.70466, we see that no values fall in that range. This suggests that most of the samples show $^{86}Sr/^{87}Sr$ values of Salango, Ecuador, or other locations with the same $^{86}Sr/^{87}Sr$ values. However, some individuals are potentially non-local or mobile, as we can see significant differences between their dental and bone $^{86}Sr/^{87}Sr$ values.

In Figure 4, I compared the individuals that had two samples. VEG individuals are shown in orange to the left of the graph (three of them) and to the right in blue are the

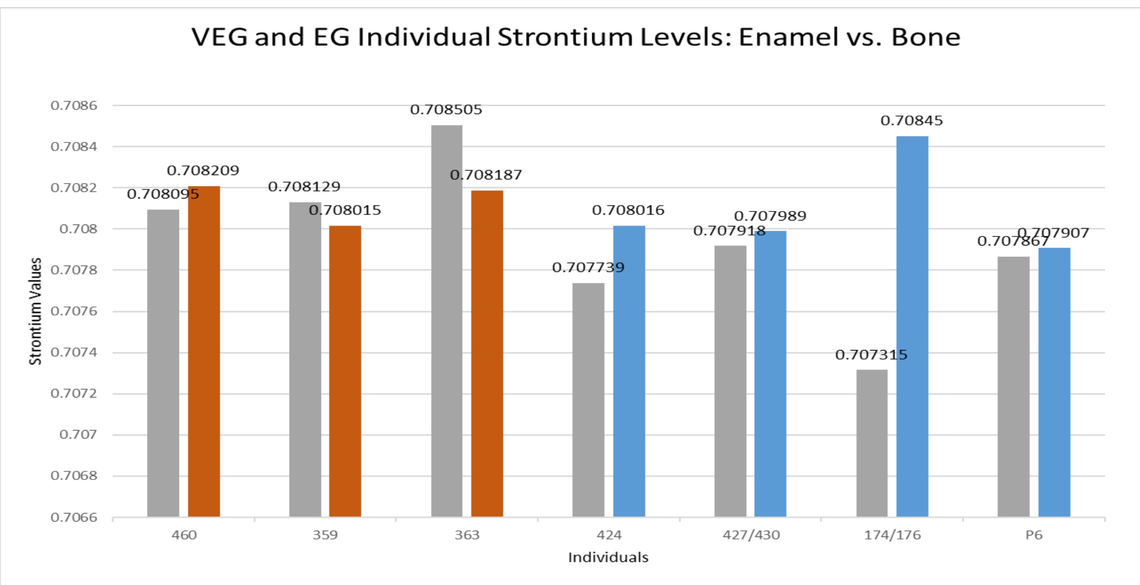

Fig. 4. Individuals with two samples: one from enamel, and another from bone. Enamel samples are in gray, bone samples in color (VEG Ind. 460-363 on left orange. EG Ind. 424-174/176 on right blue)

EG individuals. The biggest difference can be seen in Ind. 174/176 in EG culture with 2σ and Ind. 363 and 424 in VEG significance with 1σ.

Figure 5 gives a visual of VEG $^{86}Sr/^{87}Sr$ values beside those of EG. VEG individuals are to the left of the graph in orange (from Individual 460 to 346) and EG individuals are in blue to the right of the graph (from Individual 424 to P12). EG $^{86}Sr/^{87}Sr$ values seem more drastically different than that of VEG due to Individual 174/176.

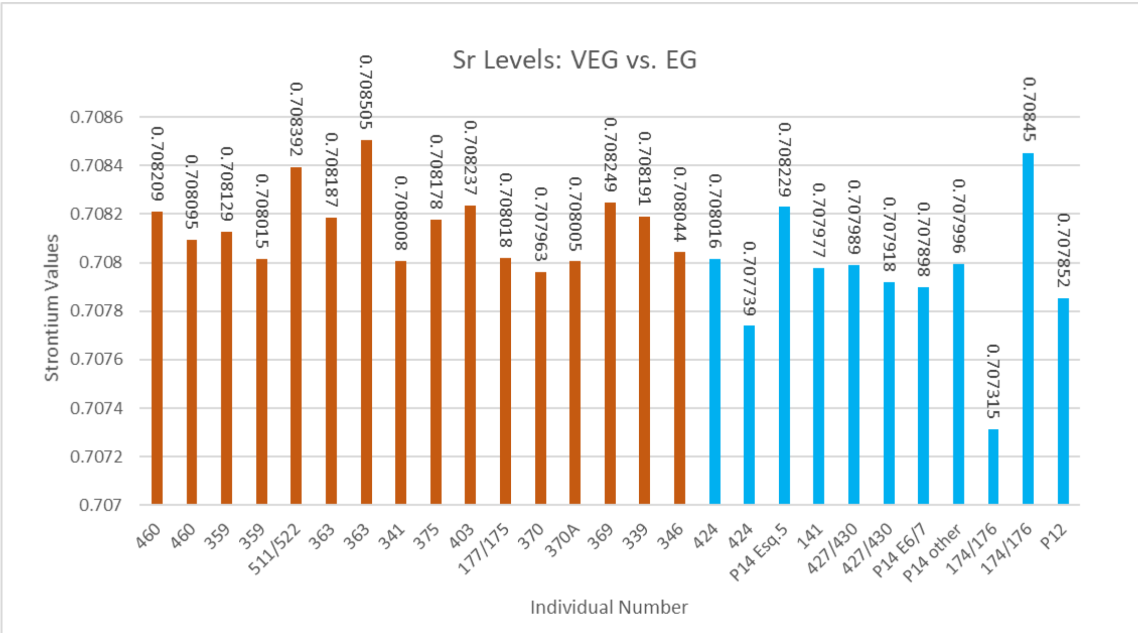

Fig. 5 VEG individuals (left orange: 460-346) beside EG individuals (right blue: 424-P12)

It is important to note that, while not included in my discussion, marine based diets can affect the $^{86}Sr/^{87}Sr$ values reflected (Slovak & Paytan, 2012). Studies have shown that diets that rely heavily on outside sourced foods can affect the $^{86}Sr/^{87}Sr$ values reflected in the samples. Specifically, foods with high Calcium and Sr levels as well as Sr-rich foods (sea salt) (Slovak & Paytan, 2012; Wright, 2005; Lewis et al., 2017).

Table 3 shows the raw data results of the radiocarbon dates acquired from one VEG individual and one EG individual. Two samples were sent to DirectAMS laboratories for analysis. Once the uncalibrated dates were determined (Table 3), I calibrated the dates using OxCal version 4.4.4. The dates were calibrated with the

Period	Individual #	RadioCarbon Age (BP)	Radiocarbon Age (1SD Error)
VEG	363	2280	30
EG	430	1909	28

Table 3 shows two RadioCarbon dated individuals uncalibrated, raw date with one standard deviation error.

International Calibration Curve (IntCal), suggested by Marsh et al. (2018) to be the more accurate curve due to proximity of the site to the equator. Figures 6 and 7 (below) show the results of OxCal using the IntCal curve updated in 2020. The calibrations below show the 2 sigma ranges. Sample SLG 25 is Ind. 363 from VEG and sample SLG 38 is Ind. 430 is from EG. These dates show that VEG did come before EG.

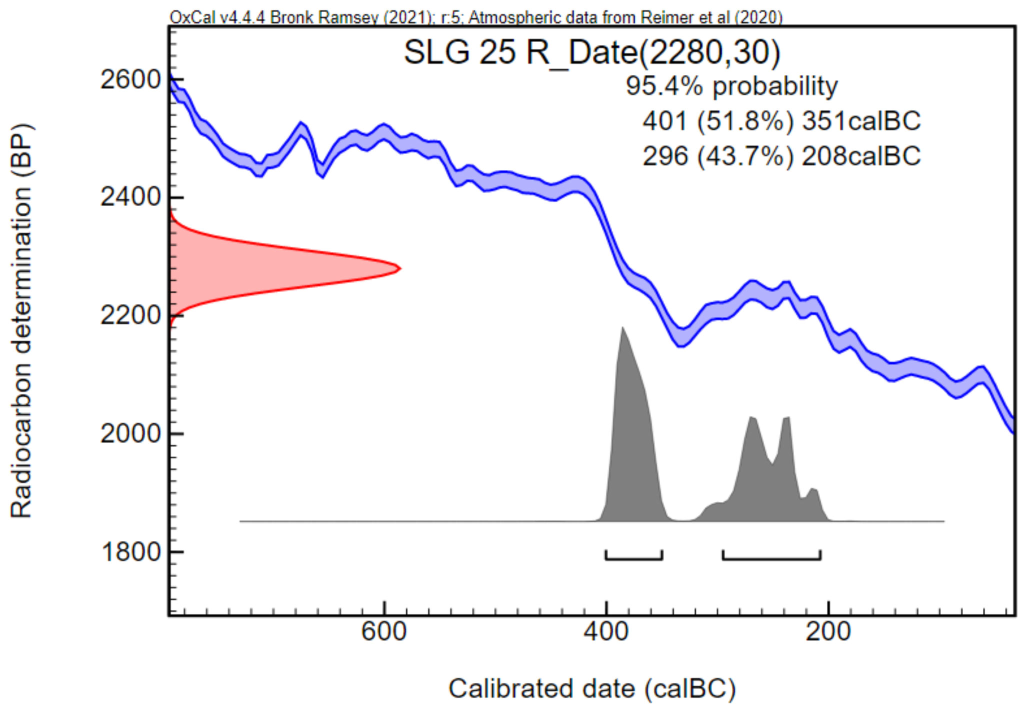

Fig. 6 shows Ind. 363 from VEG calibrated RadioCarbon Dates using OxCal.

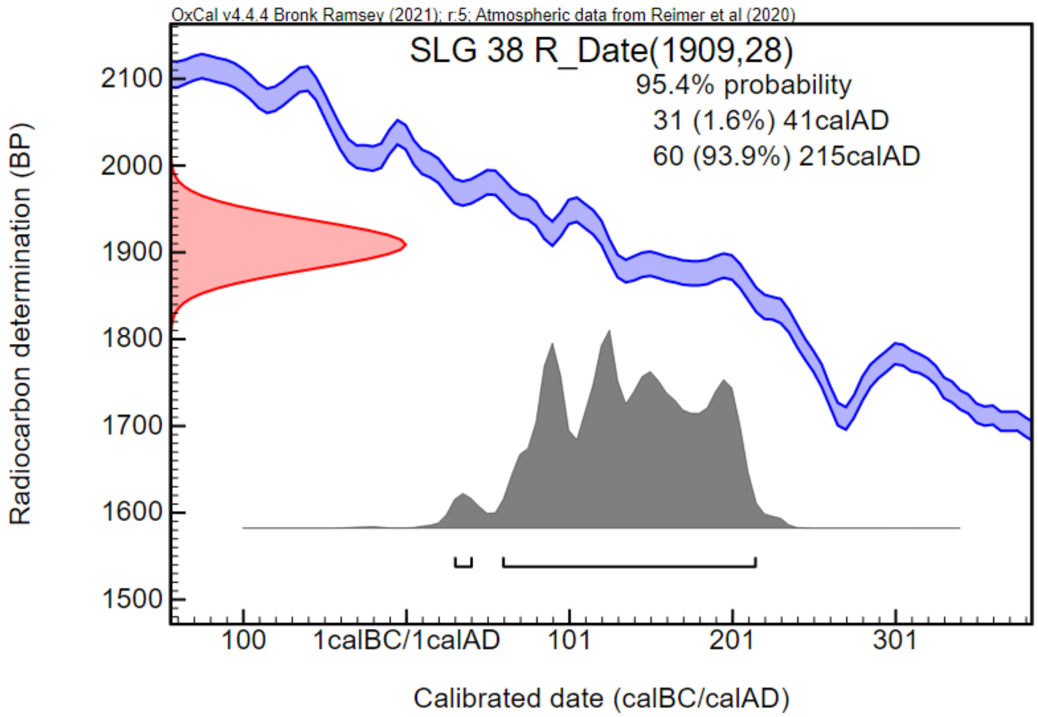

Fig. 7 shows Ind. 430 from EG calibrated RadioCarbon Dates using OxCal.

CHAPTER 7: DISCUSSION

7.1 Was there mobility: Discussing Strontium Isotopes

Evidence suggests that mobility did occur, based on the nonlocal strontium values returned from two VEG individuals and two EG individuals. Comparing previous research on oxygen ($\delta^{18}O$) and dietary isotopes, an understanding of individual mobility during the RDP can be evaluated. With mortuary artifacts and burial practices, it is possible to make inferences on social identity and see who "belonged" at Salango (Juengst et. al 2022). Differences in mortuary practices show that "living permanently near Salango and the sea was an important aspect of identity" (Juengst et. al. 2022). Combing the dietary, oxygen, and mortuary data with the strontium values provides a more complete picture of mobility and belonging at Salango.

7.2 Analyzing Mobility in VEG and EG Individuals

Two VEG individuals (511/522 and 363) had nonlocal strontium values, clearly deviating from the geological and social baselines. Identifying where these values are from is a little more difficult, as baselines across Ecuador are generally absent. However, by using previous research on $\delta^{18}O$ isotopes, it is possible to narrow down some possibilities. Juengst et al. (2021) stated that $\delta^{18}O$ ranges between -6.0 and -2.0‰ and becomes "increasingly negative moving inland" (7), based on oxygen values from precipitation and groundwater in modern environmental surveys (Maldonado Astudillo, et al., 1995). Both individuals (511/522 and 363) have negative $\delta^{18}O$ levels below -2.0 (Table 1; Cobb 2021). These oxygen values were two of the lowest oxygen values from the 29 Salango burials; while still within the coastal range predicted by Juengst et al.

(2021) and Maldonado Astudillo et al. (1995), it seems like these individuals lived further inland prior to death than most of the other people buried during the VEG.

Interestingly, Individual 363 also had significant dietary changes during their lifetime, when comparing dental and skeletal samples. Cobb (2021) stated that "the carbonate values for Burial 363 clearly vary, suggesting that their diet and water sources may have changed over their life course" (35). The $^{86}Sr/^{87}Sr$ ratios of Ind. 363 also differed significantly. The enamel sample taken from this individual (363) had $^{86}Sr/^{87}Sr$ ratio of 0.70819 and had $\delta^{18}O$ level of -1.9‰, suggesting that this individual was either "born (or gestated) coastally and relocated later" (Juengst 2022, p. 5). However, their bone sample had a lower $\delta^{18}O$ level (-3.1‰) and a higher $^{86}Sr/^{87}Sr$ ratio (0.70851) indicating that the years prior to their death, this individual lived in a location different from where they were born. This correlates with the dietary values, which suggested a move towards more terrestrial foods later in life (Cobb 2021).

The EG individuals (424 and 174/176) have lower $^{86}Sr/^{87}Sr$ ratios, in the .707 range of volcanic rock (Juengst et al. 2021) lower than the predicted geologic $^{86}Sr/^{87}Sr$ ratios of Salango. Notably, these two individuals had differences in the $^{86}Sr/^{87}Sr$ ratios from the other EG burials, and from each other, with Ind. 424 returning a significantly higher $^{86}Sr/^{87}Sr$ ratio than that of Ind. 174/176. This suggests they did not originate in the same areas. However, later in life, both did live on the coast or in the same region as the rest of the burial samples, as the skeletal $\delta^{18}O$ signatures and $^{86}Sr/^{87}Sr$ ratios from both individuals indicate that they resided in coastal Ecuador in the years prior to their death.

Another similarity between the two individuals (424 and 174/176) and other EG individuals were their dietary readings. Both individuals (424 and 174/176) had similar carbonate values of EG individuals indicating they had a marine based diet or access to marine resources (Cobb 2021). This is notable since they were not necessarily living in coastal areas but must have maintained access to coastal resources over potentially long distances.

7.3 Mobility and Identity: The Importance of Location in VEG and EG Individuals

The mortuary treatment of these mobile individuals gives insights to individual identity through their lived experiences and how they were treated after death. VEG individuals 511/522 and 363 were potentially treated differently from other VEG individuals regarding their burials. First, Ind. 511/522 was disinterred from their original resting place and moved under the retaining wall during the Middle Guangala phase. They (511/522) were found with artifacts such as a white spondylus long bead, sherds, worked stone, and isolated bones from the wall fill above of other individuals. However, these artifacts may not have been originally placed with this individual and could have been added at reinterment (Juengst et al. 2022).

While we cannot know exactly how this individual was originally buried because of the later disturbance and relocation, it would be significant if their burial was selected for the later use. Perhaps their original interment marked them as different or foreign in some way. This scenario would be unlikely though, for it would imply that information of this individual was passed on. Re-interment of this individual was likely caused by being found in preparation for constructing the wall. Being reinterred could have been an act of respect or an offering (Lunniss, personal communication, 2022). While it is possible that this individual was seen as foreign, their burial and re-interment may not show evidence of being treated differently.

In contrast, Ind. 363 was found incomplete, possibly with no artifacts, in very close association with Ind. 460, who had many accompanying grave goods such as an ocarina whistle, shells, small stone tools, ceramics, and other artifacts (full list on App. 2) (Juengst et al. 2022). The other VEG individuals, excluding two, were all found to have either artifacts or significant burials such as the infants wearing other infant skulls as helmets and artifacts symbolizing the sea (Appendix 2) (Lunniss personal communication 2018; Juengst et al. 2019). This makes Ind. 363's burial seem to stand out as plain, devoid of the accoutrement that other individuals received, but further research must be done on the other two individuals lacking grave goods to fully understand what is being shown with the isotopic analysis. Ind. 363's foreign status from two different areas of Ecuador may have meant they were not able to receive the full mortuary treatment given to others because they were seen as foreign or not.

When comparing both VEG individuals (511/522 and 363) to each other, it is possible to infer more about their identity. Ind. 511/522 potentially had closer or stronger ties to the sea than Ind. 363. This could have affected the way they were buried and later re-buried under the retention wall. I suggest this scenario due to the lower $^{86}Sr/^{87}Sr$ ratio and $\delta^{18}O$ signatures than Ind. 363, indicating they retained closer association with the ocean. It is also thought that Ind. 511/522 was originally placed in the west mound, closer to the sea, whereas Ind. 363 was buried in the east mound, more closely related to the land (Lunniss, personal communication, 2022). Juengst et al. (2022) states that "living permanently near Salango and the sea was an important aspect of identity" (5). This implies that those who did not have strong ties to the sea were potentially seen as "outsiders" and did not get treated as other Very Early Guangala individuals in death.

As with diet (Cobb 2021) and pathology (Bythell 2019), we see changes to mobility and mortuary treatment during the EG phase. Ind. 424 and 174/176 were born outside of Salango, yet both individuals had elaborate burials, similar in style and opulence to the burials in the central ritual compound (Juengst et al. 2022; Lunniss 2019). Ind. 424 was interred with a large pedestal plate, shells and shell work, stone hammer, and several jars (See full list on App. 3). They (Ind. 424) had an $\delta^{18}O$ signature of -2.5‰ and a lower $^{86}Sr/^{87}Sr$ ratio (0.70802) than Ind. 174/176. This suggests that Ind. 424 lived farther inland than Ind. 174/176 which has a $\delta^{18}O$ signature of -2‰ and a $^{86}Sr/^{87}Sr$ ratio of 0.70845. Ind. 174/176 was buried in a seated and crossed-legged position, similar to the burials at the entrance of the central burial ground (Lunniss 2019). Burial goods found with Ind. 174/176 include a small pedestal plate and a small jar. It is very interesting that burial (174/176) was in fact someone who lived elsewhere during childhood and adulthood. Potentially, both individuals (424 and 174/176) could have been seen as foreigners, yet were treated as other individuals buried at Salango, implying that regardless of foreigner status, were treated as part of the "community." There could be a shift of importance of identity from a foreigner during VEG being potentially treated differently, to a connection with the sea during EG leading to an equal treatment regardless of foreigner status.

Understanding human movement during the Regional Development Period clarifies our ideas about the Guangala burials at Calle 22 and the Guangala culture more broadly as we can see how people related to the landscape and each other. In particular, we can begin to understand how the Very Early Guangala and Early Guangala peoples at Salango navigated different landscapes and cultural worlds. Affected by the volcanic eruption that occurred approximately 2,000 years ago (Lunniss, n.d.), VEG individuals had a more varied diet and harsher living conditions than that of EG individuals (Cobb 2021, Bythell 2019). The volcanic explosion is thought to have disrupted the ancestral connections of the Guangala people (Lunniss, 2021) as evidenced by changes to mortuary practice (Juengst et. al. 2019). However, it remained unclear if individuals buried at Salango had lived in the surrounding areas of the huaca or if they traveled to Salango to bury individuals to re-establish their lost connection with their ancestors (Lunniss 2021). This research shows that mobility was occurring, and that in particular, some individuals were moved to Salango for burial from areas more inland in Ecuador.

However, we can see change over time. During the VEG, foreigners could have been buried in different ways from the other individuals by not being buried with grave goods. Whereas during the EG phase, foreigners were treated similarly, or even more elaborate, to the other individuals buried at Salango. I suggest that this is due to the differences of lived experiences between the phases. It is possible that VEG individuals were wary of travelers, or potentially individuals from certain areas, possibly because of the environmental and social upheaval post-volcanic eruption. With their connection to the ancestors being severed, “outsiders,” or those without a connection to Salango through either location or connection to the sea, were treated with less care during burial. There could have been a strong sense of community within Salango, preventing outsiders from accessing the same ritual rites in death. To re-establish the connection that was lost, either due to the volcanic eruption or an event that caused the volcanic eruption, the individuals buried at Salango needed to have some type of connection to the sea which needed to differentiate those who “belonged” versus those who did not.

In the EG phase, there is a shift to include others. VEG individuals re-established their lost connection which brought about a change in lived experiences. Stability could have been a main factor in acceptance to foreigners. With access to more resources and increasing health in the populations, it was possible to be more welcoming to foreigners.

Another possibility is that VEG individuals created new rights to burial, or potentially new ancestral line. With their prior connections gone, VEG individuals buried foreigners, albeit less elaborate, as a way to change previous thoughts of outsiders. By doing so, it was possible for EG individuals to then include foreigners in burial rites and encourage movement. With this line of thought, individuals from certain areas could have been treated differently and potentially more connected to the new ancestral line. In the EG phase, Ind. 174/176 could have been more closely connected to the volcano or Salango Island. With a $^{86}Sr/^{87}Sr$ ratio closer to the volcanic rock range ($^{86}Sr/^{87}Sr$ ratio= 0.707), Ind. 174/176 could have originated closer to an area with volcanic rock. As established in the definition of huaca, the volcano could have been seen as an important sacred site, thus those who lived closer inland to the volcano or on volcanic bedrock became huacas themselves, or at the very least, seen as important. Without having an accurate local baseline, only inferences can be made as to where individuals either lived or moved to later in life.

CHAPTER 8: CONCLUSION

The samples discussed here that were processed have added to the collective knowledge of Salango, the Guangala Culture, and the RDP. The research suggests that mobility did occur, and that individual identity could be strongly tied to the sea. This is possible to determine by analyzing the differences between the $^{86}Sr/^{87}Sr$ values of enamel to the $^{86}Sr/^{87}Sr$ values of bone (Fig. 2) and using burial contexts to better understand identity at Salango. Further understanding of this site could better, or go against, the discussion addressed. My research adds to the collective knowledge of the Andes and while I was unable to establish a local baseline on the coast of Ecuador, my research suggests a range of $^{86}Sr/^{87}Sr$ values that can be used as a comparison for other Sr isotopic research in the area.

Beyond Salango and Ecuadorian archaeology, being able to gain insights into past human movement through Sr isotopic analysis can help outline and refine migration theories. With the advances in this technology, bioarchaeologist and anthropologists alike can decolonize the profession that was, and can still be, part of racist narratives. Sr isotopic analysis allows current bioarchaeologists to completely step away from using cranial typologies in migrational studies, but bioarchaeologists and anthropologists theorizing in mobility and migration must take it another step further by making sure their discussions do not continue to use the racist narratives the theory once held.

Additionally, migration and mobility bring out aspects of cultures that need to be further explored. The importance of location and belonging go beyond boundaries and borders. There are sociopolitical factors that can be further explored once the identity and origins of an individual is better understood. As shown in this research by EG individuals, being a foreigner, or from a different area, did not hinder the individual's importance in the community and possibly was held in a higher regard. On the other hand, VEG individuals that could have potentially been seen as foreigners during times of limited resources and instability, either through environmental factors or social unrest, can lead to a stronger, potentially negative reaction towards them.

Future research should include collecting biological samples of the local area and surrounding areas to better understand and compare $^{86}Sr/^{87}Sr$ ratios. Collecting samples from the surrounding areas of Salango, including Salango Island, further inland where volcanic bedrock lies, and of other locations where the Guangala culture resided, will give more insights into mobility and potentially migration patterns of this time period. $^{86}Sr/^{87}Sr$ ratios vary throughout the world, but similar ratios can occur in different areas. While this can be seen as a limitation to Sr isotopic analysis, it can also suggest that individuals of the Guangala culture could have migrated from other Guangala sites further south. I also suggest collecting samples from Salango Island due to it being a volcanic island. While there is no archaeological evidence of a sanctuary found on the island, there is evidence of Guangala presence on the island (Lunniss 2019, Lunniss, personal communication, April 29, 2022). It would be interesting to compare the $^{86}Sr/^{87}Sr$ ratios of the volcanic rock to the individuals that suggest residency on volcanic rock. Salango Island is thought to be a huaca that has been around for a long time, and this could explain why certain individuals had elaborate burials. In this way, future bioarchaeological research can expand our understanding of migration at Salango, the movements and interactions between people and landscape during the Regional

Development Period and contribute to broader anthropological conversations on immigration and belonging globally.

References

Adams, W. Y., Van Gerven, D. P., & Levy, R. S. (1978). The Retreat from Migrationism. *Annual Review of Anthropology, 7*, 483-532.

Aguilar Mora, J., Salmón, J., & Ewell, B. C. (2017). *Anthology of Spanish American Thought and Culture.* Gainesville: University Press of Florida.

Arienzo, I., Rucco, I., Di Vito, M. A., D'Antonio, M., Cesarano, M., Carandente, A., . . . Rickards, O. (2020, July 7). Sr Isotopic Composition as a Tool for Unraveling Human Mobility in the Campania Area. *Archaeological and Anthropological Sciences, 12*, 157.

Bentley, R. A. (2006). Strontium Isotopes from the Earth to the Archaeological Skeleton: A Review. *Journal of Archaeological Method and Theory, 13*(3), 135-187.

Brown, K., & Brown, T. (2011). *BioMolecular Archaeology an Introduction.* John Wiley & Sons.

Bruhns, K. O. (1994). Regional Diversification and Development: 200 BC- AD 600. In *Ancient South America* (pp. 185-222). Cambridge University Press.

Budd, P., Montgomery, J., Barreiro, B., & Thomas, R. G. (2000). Differential diagenesis of strontium in archaeological. *Applied Geochemistry, 15*, 687-694.

Burmeister, S. (2000). Archaeology and Migration. *Current Anthropology, 41*(4), 539-567.

Bythell, A. A. (2019). *A paleopathological and Mortuary analysis of Guangala burials from Salango, Ecuador (100 BCE-800 CE)*. [Master's Thesis, University of North Carolina Charlotte]. ProQuest Dissertations Publishing.

Cobb, E. M. (2021). *Dietary Identity at Salango: Stable Light Isotope Analysis of Guangala Period Burials (100 Bce – 800 CE)*. [Master's Thesis, University of North Carolina Charlotte]. ProQuest Dissertations Publishing.

Colcha, L., & López, E. (2013). Aproximación Taxonómica a las Malacofaunas Arqueológicas del Sitio OGSE-46 Samarina y sus Implicancias Socioeconómicas Ambientales en el Guangala Temprano. Cantón La Libertad, Provincia de Santa Elena, Ecuador. *Revista Científica y Tecnológica UPSE*, *1*(3).

Conlee, C. A., Buzon, M. R., Noriega Gutierrez, A., Simonetti, A., & Creaser, R. A. (2009). Identifying Foreigners versus Locals in a Burial Population from Nasca, Peru: an Investigation using Strontium Isotope Analysis. *JOurnal of Archaeological Science*, *36*(12), 2755-2764.

Delabarde, T. (2010). Salud, Enfermedad y Muerte en la Población Manteña de Japoto: las Evidencias Osteológicas y Dentales. *Bullettin de l'Institut Français D'études Andines*, *39*(3), 531-550.

DePaolo, D. J. (1986). Detailed record of the Neogene Sr isotopic evolution of seawater from DSDP Site 590B. *Geology*, *14*(2), 103-106.

DeWitte, S. (2014). Differential survival amoung individuals with active and healed periosteal new bone formation. *International Jounal of Paleopathology*, *7*, 38-44.

Friedl, A. (2013). Desde Basura, una Cultura: El sitio Samarina, La Libertad, Ecuador. *Independent Study Project (ISP) Collection*.

Gregoricka, L. (2021). Moving Foward: A Bioarchaeology of Mobility and Migration. *Jounal of Archaeological Research, 29*(4), 581-635.

Hakenbeck, S. (2008). Migration in Archaeology: Are We Nearly There Yet? *Archaeological Review from Cambridge, 23*(2), 9-26.

Hrnčíř, V., & Laffoon, J. E. (2019). Childhood mobility revealed by strontium isotope analysis: a review of the multiple tooth sampling approach. *Archaeological and Anthropologcial Science, 11*(10), 5301-5316.

Jackson, L. J., Horton, B. K., & Vallejo, C. (2019). Detrital zircon U-Pd geochronology of modern Andean rivers in Ecuador. *Geosphere, 15*(6), 1943-1957.

Juengst, S. L., Lunniss, R., Bythell, A., & Ortiz Aguilu, J. J. (2019). Unique Infant Mortuary Ritual at Salango, Ecuador, 100 BC. *Latin American Antiquity, 30*(4), 851-856.

Juengst, S., Hundman, B., Krigbaum, J., & Kamenov, G. (2021). Exploring Dental Modification from Coastal Ecuador from an Unprovenienced Museum Collection. *Bioarchaeology International, 5*(3-4), 99-124.

Juengst, S. L., Bythell A. B., Cobb E. M., Cruz Z. Y., & Lunniss R. L. 2022. Sand, stone, and sea: A mortuary and bioarchaeological investigation of identity and ontology at Salango, Ecuador (BCE 100- 300 CE). Paper presented at the 86th Annual Meeting of the Society for American Archaeology, April 2, Chicago, Knudson, K. J. (2008). Tiwanaku Influence in the South Central Andes: Strontium Isotope Analysis and Middle Horizon Migration. *Latin American Antiquity, 19*(1), 2-23.

Knudson, K. J., & Price, T. D. (2007). Utitily of multiple chemical techniques in archaeological residential mobility studies: Case studies from Tiwanaku and Chiribaya-affiliated sites in the Andes. *American Journal of Physical Anthropology, 132*(1), 25-39.

Knudson, K. J., Price, T. D., Buikstra, J. E., & Blom, D. E. (2004). The Use of Strontium Isotope Analysis to Investigate Tiwanaku Migration and Mortuary Ritual in Bolivia and Peru. *Archaeometry, 46*(1), 5-18.

Knudson, K. J., Webb, E., White, C., & Longstaffe, F. J. (2014). Baseline data for Andean paleomobility research: a radiogenic strontium isotope study of modern Peruvian agricultural soils. *Archaeological and Anthropological Sciences, 6*(3), 205-219.

Knudson, K. J., Williams, H. M., Buikstra, J. E., Tomczak, P. D., Gordon, G. W., & Anbar, A. D. (2010). Introducing δ88/86Sr analysis in archaeology: a demonstration of the utility of strontium isotope fractionation in paleodietary studies. *Journal of Archaeological Science, 37*(9), 2352-2364.

Larsen, C. S. (2018). Bioarchaeology in perspective: From classifications of the dead to conditions of the living. *American Journal of Physical Anthropology, 165*(4), 865-878.

Lewis, J. P. (2017). Strontium concentration, radiogenic (87Sr/86Sr) and stable (δ88Sr) strontium isotope systematics in a controlled feeding study. *STAR: Science & Technology of Archaeological Research, 3*(1), 45-57.

Lunniss, R. (2001). *Archaeology at Salango, Ecuador: An Engoroy Ceremonial Site on the South Coast of Manabi (Publication No. 3023643).* [Doctoral dissertation, Univeristy of London]. ProQuest Dissertations Publishing.

Lunniss, R. (2016). Investigaciones Arqueólogicas en Salango: Nuevo Aportes al Estudio de un Antiguo Sitio Sagrado. *Revista de Ciencias Humanísticas y Sociales, 1*(2), 1-38.

Lunniss, R. (2017). Coca ritual, aristocrats, and the landscape of power on the coast of Ecuador in the Early Regional Development period (100 BC–AD 300). *Ñawpa Pacha, 37*(2), 155-174.

Lunniss, R. (2019). Huaca Salango: A Sacred Center on the Coast of Ecuador. In M. C. Lozada, & H. Tantaleán, *Andean Ontologies: New Archaeology Perspectives* (pp. 50-78). Univeristy of Florida.

Lunniss, R. (2021). Investigaciones Arqueológicas en Salango Despúes de la Catástrofe: Un Programa Funerario.

Lunniss, R. (2021). Late Formative Shamans of the Ecuadorian Coast: Architectural, Mortuary, and Artifactual Evidence from Salango in the Middle and Late Engoroy Phases (600–100 BC). *Ñawpa Pacha, 41*(2), 143-186.

Maldonado Astudillo, S., Cepeda Tobar, H., & Araguas Araguas, L. (1995). Estudio hidrogeológico e isotópico de los acuíferos del Delta del Rio Guayas (Ecuador). *Estudios de hidrología isotópica en América Latina*, 191–205.

Marsh, E. J., Bruno, M. C., Fritz, S. C., Baker, P., & Capriles, J. M. (2018). IntCal, SHCal, or a Mixed Curve? Choosing a 14C calibration curve for archaeological and paleoenvironmental records from tropical South America. *Radiocarbon*, *60*(3), 925–940.

Martin, A. J. (2010). Trade and Social Complexity in Coastal Ecuador from Formative Times to European Contact. *Journal of Field Archaeology, 35*(1), 40-57.

Masucci, M. A. (1992). *Ceramic Change in the Guangala Phase, Southwest Ecuador: a Typology and Chronology (Publication No. 9225388).* [Doctoral Dissertation, Southern Methodist University]. ProQuest Dissertations Publishing.

Masucci, M. A. (2000). Defining Ceramic Change and Cultural Interaction: Results of Typological, Chronological, and Technological Analysis of Guangala Phase Ceramics. *Andean Past, 6*(1), 175-208.

Masucci, M. A. (2008). Early Regional Polities of Coastal Ecuador. In H. Silverman, & W. H. Isbell (Eds.), *The Handbook of South American Archaeology.* Springer Science and Business. doi:10.1007/978-0-387-74907-5_25

Masucci, M. A., & Macfarlane, A. (1997). An Application of Geological Survey and Ceramic Petrology to Provenance Studies of Guangala Phase Ceramics of Ancient Ecuador. *Geoarchaeology: An International Journal*, *12*(7), 765-793.

Meggers, B. J. (1966). *Ecuador*. Praeger.

Moore, J. D. (2010). Making a huaca: Memory and praxis in prehispanic far northern Peru. *Journal of Social Archaeology*, *10*(3), 398-422.

Ortega Muñoz, A. (2014). The Use of Theoretical and Methodological Bases in Population Movements' Studies: Paleo and Archaeo Demographic Approaches. In A. Cucina (Ed.), *Archaeology and Bioarchaeology of Population Movement Among the Prehispanic Maya* (pp. 59-70). Springer International Publishing.

Paulsen, A. C. (1970). *A Chronology of Guangala and Liberty Ceramics of the Santa Elena Peninsula in South Coastal Ecuador (Publishing No. 7106236).* [Doctoral Dissertation, Columbia University]. ProQuest Dissertation Publishing.

Price, T. D., Burton, J. H., Fullagar, P. D., Wright, L. E., & Tiesler, V. (2008). Strontium Isotopes and the Study of Human Mobility in Ancient Mesoamerica. *Latin American Antiquity*, *19*(2), 167-180.

Reynaud, C., Jaillard, É., Lapierre, H., Mamberti, M., & Mascle, G. H. (1999). Oceanic plateau and island arcs of southwestern Ecuador: their place in the geodynamic evolution of northwestern South America. *Tectonophysics, 307*(3-4), 235-254.

Scaffidi, B. K., & Knudson, K. J. (2020). An archaeological strontium isoscape for the prehistoric Andes: Understanding population mobility through a geostatistical meta-analysis of archaeological 87Sr/86Sr values from humans, animals, and artifacts. *Journal of Archaeological Science, 117*, 105-121.

Slovak N. M., P. A. (2012). Applications of Sr Isotopes in Archaeology. In B. Mark (Ed.), *Handbook of Environmental Isotope Geochemistry* (pp. 743-768). Springer Berlin, Heidelberg. doi:https://doi.org/10.1007/978-3-642-10637-8

Slovak, N. M., & Paytan, A. (2012). Applications of Sr Isotopes in Archaeology. In M. Baskaran (Ed.), *Handbook of Environmental Isotope Geochemistry* (pp. 743-768). Springer Berlin Heidelberg. doi:10.1007/978-3-642-10637-8_35

Slovak, N. M., Paytan, A., & Wiegand, B. A. (2009). Reconstructing Middle Horizon mobility patterns on the coast of Peru through strontium isotope analysis. *Journal of Archaeological Science, 36*(1), 157-165.

Slovak, N. M., Paytan, A., Rick, J. W., & Chien, C.-T. (2018). Establishing radiogenic strontium isotope signatures for Chavín de Huántar, Peru. *Journal of Archaeological Science: Reports, 19*, 411-419.

Stothert, K. E. (1995). Guangala. In B. A. Tenenbaum, & B. A. Tenenbaum (Ed.), *Encyclopedia of Latin American History and Culture* (2 ed., Vol. 3, pp. 109-110). Detroit, MI: Charles Scribner's Sons.

Tantaleán, H. (2019). Andean Ontologies: An Introduction to Substance. In M. C. Lozada, & H. Tantaleán, *Andean Ontologies: New Archaeological Perspectives* (pp. 1-48). University Press of FLorida.

Tsuda, T., Baker, B. J., Eder, J. F., Knudson, K. J., Maupin, J., Meierotto, L., & Scott, R. E. (2015). Unifying Themes in Studies of Ancient and Contemporary Migrations. In B. J. Baker, & T. Tsuda, *Migrations and Disruptions: Toward a Unifying*

Theory of Ancient and Contemporary Migrations (pp. 15-30). University Press of Florida.

Turner, B. L., Kamenov, G. D., & Armelagos, G. J. (2009). Insights into immigration and social class at Machu Picchu, Peru based on oxygen, strontium, and lead isotopic analysis. *Journal of Archaeological Science*, *36*(2), 317-332.

Uribe Taborda, S. F. (2016). El Período de Desarrollo Regional. In S. F. Uribe Taborda, *La Representación zoomorfa en la cultura Guangala* (p. 20). Editorial Universitaria Abya-Yala .

Van Dommelen, P. (2014). Moving On: Archaeological Perspectives on Mobility and Migration. *World Archaeology*, *46*(4), 477-483.

Vargas Benavides, L. N., & Romero Guerrero, J. P. (2015). *La Comuna Salango como sitio arqueológico y su incidencia en los estudiantes del segundo año de bachillerato unificado en el área de Ciencias Sociales de la Unidad Educativa.* Universidad de Guayaquil.

Washburn, E., Nesbitt, J., Ibarra, B., Fehren-Schmitz, L., & Oelze, V. M. (2021). A strontium isoscape for the Conchucos region of highland Peru and its application to Andean archaeology. *PLoS ONE*, *16*(3).

White, C. D., Storey, R., Longstaffe, F. J., & Spence, M. W. (2004). Immigration, Assimilation, and Status in the Ancient City of Teotihuacan: Stable Isotopic Evidence from Tiajinga 33. *Latin American Antiquity, 15*(2), 176-198.

Wright, L. E. (2005). Identifying immigrants to Tikal, Guatemala: Defining local variability in strontium isotope ratios of human tooth enamel. *Journal of Archaeological Science*, *32*, 555–566.

Zeidler, J. A. (2008). The Ecuadorian Formative. In H. Silverman, & W. H. isbell (Eds.), *The Handbook of South American Archaeology* (pp. 459-488). Springer New York. doi:10.1007/978-0-387-74907-5_24

APPENDIX A: TABLES

Period	**IND**	**Sr**
VEG	460	0.708209
		0.708095
VEG	359	0.708129
		0.708015
VEG?	511/522	0.708392
VEG	363	0.708187
		0.708505
VEG	341	0.708008
VEG	436	\
VEG	375	0.708178
VEG	403	0.708237
VEG	177/175	0.708018
VEG	166	\
VEG	370	0.707963
VEG	370A	0.708005
VEG	369	0.708249
VEG	352	\
VEG	339	\
		0.708191
VEG	346	0.708044
EG	424	0.708016
		0.707739
EG	P14 Esq.5	0.708229
		failed
EG?	1020	\
EG	141	failed
		0.707977
EG	P12	\
EG	427/430	0.707989
		0.707918
EG?	P18 1001	\
EG	168/166	\
EG	P13 Esq. 1	\
EG	P14 E6/7	0.707898
EG	P14 other	0.707996
EG	P14 E4	\
EG	174/176	0.707315
		0.70845
EG	P12	0.707852
Bahia II	P18 1005	failed
IP	P6	0.707907
		0.707867

Period	IND	Context
VEG	460	75-100% complete. First burial in east mound. Found with: ocarina whistle, complete *S. princeps*, worked *muricanthus*, small stone tool (x2), small conch, sherd of iridescent bowl, shell spoon, and shell plaque.
VEG	359	<50% complete. East mound. Found with: stone figurine, round stone (x2), stone tool, and a sherd.
VEG?	511/522	25% complete. No lower body or cranium. Disinterred from their original resting place and buried under a retaining wall during the Middle Guangala period. Found with: white spondylus long bead, three sherds, fragment of p.mazatlanica, one sherd with a negative decoration, p. mazatlanica valve, a large sherd of a fineware jar, and a small stone disc. Furthermore, isolated bones of different individuals found interred in the wall fill above.
VEG	363	<50% complete. Above 460 in the east mound. No artifacts.
VEG	341	75-100% complete. West mound. Found with: obsidian flake, shell bead, and shell plaque.
VEG	436	25% complete. No cranium. East mound. No artifacts.
VEG	375	50-75% complete. West mound. Found with: pottery sherd, *Arca pacifica* substituted for right lower arm bones, and hollow leg of a pottery bowl substituted for right femur
VEG	403	<50% complete. No lower body. West mound. Found with: three Engoroy stone figurines around head, large sherd, rim sherd under head, round stone, red mussel, round stone hammer, and bone palillo.
VEG	177/175	<25% complete. Redeposited to be with EG individual 174/176
VEG	166	<25% complete, poorly preserved. Found with EG individual 168/166
VEG	370	50% complete. West mound. Found with: additional cranium, three Engoroy figurines around their head, a fragment of a Bahía hollow figurine under their head, and a red mussel valve.
VEG	370A	Only cranial fragments. West mound. Found encasing the head of individual 370
VEG	369	50% complete, No lower limbs. East mound. Found with: *pteria sterno* valve and a fragment, blackened sherd under their head
VEG	352	50% complete, no cranium. East mound. Buried face down next to individual 369. No artifacts.
VEG	339	75% complete. East Mound. Found with: additional cranium
VEG	346	Only cranial fragments. East mound. The additional cranium encasing the head of individual 339

Period	IND	Context
EG	424	50% complete. Found with: large pedestal plate, jar, P. mozatlanico, S. princeps (x2), worked conch, stone hammer, fragment of sandstone, obsidian flake, and a polished black jar. Disturbed by machine and partially redeposited into a mixed context with individual 427/430.
EG	P14 Esq.5	75% complete. Found sitting on a large Guangala red ware pedestal plate. Decorated with thick white slip over the center and a deep red slip over the rim. Additionally: a small black ware pedestal plate and a stone hammer in front of the head.
EG?	1020	<25% complete. Disturbed by modern construction and therefore context is lost.
EG	141	50-75% complete. Deposited in a layer of loose sand, brown loam, and yellow clay. Found with: stone tool (x2), unworked *V. caestus*, and *P. mazatlanica*
EG	P12	<25% complete, very few bones. No artifacts.
EG	427/430	25-50% complete, very fragmentary. Found near 424. Disturbed by machine and partially redeposited into a mixed context with individual424.
EG?	P18 1001	<25% complete. Above P18 1005. redeposited on top of the Bahía II urn burial. Again, given its locality, most likely from an EG burial, but not 100% certain;
EG	168/166	<25% complete, only a few bones. Found with: complete *p. mazatlanica* valve, obsidian flakes, and a polished red pottery jar decorated with diagonal black painted lines. VEG 166 included
EG	P13 Esq. 1	<25% complete, very few bones, no grave goosd
EG	P14 E6/7	
EG	P14 other	<25% complete, very few bones, disturbed but found w/ small cooking jar and single long bead of spondylus
EG	P14 E4	<25% complete,very few bones. Secondary urn burial inside a large cooking vessel. Found with: fragments of a line-burnished carinated bowl and a stone weight with a circumferential groove.
EG	174/176	PRIMARY, SEATED, CROSS LEGGED, AD, SW, Esp. 215 line burnished jar, Esp. 216 pedestal plate, Both in front, Teeth in excellent condition. Accompanied by redeposited bones of an infant (175, 177; 75-100% complete, most elements preserved. Found with: two small polished darkware pots (one a line-burnished jar and the other a small pedestalled plate) and a single pottery sherd. Also found with redeposited infant bones from a VEG burial.
EG	P12	95% complete, in large urn, excavated in lab

Bahia II	P18 1005	<25% complete. Secondary urn burial inside a cooking vessel decorated with red finger paint. Found with: Bahía whistling figurine (ceremonially attired in the front yet nude in the back), small pedestal plate, small polished jar, and a small conch.
IP	P6	Secondary Manteno Urn