Bite-Sized History: A Metric and Non-Metric Dental Trait Analysis of Pre-Colonial Indigenous Populations in the Greater Antilles

By

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A Thesis submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

MASTER OF ARTS

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Winnipeg

Abstract

Recent analyses suggest a greater diversity existed among the earliest Indigenous inhabitants of the Greater Antilles than previously thought. The pre-colonial period is broadly conceptualized into two successive chronological periods, the Archaic Age and Ceramic Age. Previous research identified biological differences between Archaic Age and Late Ceramic Age groups; however, these findings were impacted by small sample sizes and methodological issues. Further, the analysis of variation within Archaic Age and Ceramic Age populations has received less attention.

This study aimed to broaden understandings of the biological relationships between groups from different time periods, islands, and cultural horizons in the Greater Antilles. To infer biological distances, metric and non-metric dental traits were compared between four Archaic Age and six Ceramic Age sites. The first statistical approach involved analyzing the metric and non-metric dental traits through separate analyses. The second statistical approach combined the data types into a single analysis using the novel FLEXDIST software tool, representing the first implementation of this method in a Caribbean context.

Distinct variability was found between the cemeteries of Canímar Abajo, and low general biological diversity among the later Archaic Age groups. Significant differences were observed among the coeval sites at the end of the Late Ceramic Age; however, Ceramic Age groups from Cuba, Puerto Rico, and the Dominican Republic generally shared strong biological affinity. Patterns of biological continuity were seen throughout the pre-colonial period between the Archaic Age groups from Cuba with the Ceramic Age groups from Puerto Rico and the Dominican Republic. Significant differences between Archaic Age and Ceramic Age groups in Cuba suggests diverse groups cohabitated on the island. This research adds to previous knowledge about the diverse peoples and cultures present in the pre-colonial and early colonial Caribbean and the complex interaction webs they built over thousands of years.

Acknowledgements

This research would have been impossible without the continued love, support, and motivation from Nolan, my family, the loyal Prince Stanley, and the many wonderful friends at the U of W and U of M that I met along this journey.

I would like to thank my supervisor Dr. Mirjana Roksandic for her mentorship, encouragement, and support throughout my master's research. I would like to thank Dr. Yadira Chinique de Armas for permitting me access to the dental remains, assistance with theory, and sitting on my committee. Many thanks to Dr. Julia Gamble for the invaluable knowledge, feedback, and time spent as part of my committee.

My research was possible through the aid of many individuals and organizations that provided me access and arranged for my research on location: Dr. Ivor Conolley (University of the West Indies), Audene Brooks (Jamaica National Heritage Trust), Lourdes Perez Iglesias (Centro de Investigaciones y Servicios Ambientales), Dr. Silvia Teresa Hernández Godoy (Provincial Palacio de Junco and Museo Memorial El Morrillo), Dr. Ulises M. González Herrera (Instituto Cubano de Antropologia), Dany Morales Valdés (Instituto Cubano de Antropologia), Dr. Predrag Radović (University of Belgrade) and Dr. Ksenija Đukić (University of Belgrade).

I would also like to thank Josh Lindal and Dr. Predrag Radović for their assistance with methods, Luis M. Viera Sanfiel for help with photography, Grace Holmes for reviewing my thesis draft, and Dr. Hannes Rathmann for his instruction with the FLEXDIST software.

I would like to acknowledge the generous funding provided by: SSRHC Canada Graduate Scholarship- Master's (CGS M), University of Manitoba (Faculty of Graduate Studies Research Completion Award, Department of Anthropology Graduate Student Award, Carla Thorlakson Travel Award, UMGSA Conference Grant), and University of Winnipeg (Queen Elizabeth II Diamond Jubilee Scholarship). Research costs were also supplemented by the SSHRC Standard Research Grants #70505-10403 and #70505-10407.

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Chapter 1- Introduction

The Caribbean was one of the last areas of the Americas to be settled by humans; but the origins, migration routes, and settlement patterns of the first inhabitants remains largely unknown. Compared to other archipelagos, the Caribbean islands have a short history of human occupation beginning around 7000 years ago, involving possible multiple migrations and cultural interactions within a restricted geographic area (Keegan & Hofman, 2017). Rather than a barrier, the Atlantic Ocean and Caribbean Sea facilitated population movements and interaction among different groups in the circum-Caribbean area (Watters, 1997; Watters & Rouse, 1989). In the millennia following the initial settlements, diverse cultures developed throughout the region.

The Caribbean islands are thought to have been populated by at least two major dispersals from Central and/or South America (Nägele et al., 2020), although these findings are based on a very limited number of samples: Archaic Age individuals (n = 52) and Ceramic Age individuals (n = 41). Many of the earliest settlements in the region are located in the Greater Antilles, a grouping of the larger islands in the Caribbean Sea including Cuba, Hispaniola, Puerto Rico, and Jamaica together with Nassava Island and the Cayman Islands (Keegan & Hofman, 2017). The first major migrations are placed within the Archaic Age, with radiocarbon dates from charcoal indicating populations were present in the Greater Antilles as early as 5000 BCE (Rodríguez Ramos et al., 2023), although skeletal remains are confirmed only as far back as 3000 BCE (Chinique de Armas et al., 2025; Roksandic et al., 2015). The second major migration around 400 BCE originated in northern South America and marked the beginning of the Early Ceramic Age (400 BCE-600/800 CE) and later developed into the Late Ceramic Age (600/800-1500 CE) (Keegan, 2000; Keegan & Hofman, 2017; Rouse, 1986; Wilson et al., 1998).

Despite decades of research on the material cultures of Indigenous populations in the Greater Antilles, only recently have an increased number of studies focused on the biological, skeletal, and dental remains of these groups. Biological differences of dental and cranial morphological traits between Late Ceramic Age and Archaic Age groups have been identified in several studies (Coppa et al., 2008; Syutkina et al., 2021) and were also detected through aDNA analysis (Fernandes et al., 2021; Nägele et al., 2020). However, the biological variation within Archaic Age and Ceramic Age groups has not been fully characterized and is poorly understood.

Most studies that compare Archaic Age and Ceramic Age populations (Coppa et al., 2008; Lalueza-Fox et al., 2003) homogenize all non-ceramic sites as Archaic Age to obtain larger sample sizes for comparisons. This method potentially masks the underlying biological differences within and between these individual populations. Understanding biological variations in archaeological contexts requires an approach that overcomes this bias and reduces the generalization of the many communities that lived in the Caribbean for over 7,000 years.

The biological diversity among Archaic Age groups has received little attention in Caribbean archaeology and an assumed homogeneity of the populations has not been questioned rigorously enough. Further, Ceramic Age populations were believed to have originated from multiple mainland dispersals, based on the many ceramic styles identified in this period, but less is known about the biological differences and/or similarities among these peoples (Nägele et al., 2022). Understanding the diversity of Archaic Age and Ceramic Age groups can help indicate how many distinct populations were living in the islands, illuminate the number of migrations, indicate chronological differences, identify regional variations, and show how populations changed after the migration of Ceramic Age groups.

In archaeological contexts, the variation among Caribbean populations has traditionally been assessed through the analysis of shared artifacts such as lithics, ceramics, and other material items (Rouse, 1992). Often, population dynamics were indirectly inferred from the archaeological evidence and the people of the pre-colonial Caribbean have been largely absent from archaeological reconstructions of the world in which they lived. Metric (size) and non-metric (shape) dental traits have been used extensively to assess biological relatedness among past human groups (Cucina, 2016; Rathmann et al., 2017), but have so far been underused in the Caribbean. Researchers commonly rely on dental trait variation to determine biological distance, which is a measure of relatedness (affinity) or divergence among groups separated by time and/or geography (Buikstra et al., 1990). In contrast to archaeological evidence, the analysis of biological affinities with dental traits allows us to provide a relatively straightforward response to questions regarding the physical integration of a group within a site or region and the population dynamics that accompanied a region's socio-cultural development (Cucina, 2016).

1.1 Research Objectives and Questions

There is great potential for pre-colonial Caribbean dental remains to reveal past patterns of variation, biology, and mobility during the peopling of the region. This study aims to broaden the understandings of biological relationships between populations from different time periods, islands, and cultures in the pre-colonial Greater Antilles by comparing metric and non-metric dental trait variation. The first objective of this study was to assess the intra and intergroup biological diversity of Archaic Age and Ceramic Age populations. A second objective was to examine the chronological and spatial patterning of the population variation. To accomplish these objectives, dental traits from the permanent dentition of four Archaic Age sites and six Ceramic

Age sites were used to infer biological distances between these populations. The Archaic Age sites included Canímar Abajo Old Cemetery (CA OC), Canímar Abajo Young Cemetery (CA YC), Cueva del Infierno (CI), and Playa del Mango (PM). The six Ceramic Age sites included Chorro de Maíta (CM), James W. Lee Collection (JL), Los Indios (LI), Paso del Indio (PI), Pueblo Viejo de Cotuí (PVC), and Punta Candelero (PC).

Several studies have attempted to assess the biological diversity between Archaic Age and Ceramic Age populations using dental traits, but their findings were impacted by small sample sizes (Coppa et al., 1992; 1995; 2003; 2008). Due to this, most studies have analyzed Archaic Age sites as a collective sample, potentially obscuring any underlying biological differences. In this study, the Archaic Age and Ceramic Age sites were analyzed as separate groups and were not pooled together to form larger sample sizes. This was done to better assess the underlying biological differences and prevent unnecessary homogenization of the studied populations.

An extensive study of metric and non-metric dental traits will add vital knowledge about pre-colonial groups in the Greater Antilles and provide new insights into their population history. Two statistical approaches were used for estimating biological relationships. The first approach involved analyzing the metric and non-metric dental traits through separate statistical tests. The second approach combined the two data types into a single analysis using the novel FLEXDIST software tool, representing the first implementation of this method in a Caribbean context. The aims and objectives of this study seek to answer the following questions:

1. Does the metric and non-metric dental trait analysis indicate biological distance among Archaic Age groups? Do these patterns change over time and/or space?

2. Does the metric and non-metric dental trait analysis indicate biological affinity among Ceramic Age groups? Do these patterns change over time and/or space?
3. Does the metric and non-metric dental trait analysis indicate biological affinity between Archaic Age and Ceramic Age groups? Do these patterns change over time and/or space?

1.2 Outline of the Following Chapters

Chapter 2 discusses the archaeological context of this study, outlines dental anthropology as an approach, the theoretical underpinnings of dental morphology and metrics, and previous studies in the Caribbean examining biological variation. This is followed by a review of relevant past studies on Archaic Age and Ceramic Age groups. Chapter 3 discusses the ten archaeological sites and methods used in this study. Chapter 4 contains the data pre-processing steps and results of the study, while Chapter 5 includes the interpretation of data, a discussion on how these findings compare to previous knowledge, and limitations of this study. Chapter 6 includes a summary of the research and highlights significant findings before providing suggestions for further research in the field of Caribbean Archaeology.

Chapter 2 – Literature Review

2.1 Archaic Age of the Greater Antilles

The beginning of the Archaic Age is characterized by the appearance of flaked stone blades, ground-stone tools, and shell implements (Rouse, 1992). Archaeological sites associated with this period are distributed throughout the Greater Antilles and northern Lesser Antilles, although none have been found in Jamaica (Keegan, 2019). The absence of ceramics at Archaic Age sites led to the belief that these populations were hunter-gatherer-fishers who lived in small mobile bands of closely related biological groups (Tabío & Rey, 1966; Rouse, 1972, 1992).

Problems with the traditional characterization of the Archaic Age include assumptions that communities were culturally static, aceramic, isolated from other groups, and lacked horticulture. Recent findings of plant cultivation in the early Archaic Age (Chinique de Armas et al., 2015; 2022a; Pagán-Jiménez et al., 2005; 2015; 2019), increased sedentism (Chinique de Armas et al., 2024; Roksandic, 2016), and course ceramics at Archaic Age sites (Keegan, 2006; Keegan & Hofman, 2017), have challenged these assumptions. Studies have also found at least two different subsistence strategies coexisted in Cuba and Puerto Rico, suggesting greater cultural diversity among these groups than previously thought (Chinique de Armas et al., 2016; Rodríguez Ramos et al., 2023). Further, Archaic Age populations lived beyond the timeframe traditionally assigned to them, with some individuals surviving well into the Ceramic Age until 600-800 CE (Barnes, 2022; Roksandic et al., 2015).

The term ‘Archaic Age’ continues to be used in Caribbean archaeology but is misleading and inadequately portrays the cultural diversity (Chinique de Armas et al., 2016; Roksandic et al., 2016) and genetic diversity (Nägele at al., 2020) that has been found among these groups.

Archaic implies a primitive and less complex society which is condescending to communities with this lifestyle. Unfortunately, due to the absence of written records and limited oral histories, it is unknown how these Indigenous groups self-identified and how they referred to other groups (Hofman & Antczak, 2019). There is an ongoing debate regarding terminology, and only by considering all available results from different interdisciplinary methods and consulting descendent communities, can unambiguous terminology be created that is practical and non-colonial. Despite these serious limitations, the term is still commonly used in the Caribbean literature. Until a revised name is decided the term Archaic Age, although not ideal, will be used in this study to refer to groups that predated the arrival of Ceramic Age groups.

2.2 Ceramic Age of the Greater Antilles

The Ceramic Age is characterized by the arrival of horticulture and distinct decorated ceramics by incoming groups from northeastern South America, whose origin is well supported by archaeological, linguistic, and genetic connections (Fernandes et al., 2021; Nägele et al., 2022; Rouse, 1986, 1992). The many ceramic traditions in this period were thought to represent multiple dispersals from different continental areas, although recent genetic studies found these groups to be surprisingly homogenous (Fernandes et al., 2021; Nägele et al., 2020). The Early Ceramic Age is believed to have consolidated developments from the late Archaic Age, including village-based sociopolitical organization and a food economy based on horticulture and supplemented with hunting-fishing (Boomert, 1999; Siegel, 1992).

Early Ceramic Age groups, with distinct pottery known as the Saladoid series after the Saladero site in Venezuela, settled in Puerto Rico and the northern Lesser Antilles sometime between 400-200 BCE but ceased further expansion into the Greater Antilles for unclear reasons (Fitzpatrick et al., 2013; Casale et al., 2023). Some evidence suggests that Archaic Age inhabitants of Hispaniola prevented the Early Ceramic Age inhabitants of Puerto Rico from settling on the island in large numbers for about 1,000 years (Fitzpatrick et al., 2013).

The appearance of the Ostionoid and Meillacoid series of pottery signaled the Late Ceramic Age when population expansion into the Greater Antilles resumed around 700-800 CE (Keegan & Hofman, 2017). At that time, the first Ceramic Age groups arrived in Cuba at least 1000 years after settling in Puerto Rico and the Dominican Republic (Keegan & Hofman, 2017). Archaic Age and Ceramic Age groups coexisted in Puerto Rico for a period of 500 years and likely overlapped on other islands (Rodríguez Ramos et al., 2023). Meanwhile, Jamaica was first inhabited by humans around 600-650 CE, possibly by migrations from Puerto Rico and Dominican Republic (Elliot et al., 2022). The lack of Archaic Age and Early Ceramic Age sites in Jamaica is not well understood; it has been suggested that dangerous currents and winds discouraged travel from neighboring islands and sea level changes may have submerged earlier sites (Allsworth-Jones, 2008; Atkinson Swaby, 2006).

The Late Ceramic Age included hierarchical status differentiation and regional-scale political organization characterized by 'chiefdoms' (Hoogland & Hofman, 1999). Descriptions of social complexity and cultural practices from this period are largely based on European ethnohistoric sources and it is unclear if these records reflect social organization before European contact (Curet, 1992). Other studies examining archaeological evidence of socio-political organization, material culture styles, and human and animal mobility indicate interlocking regional networks during this period (Elliot et al., 2022; Mol, 2014).

2.3 Dental Anthropology

Before discussing the relevant research on Caribbean populations, it is important to review dental anthropology and the basic principles of dental metric and non-metric trait investigations. Dental anthropology is a distinct subfield of bioarchaeology, biological anthropology, and human osteology that focuses on answering questions about the development, evolution, and variability of teeth and orofacial structures (Scott, Turner, et al., 2018). Teeth are used to differentiate fossil hominins, reflect individual and groups patterns of demography, biological affinity/differences between population, features of diet adaptation, cultural characteristics, information on health of past peoples, and identification of unknown individuals in modern forensic contexts (Hefner et al., 2014; Pilloud et al., 2016; Scott & Irish, 2017).

Teeth and associated oral structures are used to address a multitude of questions. Compared to other parts of the human skeleton, teeth have a distinct anatomy and physiology, which enables them to be readily identified even when severely fragmented (Hillson, 2018). Dental remains are composed of the hardest and most durable tissues in the human body that generally preserve well after burial in varied diagenetic conditions and are more resistant to taphonomic processes than bone (Maaranen et al., 2022; Scott & Pilloud, 2007; Shaik et al., 2021). Due to their structure, teeth are especially well suited for studies in tropical or subtropical areas like the Greater Antilles, as humid climates and sandy soil often accelerate the process of bone disintegration (Cucina et al., 2003).

All modern humans share the same pattern of tooth structure and general trait expression. Within this shared pattern, there is a high degree of morphological variation that represents personal, familial, and population characteristics (Scott, Turner, et al., 2018). Teeth can also be observed in both living and past populations using similar methods. Since dental traits are heritable, they can be used to assess evolutionary origins of modern humans, population developments and dynamics, and for inferring biological affinity within and between groups (Berry, 1978; Pilloud et al., 2016).

Tooth development is a complex process that involves a combination of genetic, epigenetic, and environmental factors (Karaaslan & Gil de Bona, 2022). Teeth form early during ontogeny and their development is generally more resilient to environmental and cultural factors that affect other skeletal tissues like cranial traits (Hillson, 1996; Lin et al., 2023). Validation studies have shown that dental traits may be more reliable indicators of underlying genetic variation than cranial traits due to buffering against environmental factors (Paul & Stojanowski, 2017; Pilloud & Kenyhercz, 2016; Pilloud et al., 2016). Furthermore, cranial traits are not well-suited for population studies in the Caribbean due to high rates of intentional cranial modification among Ceramic Age groups, which artificially distorts and/or obliterates key morphological traits (Santos et al., 2013; Stojanowski & Schillaci, 2006).

2.3.1 Metric and Non-Metric Dental Traits

Dental metrics and non-metrics are prominent areas of study in dental anthropology, which involve examining dental traits from living people, dental casts, and archaeological skeletal remains. Dental metrics refers to the study of tooth size, orthogonal occlusal measurements, and measures of the enamel and dentin thickness (Pilloud & Kenyhercz., 2016). Dental non-metrics refers to the study of shape, structure, form, and numerical deviations from a species' dental formula (Irish & Nelson, 2008).

Metric dental traits are continuous measurements of the linear lengths (mesial-distal diameter), widths (buccal-lingual diameter), diagonal dimensions at the tooth crown, cemento-enamel junction (cervix), or semilandmark-based crown outlines (Hanihara & Ishida, 2005; Hillson et al., 2005, Röding et al., 2021). Metric traits are commonly measured using dental calipers (Buikstra & Ubelaker, 1994). With recent advancements in 3D scanning technologies, an increasing number of dental measurements are taken on digital models of teeth (Liu et al., 2021). Metric traits have often been incorporated into investigations of hominin evolution and diversity of local and regional populations (Hanihara & Ishida, 2005; Hillson, 1996)

Dental non-metric traits are shape-based traits that are visually scored through a binary scale (e.g., absent or present) or an ordinal scale (e.g., small, medium, large) (Buikstra & Ubelaker, 1994). When present, non-metric traits have quasi-continuous variation and their expression can range from slight to pronounced (Grüneberg, 1952; Scott & Irish, 2017). Dental crown traits take the form of accessory ridges, tubercles, and number of cusps, while root traits are primarily deviations from the normal root number (Scott & Irish, 2017). Non-metric traits are routinely characterized using standardized scoring protocols, such as the Arizona State University Dental Anthropology System (ASUDAS) for permanent dentition (Turner et al., 1991). Many dental anthropological studies have relied on non-metric traits to define the dental characteristics of major geographic groups and for reconstructing the population history, structure, and origin of modern humans (Irish & Guatelli-Steinberg, 2003; Scott, Schmitz, et al., 2018).

Metric and non-metric traits are visible characteristics (phenotype) that are expressions of a person's unique genetic makeup (genotype). Individuals or groups who share phenotypic characteristics are presumed to be genetically more closely related, while those that have differing phenotypes are genetically more divergent (Rathmann, 2024). The most widely used phenotypic observations on the dentition and cranium are some of the most heritable features of the human skeleton (Cheverud & Buikstra, 1981; Gurri & Balam, 2006; Nichol, 1990). Metric and non-metric dental traits are popular proxies for determining underlying genotypic variation between populations; however, non-metric dental traits are thought to have tighter genetic control than metric dental traits (Rathmann, Perretti, et al., 2023; Stojanowski et al., 2017, 2018, 2019). Combining metric and non-metric dental traits maximizes information about phenotypic differences and is more useful for studying neutral genetic variation compared to using the different data types separately (Rathmann et al., 2022; Rathmann, Lismann, et al., 2023). Therefore, this study examines metric and non-metric dental traits to better understand the relationship between the phenotypic characteristics in the Greater Antilles and to estimate how they may signal the genetic relationships between the different populations.

Rathmann & Reyes-Centeno (2020) reported a set of highly diagnostic trait combinations that preserve neutral genetic signatures to a greater degree than others. This set includes the following traits: mesial ridge and distal accessory ridge of the maxillary canine, protostylid, cusp 6 of the mandibular first molar, and the lingual cusp number of the mandibular second premolar. Based on these findings, Rathman & Reyes-Centeno (2020) suggest that these highly diagnostic traits should be prioritized in future research and dental traits that do not follow neutral expectations should be carefully reviewed. Rathmann et al. (2024) caution that the biological variation of dental traits should not be equated with that of genetic markers, as the connection between genotype and phenotype has not been fully characterized. Nevertheless, recent findings demonstrated that non-metric traits are adequate for reconstructing genetic relatedness among populations, with a strong level of correlation at both global and continental levels (Irish et al., 2020).

2.4 Relevant Studies in the Greater Antilles

Dental anthropological studies have been conducted in the Greater Antilles to better understand the biological relationships, diets, health, and cultural practices between different groups in the pre-colonial period. Together with the study of skeletal remains and paleogenetics, dental anthropological studies have provided insights into the early inhabitants. This section will summarize the previous metric and non-metric dental research within and between Archaic Age and Ceramic Age groups. These results will then be contrasted with other lines of evidence, including paleogenetic studies, to provide a summary of what is currently known about the biological diversity of Archaic Age and Ceramic Age groups.

2.4.1 Dental Anthropology in the Caribbean

Dental anthropological studies were first conducted in the region during the 1980s. Early studies examined patterns of dental wear by connecting them to specific subsistence strategies and how teeth were used as tools (Rivero de la Calle & Toribio Suarez, 1984). In this period Lingual Surface Attrition of Maxillary Anterior Teeth (LSAMAT), a dental wear pattern associated with craft activities, abrasive foods, and high caries rates, was first identified in the region (Crespo-Torres, 1994). Although the findings of LSAMAT are interpretations of wear patterns and not based on observational studies of these specific behaviours. During the 1990s, studies incorporated dental anthropology to examine the life conditions, dietary stress, and morphological differences between Archaic Age and Ceramic Age groups (Coppa et al., 1995; Crespo-Torres, 1994).

There are relatively few studies comparing metric and non-metric dental traits between sites in the Caribbean, especially on a regional level. Previous studies by Coppa et al. (1992, 1995, 2003, 2008) and Cucina et al. (2003) found Archaic Age non-metric trait patterns that were considerably different from Ceramic Age groups, indicating biological differences among these groups. All Archaic Age individuals were lumped into the same group, and a high degree of homogeneity was reported for Ceramic Age groups based on their dental metric and non-metric traits (Coppa et al., 1995, 2008).

When comparing non-metric dental traits across the region, significant differences were found between two clusters of Archaic Age and Late Ceramic Age populations, but the variation among Archaic Age populations was low (Coppa et al., 2008). The results obtained by Coppa et al. (2008) do not show underlying population variation and have since been challenged by recent findings of biological and cultural differences in Archaic Age populations (Chinique de Armas et al., 2016, 2022; Chinique de Armas & Roksandic, 2019; Nägele et al., 2019; Roksandic et al., 2016).

2.4.2 Paleogenetics in the Caribbean

Genetic studies focusing on Indigenous populations in the Americas are difficult, as genetic variability is generally low across the continent (Wang et al., 2007; Lalueza-Fox et al., 2003). Increasingly, studies are using ancient DNA analysis (aDNA) in the Caribbean as methods for collecting and analysing biomolecules have vastly improved. Early studies in mitochondrial DNA (mtDNA) proposed similar mainland origins for Archaic Age and Ceramic Age groups (Lalueza-Fox et al., 2003), but these findings have since been disputed (Valdés Pi, 2009; Felipe, 2009).

Recent genetic analysis by Nägele et al. (2020) proposed three different source populations of initial settlers: Central America, earlier South America, and a later expansion from South America. Around 750-550 cal BCE, two possible distinct ancestries were detected among Archaic Age associated individuals in western Cuba. This indicated the possibility of more diverse population origins populations among the early inhabitation of the islands. On the other hand, Fernandes et al. (2021) concluded that differences between Archaic Age individuals are too small to show two waves of migration, and the authors suggest a South American origin for all Archaic Age populations.

Ceramic Age individuals were found to be genetically homogenous with a connection to northeastern South America (Fernandes et al., 2021). Nägele et al. (2020) reported some variations among the Ceramic Age groups, as three individuals were found to cluster outside of the main grouping, but their results indicate that these individuals were more closely related to Ceramic populations than Archaic-related individuals. Meanwhile, both Nägele et al. (2020) and Fernandes et al. (2021) detected genetic differences between Archaic Age and Ceramic Age populations, with almost no evidence of admixture between them.

The available genetic evidence suggests that the Greater Antilles were settled and resettled by successive mainland population dispersals (Nägele et al., 2020; Fernandes et al., 2021). However, there is disagreement between Nägele et al. (2020) and Fernandes et al. (2021) regarding the number of dispersals into the islands and the relationships within Archaic Age and Ceramic Age groups. Since tooth form is an excellent proxy for DNA, metric and non-metric dental trait analysis can be used to infer biological relationships within and between Archaic Age and Ceramic Age groups. By incorporating both metric and non-metric data, this increases the number of phenotypic sources of information and can lead to a richer knowledge of population variation compared to only using one type of data (Rathmann et al., 2023). Dental trait analyses are beneficial in areas like the Caribbean where DNA preservation is poor and skeletal/dental remains are often the only source of information available (Cucina et al., 2003). Due to their preservation, dental remains are recovered in higher quantities and studies using phenotypic approaches can incorporate larger sample sizes into more robust statistical techniques (Rathmann, 2024). Further, phenotypic analyses are largely non-destructive to the samples.

There are several potential challenges and limitations related to using dental traits for reconstructing biological relationships among past populations. It is not fully understood how genetic, environmental, and epigenetic factors contribute to the development of dental phenotypic variation (Rathmann, 2024). As well, it appears that dental traits do not exhibit as much variance as simple genetic markers when comparing populations at local and regional levels (Scott et al., 2018). Lastly, dental traits may not be scorable if they are obscured or damaged by dental wear, caries, calculus, and pathologies.

Chapter 3 – Materials and Methods

3.1 Introduction

The sample includes nine sites from Cuba, Dominican Republic, Puerto Rico, and a combined assemblage of eight sites from Jamaica (locations can be seen in Figure 1). Sites were selected if they were 1) occupied during the pre-colonial to early colonial period in the Greater Antilles, 2) had permanent dental remains, and 3) were accessible for analysis. To assess the relationships among these groups, an outlier was chosen to compare with the Greater Antilles sites. The site of Gradina on Mount Jelica from Serbia was included as the site falls within a similar period but is from another continent with a different population history. The dental remains from Jelica-Gradina were scored at the University of Belgrade in Serbia by the same examiner using identical methods as the Caribbean sites.

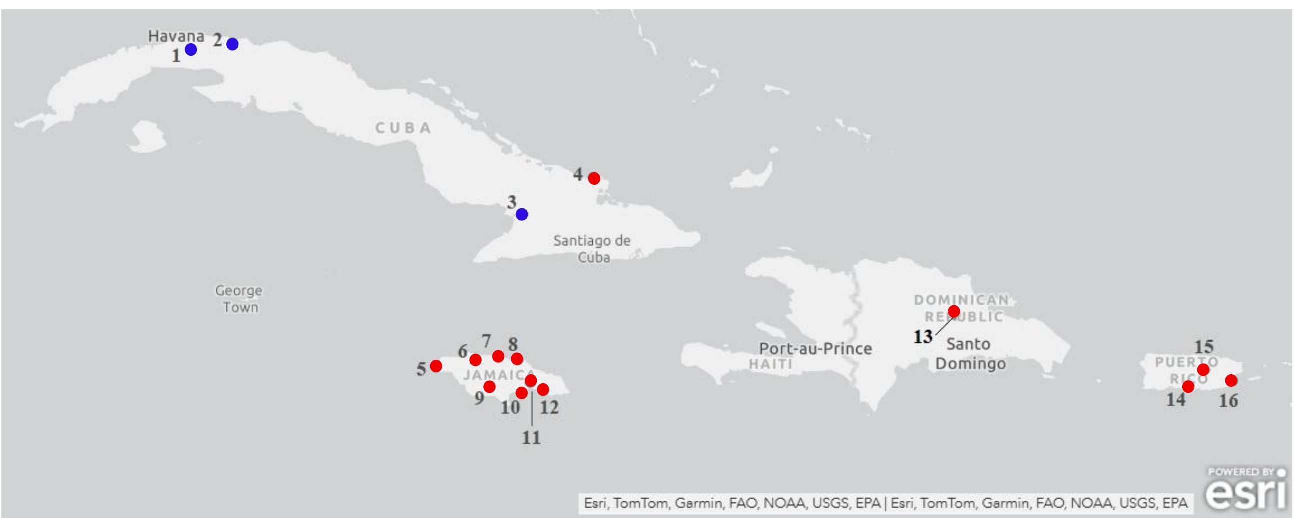

Figure 1: Map of the Greater Antilles showing the sites examined in this study. Blue points represent Archaic Age sites, red points represent Ceramic Age sites
Note:(1) Cueva del Infierno, (2) Canímar Abajo, (3) Playa del Mango, (4) Chorro de Maíta, (5) New Mountain Cave, (6) Pantrepant, (7) Belle Air Cave, (8) Rio Nuevo, (9) Spot Valley Cave, (10) Hellshire Hills, (11) Chancery Hall, (12) Cambridge Hill Cave, (13) Pueblo Viejo de Cotuí, (14) Los Indios, (15) Paso del Indio, (16) Punta Candelero. Figured adapted from Esri World Imagery basemap.

The archaeological sites examined in this study date between 5000 BCE-1670 CE, covering a period of almost 7,000 years of habitation in the Greater Antilles. The human remains from these sites have been dated between 2237 BCE-1670 CE, spanning roughly 3,906 years. Figure 2 shows the chronology of the individual sites and skeletal assemblages that range from the Archaic Age to the early colonial period.

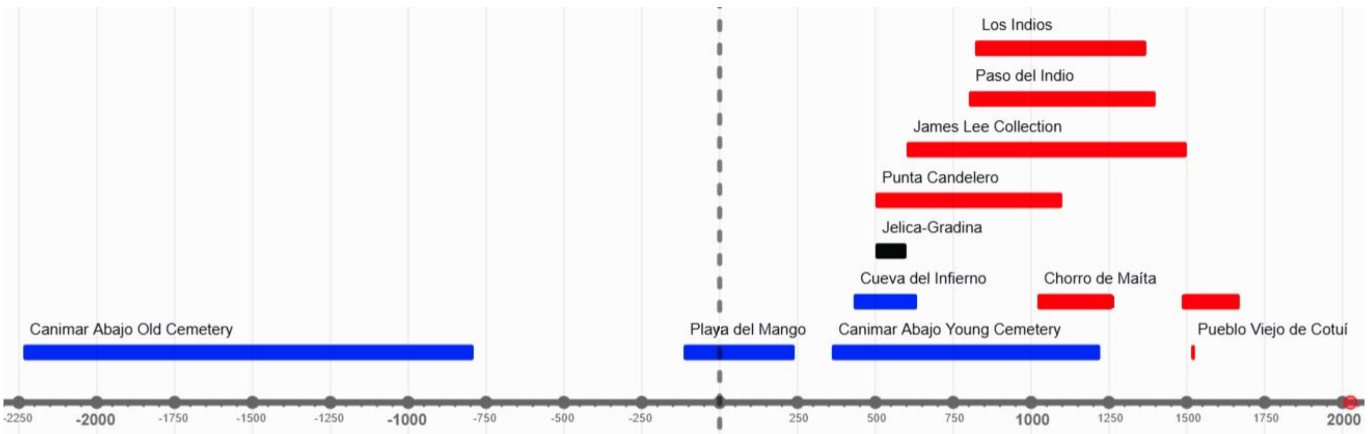

Figure 2: Chronology of the nine Caribbean sites and outlier from Serbia included in this study. Blue bars represent Archaic Age sites, red bars represent Ceramic Age sites, and black for the outlier.

3.2 Sites and Skeletal Assemblages

A total of 2,671 permanent adult teeth from 472 individuals were selected for analysis from 10 sites, of which 1,919 teeth were scored for metric and non-metric traits. The remaining teeth were excluded due to dental wear, caries, calculus, and postmortem damage that prevented scoring of dental traits. The minimum number of individuals (MNI) was determined to be 189 for all sites. A summary of the dental assemblages examined in this study are outlined in Table 1 and includes the MNI per site. Within Appendix A, Table A.1 contains a full list of the samples, their cultural contexts, age/sex estimates, and applicable radiocarbon dates.

Table 1: Summary of information about the 10 sites examined in this study including the minimum number of individuals (MNI) based on dental remains and the number of teeth examined from each site.

Site Name	**Site Location**	**Location of Dental Remains**	**Temporal Period**	**Classification**	**MNI from Teeth**	**Number of Teeth Examined**
Cuba						
Canímar Abajo	Bank of Canímar River, Matanzas city	University of Winnipeg, Museo Provincial Palacio de Junco and Museo Memorial El Morrillo	Old Cemetery cal 2237-790 BCE and Young Cemetery 332-1222 CE	Archaic Age	Old Cemetery: 8 Young Cemetery: 12	Old Cemetery: 150 Young Cemetery: 189
Playa del Mango	Rio Cauto Basin, Granma	University of Winnipeg and Instituto Cubano de Antropologia	116 BC-241 CE	Archaic Age	13	190
Cueva del Infierno	San José de las Lajas, Mayabeque	University of Winnipeg and University of Havana	430-654 CE	Archaic Age	45	232
Chorro de Maíta	Cerro de Yaguajay, Holguín	Centro de Investigaciones y Servicios Ambientales in Holguin	1020-1280 CE and cal 1460-1670 CE	Late Ceramic Age to Early Colonial	40	963
Dominican Republic						
Pueblo Viejo de Cotuí	Cotuí, Sánchez Ramírez	University of Winnipeg	Unknown	Late Ceramic Age to Early Colonial	8	89
Puerto Rico						
Paso del Indio	Bank of the Río Indio, Vega Baja	University of Winnipeg	800-1400 CE	Archaic Age to Early Colonial	5	51
Los Indios	Santa Isabel	University of Winnipeg	820-1370 CE	Late Ceramic Age	21	166

Punta Candelero	Southeast Humacao	University of Winnipeg	500-1100 CE	Early to Late Ceramic Age	14	118
Jamaica						
James W. Lee Collection	Sites across Jamaica	University of the West Indies and Jamaica National Heritage Trust	600-1500 CE	Late Ceramic Age	10	132
Serbia						
Jelica-Gradina	Mt. Jelica	University of Belgrade	500-600 CE	Early Byzantine	15	391

Ideally, population studies include hundreds of individuals with well-preserved dental and skeletal remains, equal representation of the sexes, and even distribution throughout time and space (Mickleburgh, 2013). This is difficult in Caribbean archaeology, because a considerably smaller number of Archaic Age individuals have been uncovered thus far compared to Ceramic Age burials (Hofman & Antczak, 2019). Preservation and fragmentation remain a significant problem with Archaic Age skeletal remains. There are also issues with sites containing multiple burial areas, and whether they were used by the same population. In the case of Canímar Abajo, the site has two funerary areas separated by a shell midden and it is unclear if the two burial populations were related (Chinique de Armas et al., 2015). Additionally, cemeteries in the early colonial period like Chorro de Maíta and Pueblo Viejo de Cotuí may include non-Indigenous individuals from Africa and Europe. Each site included in this study was treated as an individual population. For sites like Canímar Abajo, the chronological units were treated as individual populations and examined separately.

The tooth types recorded from each site (Table 2) were used to determine the MNI of each site in Table 1. The sites varied regarding their sample size, the number of teeth from each tooth type, level of preservation, and available contextual information. Many of the teeth scored in this study were loose teeth, meaning they were no longer *in situ* within the maxilla and mandible. Most of these teeth were associated with specific burials, but some were isolated from other remains or comingled with several burials. Isolated dental remains are incredibly useful for population studies on dental morphology and pathologies but can be difficult to assign to a specific individual. Alternatively, teeth *in situ* provide information about dental structure, habits, and health of a specific individual. The sites of Cueva del Inferno, Los Indios, Paso del Indio, Pueblo Viejo de Cotuí, and Punta Candelero had primarily loose and isolated teeth available for study, while the sites of Canímar Abajo, Chorro de Maita, James W. Lee Collection, and Playa del Mango had a combination of isolated teeth, loose teeth, and teeth *in situ*. Further, for certain sites (like Cueva del Inferno, Los Indios, Paso del Indio, Pueblo Viejo de Cotuí, and Punta Candelero) only a portion of the dental remains were available for scoring during this study.

Table 2: Summary of the total number of permanent teeth from 11 sites and the breakdown by tooth type.

Tooth Type	**Site**										
	CA OC	**CA YC**	**CI**	**CM**	**JL**	**LI**	**PC**	**PI**	**PM**	**PVC**	**Jelica**
URM3	6	5	0	20	5	7	5	0	4	3	6
URM2	3	4	0	32	7	7	1	1	6	1	9
URM1	3	8	0	29	10	11	4	3	6	0	11
URP2	5	4	24	28	5	1	4	0	3	0	13
URP1	4	5	1	29	6	0	2	1	2	0	13
URC	4	8	6	40	4	4	2	1	5	3	14
URI2	3	2	4	23	2	0	3	1	3	2	9
URI1	2	1	0	25	2	3	3	0	1	0	9
ULI1	4	2	1	32	2	3	4	3	2	1	8
ULI2	1	10	2	29	1	2	3	1	2	0	9
ULC	5	7	10	37	4	5	1	1	2	8	12
ULP1	3	12	23	26	4	0	0	0	5	1	12
ULP2	2	4	1	32	7	0	0	0	3	1	10
ULM1	3	8	43	28	10	7	3	4	4	2	11

ULM2	4	3	0	34	10	8	3	3	8	0	11
ULM3	3	5	0	16	2	16	4	1	6	4	6
LRM3	4	1	45	15	2	10	3	0	9	4	7
LRM2	4	2	0	36	3	4	5	0	8	5	15
LRM1	8	8	17	26	6	21	12	5	9	6	10
LRP2	6	7	0	36	2	2	2	0	4	4	12
LRP1	7	7	0	30	1	5	4	0	8	2	13
LRC	4	6	14	39	4	3	1	0	12	3	13
LRI2	7	5	2	36	2	2	5	1	6	4	11
LRI1	5	5	1	35	2	3	2	3	6	3	7
LLI1	0	3	0	32	2	1	1	1	3	1	6
LLI2	4	10	1	36	1	2	1	3	5	1	8
LLC	5	8	9	41	4	2	2	1	13	4	12
LLP1	5	8	0	36	3	2	1	0	5	2	12
LLP2	4	9	0	34	2	3	1	0	8	5	11
LLM1	8	10	0	20	5	17	14	2	6	6	12
LLM2	2	5	0	27	4	7	3	1	8	5	14
LLM3	5	4	23	20	4	8	7	0	10	4	5
Unknown	17	3	5	4	4	0	12	14	8	4	60
Total	150	189	232	963	132	166	118	51	190	89	391

Note. Site abbreviations= CA OC: Canímar Abajo Old Cemetery, CA YC: Canímar Abajo Young Cemetery, CI: Cueva del Infierno, CM:Chorro de Maíta, JL: James W. Lee Collection, LI: Los Indios, PC: Punta Candelero, PI: Paso del Indio, PM: Playa del Mango, PVC: Pueblo Viejo de Cotuí, Jelica: Jelica-Gradina

3.2.1 Sites from Cuba

Canímar Abajo (CA OC and CA YC)

Canímar Abajo is an Archaic Age shell-matrix site located 40 m from the southwestern bank of the Canímar River in the province of Matanzas (Chinique de Armas et al., 2017; González Herrera et al., 2021). The earliest date reported for the site (UNAM-0715: 5430 ± 50 BCE, charcoal) is one of the oldest dates currently available for the Caribbean (Roksandic et al., 2015). Canímar Abajo is a sheltered site at the base of a karst outcrop and the site stratigraphy presents two periods of burial activity separated by 1,200 years.

The Old Cemetery (OC) is dated to 2237-845 cal BCE and the Young Cemetery (YC) is dated to 332-1222 cal CE (Hernández Godoy et al., 2024; Roksandic et al., 2015). The cemeteries are separated by a 1 m thick habitation, ritual, or food-processing layer (González Herrera et al., 2021). More than 230 individuals, including 83 adults and 130 juveniles, have been excavated from the cemeteries, making Canímar Abajo one of the largest pre-colonial cemeteries excavated in Cuba (Hernández Godoy et al., 2024). Excavations are ongoing at the site and the MNI will likely be updated as new findings are catalogued.

The dental sample from the OC included 150 teeth, representing an MNI of 8 individuals. The dental sample from the YC included 189 teeth, representing an MNI of 12 individuals. The number of individuals with osteological and genetic estimated sex was: 2 females from the OC, 4 females from the YC, and 2 males from the YC (Chinique de Armas et al., 2015; Nägele et al., 2020). A non-local individual CA E-105 from the OC was excluded from statistical analyses (Chinique de Armas et al., 2025).

Chorro de Maíta (CM)

Chorro de Maíta is a burial and habitation site located on Cerro de Yaguajay, in the province of Holguín, approximately 4 kilometers from the Atlantic coast (Valcárcel Rojas, 2016). The cemetery was dated from 1200-1550 CE, placing the occupation within the Late Ceramic Age and early colonial period (Valcárcel Rojas, 2016). Radiocarbon dating of the skeletal materials falls immediately before and after European contact (1420-1640 cal. CE) (Mickleburgh, 2013). The MNI for the site is 133, with at least 43 juveniles and 90 adults (Weston & Valcárcel Rojas, 2016). At least 32 burials from the contact period based on the inclusions of European grave goods (Valcárcel Rojas et al., 2011). The remaining individuals cannot be reliably placed in the pre-colonial period based only on the lack of European mortuary treatments and are associated with the early colonial period.

The dental sample from Chorro de Maíta included 963 teeth, representing an MNI of 40 individuals. This consisted of 14 juveniles (2 females), 46 adults (22 females, 23 males), and 13 individuals of indeterminate age and sex (Weston & Valcárcel Rojas et al., 2016). 17 individuals were previously identified as non-locals by Valcárcel Rojas et al. (2011) and excluded from the statistical analyses.

Cueva del Infierno (CI)

Cueva del Infierno, or Bacurano I, is an Archaic Age cave site in the municipality of San Jose de Las Lajas located 15 km inland from the north coast, province of Mayabeque (Chinique de Armas et al., 2022). Human skeletal remains have been dated to 430-654 CE (Chinique de Armas et al., forthcoming). The MNI of the site is approximately 169 individuals, based on scattered remains and permanent isolated teeth (Garcell Domínguez, 2009).

The dental sample from Cueva del Infierno included 232 teeth, representing an MNI of 45 individuals. Many of the samples were isolated teeth that were stored by tooth type (e.g., box 6A/2 contained 20 maxillary left first molars). There was limited contextual information about the isolated teeth which could not be assigned to specific individuals. Published age and sex estimates were not available for the individuals included in this study.

Playa del Mango (PM)

Playa del Mango is an Archaic Age cemetery and habitation site in the Rio Cauto Basin of the province of Granma in eastern Cuba. The site was occupied from at least 116 cal. BCE to 453 CE (2σ), the Mound 2 was used from at least 116 BCE-241 CE (2σ) and Mound 1 was used from cal. 125-435 CE (2σ) (Chinique de Armas et al., 2020). It is difficult to determine the exact number of burials at Playa del Mango as natural and anthropogenic factors, including excavations by non-specialized individuals, have impacted the preservation of the skeletal remains (González Herrera et al., 2021). The estimated MNI is 67, with at least 42 individuals from Mound 1 (Morales et al., 2023; Utset Masía, 1941) and 25 individuals from Mound 2 (Chinique de Armas et al., 2022; García Méndez et al., 2024). The dental sample from Playa del Mango included 190 teeth, representing an MNI of 13 individuals. This consisted of 1 juvenile female, 16 adults (5 females, 8 males), and 1 individual of indeterminate age and sex (Chinique de Armas et al., 2022).

3.2.2 Site from Dominican Republic

Pueblo Viejo de Cotuí (PVC)

Pueblo Viejo de Cotuí is located in central Dominican Republic and contains one of the first and largest colonial gold mines in the Americas (founded in 1516 CE), surrounded by several Indigenous settlements and a Taíno town called Cotuí (Ting et al., 2018). At least 42 archaeological sites have been identified in the area that range from the Ceramic Age to the early colonial period (Ting et al., 2018; Olsen Bogaert & Coste, 2008). The dental remains from seven nearby sites were included in this study: Cueva de La Lluvia, Cueva de Los Cacaos, Cueva San Juan, Estructura Colonial, Cueva Balaguer, Cueva Margajita, and Cueva del Monolito. The excavation reports have not been published for these sites, and it is unclear how many skeletal remains were recovered from each area. Radiocarbon dating has not been performed for sites at Pueblo Viejo de Cotuí, most are placed within the Late Ceramic Age to early colonial period based on archaeological materials and ceramic styles (Ting et al., 2018).

The dental sample from Pueblo Viejo de Cotuí included 89 teeth, representing an MNI of 8 individuals. Sex and age estimates have not been published for these individuals. Since there were so few dental remains available from each individual site, the samples were combined into one group for analysis.

3.2.3 Sites from Jamaica

<u>James W. Lee Collection (JL)</u>

The geologist Dr. James W. Lee inventoried 265 archaeological sites across the island of Jamaica between 1959-1986, of which 24 contained human remains (Santos & Allsworth-Jones, 2022). The earliest settlement on the island dates to 645-898 CE (Bottom Bay), and since radiocarbon dating has not been performed for most of the collection, sites are placed within the Late Ceramic Age based on archaeological materials (Allsworth-Jones, 2008). Sites examined for this study included: Chancery Hall, Cambridge Hill Cave, Belle Air Cave, Rio Nuevo, Pantrepant, New Mountain, Spot Valley Cave, Hellshire Hills, and several unknown sites.

The skeletal remains were collected primarily through surface findings; therefore, contextual information is largely unknown. The MNI was estimated to be 46 (14 juveniles, 18 adults, and 14 indeterminates), although this number should be interpreted with caution due to high levels of fragmentation (Santos & Allsworth-Jones, 2022). Most of the skeletal remains from the collection were found disarticulated inside caves (Santos & Allsworth-Jones, 2022).

The dental remains from the James W. Lee Collection had been previously examined and photographed during the 2017 field season. The dental sample from the James W. Lee Collection included 132 teeth, representing an MNI of 10 individuals. There is limited contextual information about the dental remains due to the collection methods, and the preservation of the teeth varies between sites. Dental remains were often commingled, which has presented issues for determining the site demographics (Santos & Allsworth-Jones, 2022). The samples in this study included 1 juvenile and adult from Chancery Hall, a possible female from Pantrepant, 1 adult from Pantrepant, 1 adult from Hellshire Hills, 1 individual from Rio Nuevo, and at least 4 adults from Cambridge Hill Caves (Allsworth-Jones, 2008; Santos & Allsworth-Jones, 2022) Lastly, at Belle Air Cave two pots were recovered that each contained the remains of at least two people (Allsworth-Jones et al., 2011). Since there were so few dental remains available from each individual site, the samples were combined into one group for analysis.

3.2.4 Sites from Puerto Rico

<u>Los Indios (LI)</u>

Los Indios is a Late Ceramic Age multi-component site in the municipality of Santa Isabel on the southern portion of the island. The site was occupied from at least 820-1370 CE with 130 excavated individuals (Nägele et al., 2020). The dental sample from Los Indios included 166 teeth, representing an MNI of 21 individuals. Age and sex estimates are not available, currently there are no published osteological reports on the population from Los Indios.

Paso del Indio (PI)

Paso del Indio is a multicomponent site located on the west bank of the Río Indio, in the Río Indio River Valley, within the municipality of Vega Baja with occupations attributed to the Archaic Age and Ceramic Age (Barnes, 2022). The site was occupied from 2580 BCE-1655 CE and is the largest and deepest stratified multi-component pre-colonial site in Puerto Rico, and possibly the Greater Antilles (Barnes, 2022). Of the 152 burials found at the site, 98 were dated between 820-1360 CE (Pestle, 2010). 138 of the burials are believed to represent a single population from the Early Ostionoid (Pre-Taíno) occupation of the site (Crespo-Torres, 2000). The dental sample from Paso del Indio included 51 teeth, representing an MNI of 5 individuals. This consisted of 2 juveniles, 7 adults (5 females, 2 males), and 7 individuals of indeterminate age and sex (Crespo-Torres, 2000).

Punta Candelero (PC)

Punta Candelero is a Ceramic Age site located on a sandy coastal peninsula in the municipality of Humacao in south-eastern Puerto Rico. Around the central plaza, excavators recovered skeletal remains from 106 burials (Pestle, 2013). Radiocarbon dating of these individuals range from 260-1440 CE (Pestle, 2013), placing them within the later occupation of the site. The dental sample from Punta Candelero included 118 teeth, representing 10 individuals. This consisted of 6 juveniles, 20 adults (8 females, 11 males), and 20 individuals of indeterminate age and sex (Crespo-Torres, 2000).

3.2.5 Site from Serbia

Jelica-Gradina (Jelica)

Gradina is an Early Byzantine site (6th century CE) located on Jelica Mountain in western Serbia (Križanac, 2009). In total, 63 graves have been excavated at the site (Milinković, 1995). The dental sample from Jelica-Gradina included 391 teeth, representing an MNI of 15 individuals. This consisted of 3 juveniles, 17 adults (6 females, 8 males), and 8 individuals of indeterminate age and sex (Ksenija Djukić, personal communication, 2022).

3.3 Methods

As the samples used in this study are part of several interdisciplinary projects, it was important to incorporate methods that could collect different types of data (metric and non-metric traits), and methods that were non-destructive to the samples. Methods were selected that could accommodate high levels of missing data due to different levels of preservation between the groups.

3.4 Data Collection and Methods

3.4.1 Dental Notation System

For this study a shorthand notation system was used to identify each tooth (Table 3). In this shorthand the capital letters **U** and **L** identify upper (maxillary) and lower (mandibular), respectfully. Next letter was **R** (right) or **L** (left) to indicate what side the tooth came from. The letters **I**, **C**, **P**, and **M** represent incisors, canines, pre-molars, and molars, respectively. While the position that a tooth holds in the tooth class was indicated by numbers (e.g., **1**s for central incisors and **2**s for lateral incisors).

Table 3: Examples of shorthand notation system used for identifying tooth type and side.

Shorthand Notation	**Description**
ULM1	Upper left maxillary first molar
LRC	Lower right canine

3.4.2 Metric Dental Traits

The measurement techniques used in this study followed those of Mayhall (1992) and Moorees (1957) as detailed in Buikstra & Ubelaker (1994). The mesiodistal diameter (crown length) was measured as the maximum width of the tooth crown in the mesiodistal plane (Figure 3) for anterior and posterior teeth. The buccolingual diameter (crown width) is the widest diameter of the tooth that is measured perpendicular to the mesiodistal plane. All measurements were conducted using a Mitutoyo pointed blade digital sliding caliper.

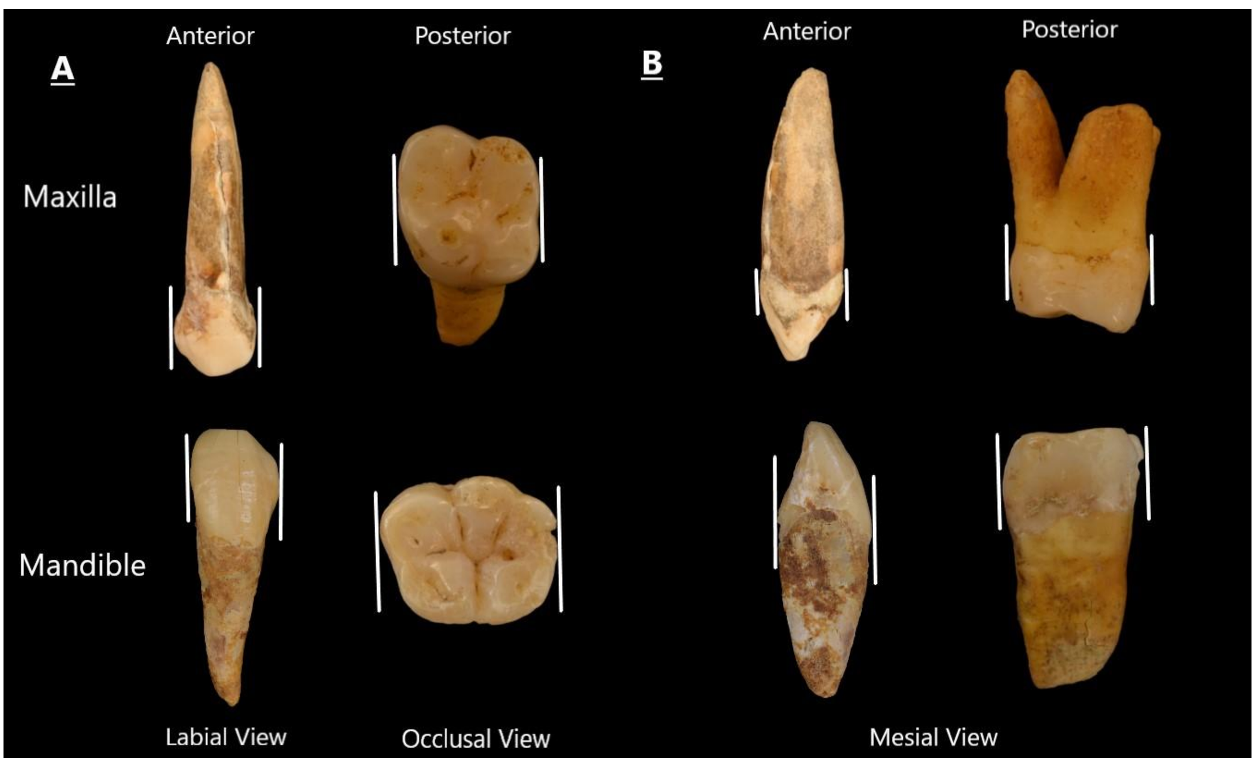

Figure 3: Measurements for mesiodistal crown diameters (A) and buccolingual crown diameters (B) of anterior and posterior teeth based on methods from Mayhall (1992), images are teeth from this study.

Measurements were also taken from the cervix, which is helpful when crowns are damaged by caries or wear (Figure 4). The dental cervix is the area where the outermost layer of the crown (enamel) connects with the outermost layer of the root (cementum) at the cementoenamel junction (CEJ). Measurements taken from the cervix are equally useful due to their strong correlation with crown dimensions (Hillson et al., 2005).

The maximum mesiodistal (MD) and buccolingual (BL) diameters were measured from the crown following the methods of Mayhall (1992) and the CEJ following the methods of Hillson et al. (2005). Metric data were collected from eight key teeth in the permanent dentition (UI1, UC, UP1, UM1, LI2, LC, LP1, and LM1). Key teeth are classified as the most stable members in each tooth class in terms of development and which display the most variation (Rathmann et al., 2020, 2022). When the key tooth was present on the right and left side, measurements from both sides were recorded.

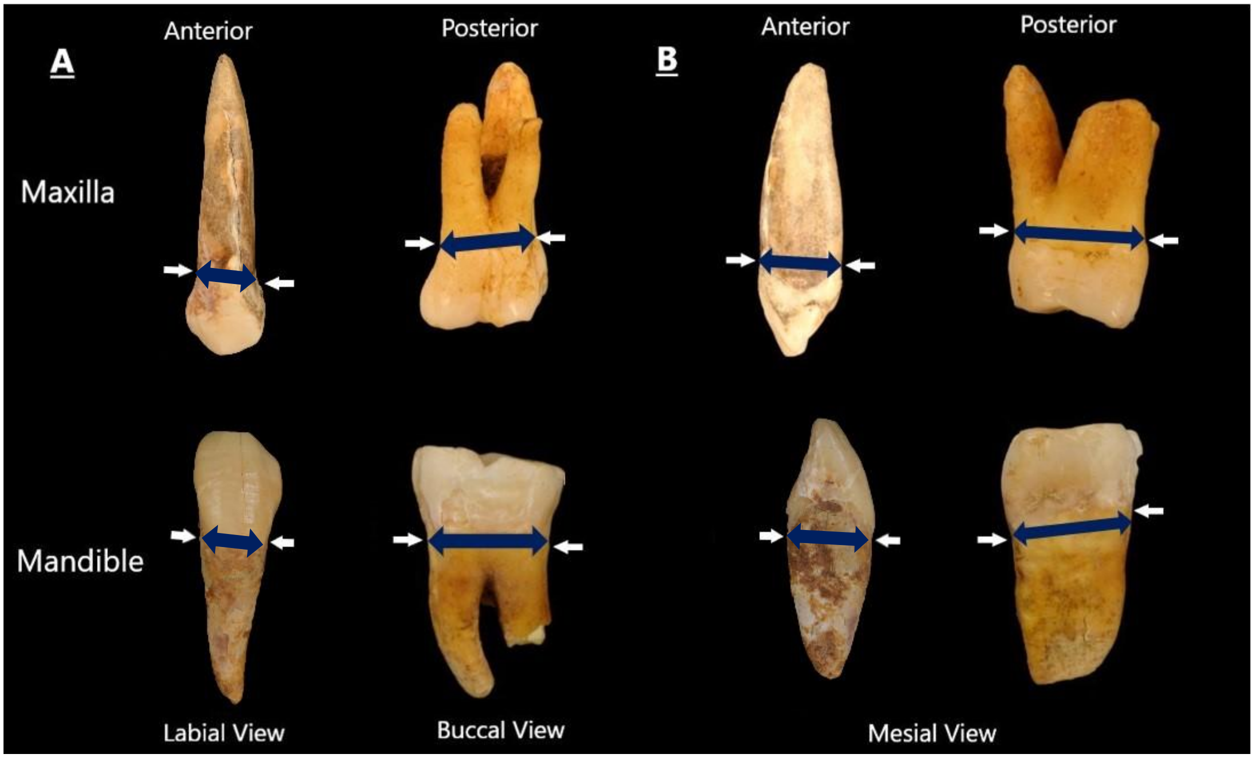

Figure 4: Measurements for mesiodistal cervix diameters (A) and buccolingual cervix diameters (B) of anterior and posterior teeth, white arrows represent the cervix and blue arrows represent where measurements were taken from. Based on methods from Hillson et al. (2005), images are teeth from this study.

3.4.3 Non-Metric Dental Traits

ASUDAS is a widely adopted data collection system that uses a set of standard reference plaques with written descriptions to record variation among commonly observed dental traits in human populations worldwide (Scott & Irish, 2017). In total, 36 non-metric traits were assessed following the methods of Rathmann et al. (2019, 2022) (Table 4). All traits were scored according to the reference standards of ASUDAS as described in Scott and Irish (2017). For trait selection, 31 non-metric traits were chosen that are common in populations of the Americas (Scott & Irish, 2017). The remaining traits included: mesial ridge (UC), distal accessory ridge (UC), protostylid (LM1), lingual cusp variation (LP2), and cusp 6 (LM1) as they have been found to preserve neutral genetic signals (Rathmann & Reyes-Centeno, 2020).

Traits were scored bilaterally when the key tooth was present on both sides as the degree of expression of non-metric traits can vary within individuals (e.g., ULM1 cusp 5 is scored as a 5 but URM1 is scored as a 6). Only permanent dentition was scored for non-metric traits. After scoring, the traits were dichotomized into simplified binary categories of 'present' or 'absent' using established breakpoints (Scott & Irish, 2017) (Table 4). Breakpoints are the level of expression needed to score a trait as present or absent (Scott & Irish, 2017).

Table 4: Dental morphological traits assessed in this study and their associated breakpoints. Adapted from Scott & Irish (2017).

Dental Non-Metric Traits (Key Tooth)	**Breakpoints**	
	Absent	**Present**
Shoveling (UI1)	0-1	2-7
Double Shoveling (UI1)	0-1	2-6
Interruption Groove (UI2)	0	M, D, MD, med[a]
Tuberculum Dentale (UI1)	0-1	2-6
Tuberculum Dentale (UI2)	0-1	2-6
Tuberculum Dentale (UC)	0-1	2-6
Mesial Ridge (UC)	0	1-3
Distal Accessory Ridge (UC)	0-1	2-5
Distal Accessory Ridge (LC)	0-1	2-5
Mesial and Distal Accessory Cusps (UP1)	0	1-3
Odontome (P1-P2)	0	1
Metacone (UM2)	0-2	3-5
Hypocone (UM2)	0-2	3-5
Cusp 5 (UM1)	0-1	2-5
Carabelli (UM1)	0-1	2-7
Parastyle (UM1)	0-1	2-5
Parastyle (UM2-UM3)	0-1	2-5
Enamel Extension (UM1)	0	1-3
Enamel Extension (LM1)	0	1-3
Root Number (UP1)	1	2-3
Root Number (UM2)	1,2	3+
Peg-reduced (UI2)	Normal	P, R[b]
Peg-reduced-missing (UM3)	Normal	P, R, M[c]

Lingual Cusp Variation (LP2)	0-1	2-9
Anterior Fovea (LM1)	0-1	2-4
Deflecting Wrinkle (LM1)	0-1	2-3
Groove Pattern (LM2)	X, +	Y
Protostylid (LM1)	0	1-7
Hypoconulid (LM1)	0-1	2-5
Hypoconulid (LM2)	0-1	2-5
Cusp 6 (LM1)	0	1-5
Cusp 7 (LM1)	0	1-4
Root Number (LC)	0 (one-rooted)	1 (two-rooted)
Tome's Root (LP1)	0-3	4-5
Root Number (LM1) i.e., three-rooted LM1	1-2 (one/two-rooted)	3 (three-rooted)
Root Number (LM1) i.e., three-rooted LM2	1 (one-rooted)	2

[a] Abbreviations represent the location of interruption groove when present: M= groove on mesiolingual marginal ridge, D=groove on distolingual marginal ridge, MD=grooves on both mesiolingual and distolingual marginal ridges, med= groove on medial aspect of basal cingulum
[b] Abbreviations represent different variants of UI2: P= peg-shaped (conical in form, often no morphological features), R= significantly reduced in size (half normal size)
[c] Abbreviations represent different variants of UM3: P= peg-shaped (only a single cusp evident), R= significantly reduced in size (half normal size), M= tooth congenitally absent.

3.4.9 Photography

Reference photographs were taken of all the teeth examined in this study. Different cameras were used based on equipment availability. Teeth were photographed from five different views: labial/buccal, mesial, lingual, distal, and occlusal. The photos from James W. Lee Collection were taken in the summer of 2017 by Tyler Tymchen with a Canon PowerShot SX20 IS and Steven Mellor with a Canon PowerShot SX50 HS along with photoscales. The teeth housed at the University of Winnipeg were photographed with a Nikon D7200 with a macrophotograpy lens, dark background, photoscales, tripod, and adjustable lights. When photographing the dentition from the sites housed at institutions in Cuba, an iPhone 13 was used for capturing the photos along with a photoscale using either natural light or portable lights (when available).

3.5 Statistical Methods

After the metric and non-metric data were collected, several standard data pre-processing and quality control procedures were conducted before continuing with further statistical testing. This included testing for intra-observer error, sexual dimorphism, and normal distribution of data. Pre-processing steps were done to ensure that patterns of metric and non-metric phenotypic variation closely approximated the underlying genotypic variation and was not the result of other influences.

3.5.2 Intra-Observer Error

The level of intra-observer error was quantified by re-scoring 130 teeth housed at the University of Winnipeg from the sites of Cueva del Infierno, Canímar Abajo, Punta Candelero, and Los Indios three months after the first scoring sessions. Thirteen different tooth types were used for scoring metric and non-metric traits (UI1, UI2, UC, UP1, UM1, UM2, UM3, LI2, LC, LP1, LP2, LM1, LM2), ten samples of each tooth type were re-scored per site. Due to the condition of the teeth, several traits could not be scored or measured in both sessions.

Metric traits from the two scoring sessions were compared with paired Student's *t*-tests and Mann-Whitney U tests. Paired Student's *t*-tests compare the means of two measurements taken from the same object and whether the difference is statistically significant. In this case it compares measurements from the same tooth. Many statistical tests, including Student's *t*-test, require normally distributed sample populations for correct calculations (Ghasemi & Zahediasl, 2012). The Shapiro-Wilk test was used to determine if the measurements from the scoring sessions were normally distributed. Normality tests were conducted using Paleontological Statistics (PAST) software (Hammer et al., 2001). If the measurements were normally distributed, Student's *t*-tests were conducted in R Studio (R Core Team, 2024) using the 'rstatix' package (Kassambara, 2023). If measurements were not normally distributed the scores were compared using the Mann-Whitney U test, a non-parametric alternative test to t-tests and suitable for small sample sizes ($n < 30$) (MacFarland & Yates, 2016) using PAST. For all tests performed, a *p*-value of less than 0.05 ($p < 0.05$) was set to indicate statistical significance.

Non-metric traits from the two scoring sessions were compared using Cohen's Kappa, a statistical measure used to quantify the level of agreement between the scoring sessions using nominal data (McHugh, 2012). The Cohen's Kappa coefficient ranges from 0-1, with a higher score indicating stronger levels of intra-observer agreement. Scores from the two sessions were dichotomized using the established breakpoints in Table 4 before using the 'Psych' package (Revelle, 2024) in R Studio to calculate the Cohen's Kappa value.

The James W. Lee Collection was only scored for non-metric traits through photographs from previous fieldwork conducted in 2017. To determine if there was compatibility between the samples scored directly (in-person) and through photographs from the James W. Lee Collection, non-metric traits from two scoring sessions were compared using Cohen's Kappa (McHugh, 2012). To accomplish this, 72 teeth from Canímar Abajo, Los Indios, and Punta Candelero were re-scored through photographs and the values were compared to the original scores that were collected directly. Ten scores from each of the following traits were recorded in both scoring sessions: carabelli (UM1), metacone (UM2), hypocone (UM2), root number (UM2), peg-reduced-missing (UM3), root number (LC), protostylid (LM1), cusp 6 (LM1), root number (LM1), enamel extension (LM1), root number (LM2). Scores from the two sessions were dichotomized using the established breakpoints in Table 4 before using the ‘Psych’ package (Revelle, 2024) in R Studio to calculate the Cohen’s Kappa value. No significant differences were found between the direct scoring and photographic scoring methods (Appendix B Table B.9) and the scores from the James W. Lee Collection were included in the MMD analysis.

3.5.3 Sexual Dimorphism

The non-metric and metric data were tested for morphological differences that may result from sexual dimorphism. In modern human populations males often possess larger tooth crowns than females, but the degree of dimorphism varies within populations and in different teeth (Schwartz & Dean, 2005). Metric and non-metric traits scored from 13 tooth types were contrasted (UI1, UI2, UC, UP1, UM1, UM2, UM3, LI2, LC, LP1, LP2, LM1, LM2). 96 individuals (48 male and 48 female) from Canímar Abajo, Chorro de Maita, Punta Candelero, Paso del Indio, and Playa del Mango were incorporated. For Canímar Abajo, only individuals with genetically determined sex were analyzed for sexual dimorphism which included 2 males and 7 females (Nägele et al., 2020). Determinations of genetic sex were not available for the individuals from Chorro de Maita, Punta Candelero, Paso del Indio, so the estimations of sex from osteological methods were used. Metric traits were analyzed with Student’s *t*-test for normally distributed metric traits and Mann-Whitney U test for non-normally distributed metric traits (Appendix B Tables B.6 and B.7). For non-metric traits, Fisher’s Exact test was used to determine if there are non-random associations between two categorical variables (Hess & Hess, 2017). The Fisher’s Exact test was analyzed in R Studio (Appendix B Table B.10).

3.5.4 Statistical Testing for Metric and Non-Metric Dental Traits

After completion of the data pre-processing steps, traits that were impacted by intra-observer error and sexual dimorphism were removed from the datasets (Appendix B). Due to variable preservation of the dental remains, many teeth could not be scored for all metric and non-metric traits. Two statistical approaches were used to analyze data and account for the large number of missing values. The first approach involves analyzing metric and non-metric data separately using Kruskal-Wallis for metric and the mean measure of divergence (MMD) for the non-metric data. The second approach involves combining the different data types into a single analysis using the FLEXDIST software tool for estimating inter-individual distances (Rathmann, Lismann, et al., 2023).

The first approach is commonly incorporated into dental morphological studies, likely due to the complexity of combining multiple variable scales into a single analysis. Metric and non-metric datasets are generally a mix of continuous, ordinal, and nominal variables which are recorded on different scales (Hillson, 1996; Scott & Irish, 2017). Many standard statistical tests do not accept or work properly with mixed data and separate tests are needed for each type of variable (Rathmann, Lismann, et al., 2023). The metric data were analyzed using Kruskal-Wallis tests and visualized with principal component analysis (PCA). The non-metric data were analysed using MMD which is a dissimilarity measure that uses dichotomous trait frequencies to compare group differences, which allows it to accommodate missing data (Santos, 2018).

The second approach used the FLEXDIST software tool which takes correlations among variables into account, works with multiple variable scales (i.e., continuous, nominal, and ordinal), imputes missing data values, and allows for high-dimensional data. This method was first introduced by Rathmann et al. in 2023 and at the time of writing this study, this method has not been used in any other Caribbean contexts. The FLEXDIST computes inter-individual Mahalanobis-type distances (another common dissimilarity measure) using mixed data PCA (dimensionality reduction method) repeated over 1000 multiple randomly imputed datasets which takes into account uncertainty from incomplete data (Rathmann, Lisman, et al., 2023).

Statistical Analysis of Metric Dental Traits

Before submitting the metric dataset to statistical testing, the variables were reduced to remove traits with excessive amounts of missing data. First, only measurements from the left side were used and if the left was not available then the right antimere was chosen instead. The traits with more than 50% missing variables and less than 5 samples per site were removed in a stepwise manner. After the 32 traits were reduced, 15 remained for statistical analysis including: UC BL crown, UP1 MD cervix, UM1 BL crown, UM1 MD crown, UM1 MD cervix, LI1 BL crown, LI2 MD crown, LI2 BL cervix, LI2 MD cervix, LC BL cervix, LP1 BL crown, LP1 MD crown, LP1 MD cervix, LM1 MD crown, and LM1 MD cervix.

Kruskal-Wallis tests were then conducted to determine if there were statistically significant differences between the crown and cervix measurements. The Kruskal-Wallis test is a nonparametric test that determines if there are differences between three or more groups for continuous or discrete variables (Ostertagova et al., 2014). The results identify if there are statistically significant differences among the sites, but do not indicate which differences between pairs of means are significant. Post-hoc tests, such as Dunn's multiple comparisons test, are pairwise tests used to compare the means of groups to each other and identify differences between two means that are greater than expected standard error (Dunn, 1964). All statistical tests for metric dental traits were conducted using PAST.

PCA is a nonparametric dimensionality reduction method that is used to reduce large datasets into smaller datasets while maintaining significant patterns and trends (Jolliffe & Cadima, 2016). This method reduces data and visualizes patterns within the metric trait dataset. To handle missing data in the dataset, iterative imputation was used. This method replaces the missing values with their column average before running an initial PCA. The PCA is then used to compute regression values for the missing data and these steps are iterated until convergence (Ilin & Raiko, 2010). The PCA and iterative imputation was conducted with PAST.

Statistical Analysis of Non-Metric Dental Traits

Due to preservation issues with the samples, scores from both right and left teeth were used based on availability to avoid considerable loss of data for statistical analysis. This method is preferred by Ossenberg (1981) who proposed that the total side count method (number of left plus right sides with trait present) may be better suited than the individual count method (number of individuals with trait present on one or both sides) for studies with highly fragmentary skeletons. Roksandic (1999) argued that the correlation between the level of trait incidence and the proportion of bilateral expression reflects genetic factors, as individuals who express a trait bilaterally have a larger amount of the trait positive alleles than an individual with unilateral expression of the trait. Therefore, computing the frequency of a trait by using both sides quantifies the genetic potential in the population better than the individual count. Tagaya (2022) recently compared the side count versus individual count and found that the use of both sides improves the reliability of estimations of inter-trait correlations. This method of scoring considers the total genetic potential for the trait expression within a population and increases the sample sizes without violating the biological bases of the trait expression (Roksandic, 1999).

The reasoning behind the individual count method is that, since non-metric traits are threshold characters, a trait is considered 'present' if it is expressed on at least one side, even if the trait is absent on the opposite side (Scott, Schmitz, et al., 2018). This presents an issue in this study as both sides were not always present or sufficiently preserved for scoring. Using this method would drastically reduce the number of observations (already low for certain sites) and would subsequently, due to small sample sizes, bias the frequencies of trait expression.

Before submitting the non-metric dataset for testing, the variables were reduced to remove traits with excessive amounts of missing data. If traits were scored on more than one tooth (i.e., shoveling), it was necessary to choose only one key tooth for statistical analysis as the same combination of genes control the phenotypic expression of the trait for different teeth and thus their frequencies would be highly correlated (Scott, Schmitz, et al., 2018). For these traits, the key tooth with the highest number of scores available was chosen. After the raw scores were dichotomized, non-metric traits were removed from the dataset if they were monomorphic or were not well represented among the sites. After the 36 non-metric traits were reduced, 11 remained for statistical analysis with at least 2 scores per site: carabelli (UM1), metacone (UM2), hypocone (UM2), root number (UM2), peg-reduced-missing (UM3), root number (LC), protostylid (LM1), cusp 6 (LM1), root number (LM1), enamel extension (LM1), root number (LM2). When Jelica was removed, 8 non-metric traits remained for statistical analysis with at least 2 scores per site: carabelli (UM1), metacone (UM2), peg-reduced-missing (UM3), anterior fovea (LM1), protostylid (LM1), cusp 6 (LM1), root number (LM1), and enamel extension

(LM1). The dentition from Cueva del Infierno, Paso del Indio, and Pueblo Viejo Cotui were excluded from further testing as they did not have enough scorable non-metric traits.

After the non-metric traits were reduced, the mean measure of divergence (MMD) was used to assess the biological distances between the sites. The MMD is a popular dissimilarity measure for assessing phenetic relationships between populations as it can accommodate nonmetric skeletal or dental traits if they are poorly-preserved (Santos, 2018), and has a correction factor built in for small sample sizes (Irish, 2010). The "AnthropMMD" package created by Santos (2018) was used in R Studio to calculate the MMD. The Freeman and Tukey (1950) angular transformation was used to correct for low or high trait frequencies and the small sample size. For trait selection, Fisher's exact test was used as it will only include traits with significant differences between at least one pair of groups (Harris & Sjøvold, 2004), only traits with substantial frequency variation across most groups tend to be selected (Santos, 2018). The MMD produces a series of pairwise values for each compared sample, where low values indicate more biological affinity, and high values indicate biological dissimilarity. To visualize the distances matrices, the software also produces a 2D multidimensional scale (MDS) plot of the MMD results where similar sites are plotted closer together and less similar are further away and a hierarchical cluster analysis.

The MMD value is considered significant if it is more than twice the value of its standard deviation. MMD scores from 0.0 to less than 0.1 suggest similar populations with common ancestry. Negative values are statistical artifacts that can occur with small sample sizes and only occur when comparisons are not significantly different (Waters-Rist et al., 2016).

FLEXDIST for Metric and Non-Metric Dental Trait Analysis

The FLEXDIST software tool was used to examine inter-individual differences between the sites, therefore isolated teeth with unknown archaeological contexts were excluded for this analysis and only teeth that were associated with specific individuals were included. For non-metric traits, if both antimeres were present, the side with the highest level of expression was included (Rathmann, Lismann, et al., 2023; Scott & Irish, 2017). Non-metric scores were not dichotomized to ensure variation was retained for detecting small-scale inter-individual connections. For metric traits, left side measurements were used. In total 68 dental metric and non-metric traits were collected for 262 individuals from 8 Caribbean sites and 13 individuals from Jelica-Gradina. Cueva del Infierno was excluded from analysis due to a high proportion of isolated teeth and the Jamaican sites were excluded as they were only scored for non-metric traits.

Although FLEXDIST can accommodate missing data, dental traits and individuals were reduced to avoid comparing individuals with little or no shared data. Traits were first removed for intra-observer error, sexual dimorphism, and monomorphism. Then traits and individuals with over 50% missing variables were removed from the dataset. These data pre-processing steps reduced the number of variables to 33 metric and non-metric dental traits but greatly reduced the number of individuals to 34 Caribbean individuals from 6 sites and 13 individuals from Jelica Gradina. The last step was ensuring that the nominal and ordinal traits were coded as non-negative integers differing by one. Traits that were missing grades on the grade expression scale were re-coded to ensure there were no missing values. If a trait was listed as 0, 2, 3, 5 it would be re-coded as 0, 1, 2, 3. Although this step removes some data about trait expressivity, the general ordering of expression grades is maintained (Rathmann, Lismann, et al., 2023).

Once traits and number of individuals were reduced, the FLEXDIST procedure involved five steps as detailed by Rathmann et al. (2023a). A fully automated R script for FLEXDIST was retrieved from the repository published by Rathmann (2024) on Zenodo and was used in R Studio. In the first step, missing values were replaced with randomly generated values using multiple imputation for individuals (1000 iterations were run) with partially observed data, which created differentially imputed datasets. Second, the imputed datasets were submitted to a mixed data PCA (which can accommodate continuous and discontinuous variables) for estimating uncorrelated principal components (PCs), these were then used to determine the inter-individual Mahalanobis-type distance matrix. Third, the uncorrelated PCs scores are used as new variables to estimate a matrix of pairwise Euclidean distances across individuals. In the fourth step, summary statistics are computed for each inter-individual comparison: FLEXDIST median, FLEXDIST upper, and FLEXDIST lower. Lastly, the individuals are plotted to visualize the relatedness between them, while taking into consideration the uncertainty from the missing values. After the initial FLEXDIST was run, another version was run without Jelica to better visualize the inter-individual connections among the Caribbean sites.

Chapter 4- Results

4.1 Data Pre-Processing Results

The results indicated there was moderate-high level of intra-observer agreement. Between the two scoring sessions, there was agreement among the scores for 26 (81%) of the 32 metric traits and 31 (86%) of the 36 non-metric dental traits (see Appendix B Tables B.1-B.5 for all scores). Six metric traits were excluded from further analyses due the low intra-observer agreement: UC BL Cervix (*t = 2.498, df = 8, p = .037)*, UC MD Cervix (t = 3.516, df = 8, p = .008), UM1 BL Cervix (t = 3.808, df = 6, p = .009), LC MD Cervix (t = 4.785, df = 9, p = .001), LP1 BL Cervix (t = 2.541, df = 6, p = .044), and LM1 BL Crown (t = -2.344, df = 9, p = .044). Five non-metric traits were excluded from further analysis due to low intra-observer agreement: UI1 tuberculum dentale (k = 0), UP1 mesial and distal accessory cusps (k = 0), UM1, UM2, UM3 parastyle (k = .01), and LC distal accessory ridge (k = .053).

When assessing sexual dimorphism among 13 tooth types (UI1, UI2, UC, UP1, UM1, UM2, UM3, LI2, LC, LP1, LP2, LM1, LM2) from 96 individuals (48 male and 48 female), six metric traits had significant differences in size between sexes. There were no significant differences among the non-metric traits, all scored can be seen in Appendix B Tables B.5-B.8. The six metric traits with significant differences included: UC BL Cervix (t =-3.874, df = 38, p = .004) UC MD Cervix (t = -2.341, df = 35, p = .020) LC BL Crown (t = -3.167, df= 33, p = .003), LC MD Crown (t = -3.798, df = 34, p = .005), LC MD Cervix (t = -4.086, df = 37, p = .002), and LM1 BL Cervix (t = -2.657, df = 29, p = .013). These traits were excluded from further analysis and statistical testing. Given the unequal representation of individuals with estimated sex between sites, some traits might have performed differently if sexual dimorphism was evaluated on a site-by-site basis.

When assessing the two methods of direct and photographic scoring, 11 non-metric traits were scored in both sessions: carabelli (UM1), metacone (UM2), hypocone (UM2), root number (UM2), peg-reduced-missing (UM3), root number (LC), protostylid (LM1), cusp 6 (LM1), root number (LM1), enamel extension (LM1), root number (LM2). Results showed no statistically significant differences between the two scoring methods as detailed in Appendix B Table B.9. As there were no significant differences, the scores from the James W. Lee Collection could be included in further analyses.

4.2 Statistical Testing for Metric and Non-Metric Dental Traits

4.2.1 Statistical Analysis of Metric Dental Traits

The summary statistics for the metric dental traits in Table 5 includes: the number of samples per group (n), mean (M), and standard deviation (SD). This table includes the remaining traits that had a high level of intra-observer agreement and were not significantly influenced by sexual dimorphism. A total of 1,371 measurements were included in the metric trait analysis from Canímar Abajo OC and YC, Cueva del Infierno, Chorro de Maíta, Los Indios, Punta Candelero, Paso del Indio, Playa del Mango, Pueblo Viejo de Cotuí and Jelica.

Kruskal-Wallis tests were conducted to examine the significance of differences in crown and cervix size between groups. For several traits, groups were excluded if the sample size was less than two measurements (Table 5). The results of the Kruskal-Wallis tests can be seen in Table 6. There were significant differences between groups for the following metric traits: UC BL crown (H = 38.43, p = .001), UP1 MD crown (H = 13.04, p = .023), UM1 BL crown (H =

24.59, p = .002), UM1 MD crown (H = 49.43, p = .001), UM1 MD cervix (H = 35.5, p = .001), LI2 MD cervix (H = 11.03, p = .027), LP1 MD crown (H = 17.85, p = .013), LP1 MD cervix (H = 18.93, p =.008), LM1 MD crown (H = 38.51, p = .001), LM1 MD cervix (H = 23.67, p = .005). There were no statistically significant differences for the remaining traits.

Ten of the fifteen traits had statistically significant differences and post-hoc Dunn's multiple comparisons tests were used to explore which group means were different from one another (Table 7). The metric traits that differed the most between Caribbean groups was the UC BL crown and UM1 MD crown. Metric traits from Jelica were significantly different to most groups. The metric traits that returned non-significant values between the Caribbean sites and Jelica are excluded in the comparisons below.

Table 5: Summary information of the 15 dental metric traits used in the Kruskal-Wallis test and Principal Component Analysis (PCA), including the number of individual scores (n), mean (M), and the standard deviation (SD) per trait for each group examined.

Metric Trait	CA OC			CA YC			CI			CM			LI			PC			PI			PM			PVC			Jelica		
(Key Tooth)	n	M	SD	n	M	SD	n	M	SD	n	M	SD	n	M	SD	n	M	SD	n	M	SD	n	M	SD	n	M	SD	n	M	SD
UC BL Crown	4	7.6	0.3	4	7.9	0.4	7	7.7	0.5	18	6.9	0.4	7	8.3	0.4	3	7.6	0.7	2	7.6	0.2	2	8.1	0.3	5	8.2	0.9	17	7.9	0.6
UP1 MD Cervix	4	4.8	0.2	11	4.9	0.4	18	4.8	0.4	21	5.1	0.7	0	NA	NA	0	NA	NA	0	NA	NA	3	4.8	0.3	1	NA	NA	14	4.8	0.9
UM1 BL Crown	2	11.3	0.1	7	12	0.4	37	11.6	0.1	27	11.4	0.6	17	11.2	0.4	3	11.1	0.1	6	11.2	1.1	2	11.4	0.5	1	NA	NA	15	10.3	1.8
UM1 MD Crown	2	9.8	0.3	8	11	0.3	37	10.8	0.6	26	10.6	0.6	17	9.9	0.5	3	10	0.4	5	10.4	0.5	2	11.3	0.5	1	NA	NA	13	9.8	0.4
UM1 MD Cervix	3	9.2	0.7	9	8.2	0.6	25	8.2	0.6	23	8.1	0.6	17	7.9	0.5	5	8.1	0.5	5	7.7	0.9	6	6.7	0.8	2	7.6	0.1	16	7.3	0.4
LI2 BL Crown	4	5.6	0.2	8	6.1	0.3	2	5.9	0.3	30	6.1	0.4	3	6.1	0.2	2	5.7	0.1	4	6.4	0.9	7	6.1	0.4	3	5.9	0.3	12	5.9	0.3
LI2 MD Crown	4	6.1	0.2	8	5.8	0.4	2	6.1	0.5	35	6.1	0.5	3	5.9	0.3	2	5.2	0.4	3	5.7	0.4	7	5.9	0.6	4	6.1	0.5	9	5.7	0.3
LI2 BL Cervix	6	5.6	0.2	10	6.1	0.3	1	5.8	0.4	24	6.2	0.5	3	6.1	0.1	2	6.1	0.2	3	5.3	1	7	5.6	0.9	4	5.9	0.4	10	5.8	0.2
LI2 MD Cervix	7	3.7	0.3	9	3.9	0.3	1	3.9	0.5	29	4.1	0.4	3	3.7	1.2	2	3.9	0.1	3	3.8	0.2	6	3.8	0.2	4	3.7	0.3	10	3.6	0.2
LC BL Cervix	5	7.5	0.3	9	7.8	0.5	22	7.4	0.6	33	7.3	0.7	3	7.5	0.3	0	NA	NA	1	NA	NA	27	7.4	0.7	6	7.5	0.6	13	7.2	0.5
LP1 BL Crown	6	7.5	0.2	8	7.7	0.6	0	NA	NA	28	7.6	0.4	5	7.9	0.4	3	7.4	0.2	0	NA	NA	9	7.3	0.6	3	7.7	0.3	16	7.4	0.5
LP1 MD Crown	6	6.8	0.7	9	7.1	0.5	0	NA	NA	27	6.8	0.5	5	7.3	0.5	3	6.6	0.3	0	NA	NA	8	6.8	0.3	3	6.6	0.3	16	6.5	0.2
LP1 MD Cervix	10	4.5	0.4	9	4.8	0.6	0	NA	NA	25	5.1	0.6	4	5.4	0.5	3	5.3	0.6	0	NA	NA	8	4.7	0.4	4	5.1	0.2	12	4.6	0.2
LM1 MD Crown	6	11.5	0.2	10	12	0.4	10	10.7	0.6	19	11.5	0.5	35	11.1	0.5	17	10.9	0.9	4	11.5	0.1	5	11.6	0.7	3	11.7	0.7	12	10.6	0.4
LM1 MD Cervix	9	9.3	0.4	12	9.3	0.8	6	8.9	0.6	15	9.4	0.7	32	9.1	0.7	18	9.3	0.8	4	8.4	0.6	6	8.9	0.7	9	9.2	0.7	11	8.2	0.5

Site abbreviations= CA OC: Canímar Abajo Old Cemetery, CA YC: Canímar Abajo Young Cemetery, CI: Cueva del Infierno, CM:Chorro de Maíta, LI: Los Indios, PC: Punta Candelero, PI: Paso del Indio, PM: Playa del Mango, PVC: Pueblo Viejo de Cotuí, Jelica: Jelica-Gradina

Table 6: Kruskal-Wallis test for metric dental trait comparisons between groups

Dental Metric Trait (Key Tooth)	**H (chi^2)**	**Significance (*p*-value)**
UC BL Crown	38.43	0.001*
UP1 MD Cervix	13.04	0.023*
UM1 BL Crown	24.59	0.002*
UM1 MD Crown	49.43	0.001*
UM1 MD Cervix	35.5	0.001*
LI2 BL Crown	12.76	0.173
LI2 MD Crown	11.03	0.255
LI2 BL Cervix	16.46	0.058
LI2 MD Cervix	18.74	0.027*
LC BL Cervix	4.98	0.622
LP1 BL Crown	6.171	0.52
LP1 MD Crown	17.85	0.013*
LP1 MD Cervix	18.93	0.008*
LM1 MD Crown	38.51	0.001*
LM1 MD Cervix	23.67	0.005*

Note. Significant values indicated by *

Two out of the fifteen metric traits in Table 7 showed significant differences among Archaic Age groups, including the UM1 MD cervix, and LM1 MD crown. The UM1 MD cervix measurements from Playa del Mango were significantly different to Canímar Abajo OC (H = 35.5, p = .001), Canímar Abajo YC (H = 35.5, p = .008), and Cueva del Infierno (H = 35.5, p = .001). The LM1 MD crown measurements from Cueva del Infierno were significantly different to Canímar Abajo OC (H = 38.51, p = .005), and Canímar Abajo YC (H = 38.51, p = .001). No significant differences were found for the remaining pairwise comparisons.

Table 7: Dunn's Multiple Comparisons test using pairwise metric dental trait comparisons between sites.

Pairwise Comparisons	**Dunn's Multiple Comparisons Test Significance (*p*-value)**									
	UC BL Crown	UP1 MD Cervix	UM1 BL Crown	UM1 MD Crown	UM1 MD Cervix	LI2 MD Cervix	LP1 MD Crown	LP1 MD Cervix	LM1 MD Crown	LM1 MD Cervix
CA OC-CA YC	0.543	0.570	0.694	0.021*	0.067	0.163	0.511	0.299	0.343	0.972

CA OC-CI	0.922	0.823	0.667	0.016*	0.124	0.659	NA	NA	0.005*	0.387
CA OC-CM	0.438	0.306	0.993	0.064	0.070	0.043*	0.557	0.018*	0.749	0.704
CA OC-LI	0.054	NA	0.623	0.627	0.022*	0.725	0.311	0.009*	0.014*	0.452
CA OC-PC	0.094	NA	0.650	0.612	0.124	0.503	0.290	0.058	0.089	0.749
CA OC-PI	0.130	NA	0.780	0.159	0.046*	0.729	NA	NA	0.869	0.063
CA OC-PM	0.463	0.983	0.947	0.016*	0.001*	0.759	0.527	0.328	0.827	0.380
CA OC-PVC	0.373	NA	NA	NA	0.026*	0.726	0.314	0.054	0.913	0.865
CA OC-Jelica	0.061	0.248	0.143	0.874	0.001*	0.336	0.033*	0.682	0.002*	0.001*
CA YC-CI	0.557	0.581	0.997	0.841	0.466	0.655	NA	NA	0.001*	0.346
CA YC-CM	0.985	0.543	0.466	0.246	0.785	0.693	0.112	0.287	0.116	0.710
CA YC-LI	0.011*	NA	0.131	0.001*	0.612	0.156	0.633	0.077	0.003*	0.377
CA YC-PC	0.021*	NA	0.291	0.044*	0.856	0.823	0.100	0.25	0.002*	0.695
CA YC- PI	0.038*	NA	0.329	0.255	0.675	0.486	NA	NA	0.312	0.05*
CA YC-PM	0.812	0.627	0.757	0.460	0.008*	0.312	0.157	0.978	0.258	0.339
CA YC-PVC	0.803	NA	NA	NA	0.302	0.125	0.113	0.271	0.521	0.828
CA YC-Jelica	0.009*	0.014*	0.002*	0.001*	0.011*	0.01*	0.001*	0.139	0.001*	0.001*
CI-CM	0.406	0.169	0.225	0.127	0.548	0.494	NA	NA	0.001*	0.203
CI-LI	0.023*	NA	0.021*	0.001*	0.117	0.513	NA	NA	0.023*	0.699
CI-PC	0.043*	NA	0.226	0.032*	0.710	0.854	NA	NA	0.101	0.490
CI-PI	0.077	NA	0.218	0.231	0.291	0.900	NA	NA	0.022*	0.305
CI-PM	0.474	0.863	0.734	0.362	0.001*	0.822	NA	NA	0.015*	0.990
CI-PVC	0.360	NA	NA	NA	0.138	0.508	NA	NA	0.019*	0.476
CI-Jelica	0.015*	0.027*	0.001*	0.001*	0.001*	0.285	NA	NA	0.822	0.050
CM-LI	0.001*	NA	0.234	0.001*	0.326	0.071	0.071	0.235	0.081	0.156
CM-PC	0.002*	NA	0.490	0.142	0.989	0.665	0.427	0.570	0.049*	0.406
CM-PI	0.01*	NA	0.604	0.712	0.490	0.311	NA	NA	0.937	0.023*
CM-PM	0.770	0.379	0.934	0.151	0.001*	0.128	0.849	0.292	0.972	0.197
CM-PVC	0.720	NA	NA	NA	0.216	0.044*	0.463	0.655	0.714	0.569
CM-Jelica	0.001*	0.004*	0.001*	0.001*	0.001*	0.001*	0.017*	0.003*	0.001*	0.001*
LI-PC	0.721	NA	0.935	0.874	0.542	0.393	0.062	0.699	0.622	0.603
LI-PI	0.788	NA	0.777	0.109	0.961	0.555	NA	NA	0.299	0.116
LI-PM	0.021*	NA	0.556	0.006*	0.012*	0.559	0.094	0.079	0.276	0.687
LI-PVC	0.003*	NA	NA	NA	0.424	0.976	0.067	0.571	0.224	0.590
LI-Jelica	0.595	NA	0.036*	0.510	0.014*	0.725	0.001*	0.003*	0.009*	0.009*
PC-PI	0.963	NA	0.793	0.327	0.596	0.744	NA	NA	0.208	0.074
PC-PM	0.036*	NA	0.598	0.033*	0.013*	0.653	0.548	0.249	0.185	0.481
PC-PVC	0.007*	NA	NA	NA	0.278	0.382	0.964	0.890	0.158	0.902
PC-Jelica	0.906	NA	0.275	0.593	0.023*	0.191	0.669	0.028*	0.047*	0.001*

PI-PM	0.049*	NA	0.718	0.141	0.055	0.923	NA	NA	0.969	0.310
PI-PVC	0.016*	NA	NA	NA	0.494	0.548	NA	NA	0.810	0.084
PI-Jelica	0.881	NA	0.069	0.045*	0.103	0.278	NA	NA	0.012*	0.572
PM-PVC	0.963	NA	NA	NA	0.47	0.546	0.585	0.271	0.774	0.468
PM-Jelica	0.025*	0.291	0.119	0.003*	0.507	0.212	0.118	0.161	0.007*	0.052
PVC-Jelica	0.001*	NA	NA	NA	0.72	0.667	0.655	0.023*	0.010*	0.002*

Note. Significant values indicated by *. Site abbreviations= CA OC: Canímar Abajo Old Cemetery, CA YC: Canímar Abajo Young Cemetery, CI: Cueva del Infierno, CM: Chorro de Maíta, LI: Los Indios, PC: Punta Candelero, PI: Paso del Indio, PM: Playa del Mango, PVC: Pueblo Viejo de Cotuí, Jelica: Jelica-Gradina

Five out of fifteen metric traits showed significant differences among Ceramic Age groups, including UC BL crown, UM1 MD crown, LI2 MD cervix, LM1 MD cervix, and LM1 MD cervix. Chorro de Maíta had significant differences with Los Indios of the UC BL crown (H = 38.43, p = .001) and UM1 MD crown (H = 49.43 p = .001), Paso del Indio with the UC BL crown (H = 38.43, p = .010) and LM1 MD cervix (H = 23.67, p = .020), Punta Candelero with the UC BL crown (H = 38.43, p = .002) and LM1 MD crown (H = 38.51, p = .049), and Pueblo Viejo de Cotuí with the LI2 MD cervix (H = 18.74, p = .044). There were no significant differences between Puerto Rico's Punta Candelero, Paso del Indio, and Los Indios. Inter-island variation was observed between Chorro de Maíta from Cuba with Pueblo Viejo de Cotuí from the Dominican Republic, and the Puerto Rico groups.

Five out of fifteen metric traits showed significant differences between Archaic Age and Ceramic Age groups, including UC BL crown, UM1 MD crown, UM1 MD cervix, LM1 MD crown, and LM1 MD cervix. Canímar Abajo OC had significant differences with Los Indios of the UM1 MD cervix (H = 35.5, p = .022) and LM1 MD crown (H = 38.51, p = .014), and Pueblo Viejo de Cotuí with the UM1 MD cervix (H = 35.5, p = .026). Canímar Abajo YC had significant differences with Los Indios of the UC BL crown (H = 38.43, p = .011), UM1 MD crown (H =

49.43, p = .001), and LM1 MD crown (H = 38.51, p = .003), Punta Candelero with the UC BL crown (H = 38.43, p = .021) UM1 MD crown (H = 49.43, p = .040) and LM1 MD crown (H = 38.51, p = .002), and Paso del Indio with the UC BL crown (H = 38.43, p = .038) and LM1 MD cervix (H = 23.67, p = .050). Cueva del Infierno had significant differences with Los Indios of the UC BL crown (H = 38.43, p = .023), UM1 BL crown (H = 24.59, p = .021), and UM1 MD crown (H = 49.43, p = .001), and Punta Candelero with the UC BL crown (H = 38.43, p = .043) and UM1 MD crown (H = 49.43, p = .032). The UM1 MD cervix measurements from Playa del Mango were significantly different with Los Indios (H = 35.5, p = .012), Punta Candelero (H = 35.5, p = .012), and Chorro de Maíta (H = 35.5, p = .001). No significant differences were found for the remaining pairwise comparisons.

The 15 metric traits from 10 groups were then visualized using PCA. The first two principal components account for 90% of the total variation of the sample based on metric dental traits (Table 8). The first principal component (PCI) accounts for 51% of the variation and is mainly correlated (negatively) with UM1 MD crown and positively with LM1 MD cervix. The second principal component (PCII) accounts for 43% of the variation and is mainly correlated with UM1 BL crown and UM1 MD cervix.

Table 8: Component loadings, eigenvalues, and variance for dental metric traits.

Dental Metric Trait (Key Tooth)	**Principal Components**								
	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8	PC 9
UC BL Crown	0.276	0.171	0.083	-0.296	0.388	0.169	0.478	-0.449	-0.069
UP1 MD Cervix	0.136	-0.093	0.21	0.38	0.118	0.218	0.085	-0.24	-0.061
UM1 BL Crown	0.069	0.737	-0.216	-0.063	-0.276	-0.015	0.281	0.085	0.036
UM1 MD Crown	-0.799	0.313	0.256	0.22	0.308	-0.037	0.076	-0.071	-0.11
UM1 MD Cervix	0.106	0.403	-0.384	0.189	0.115	0.377	-0.364	0.155	-0.128
LI2 BL Crown	0.001	-0.032	0.296	0.141	-0.47	0.557	0.011	-0.013	0.036
LI2 MD Crown	0.072	0.084	-0.053	-0.057	-0.008	-0.203	0.1	-0.056	0.528

LI2 BL Cervix	0.204	-0.008	0.076	-0.183	0.343	-0.002	-0.002	0.251	-0.368
LI2 MD Cervix	0.086	0.037	0.168	0.007	0.002	0.386	0.017	-0.12	-0.176
LC BL Cervix	-0.007	0.142	0.201	-0.171	0.063	0.015	0.011	0.057	0.118
LP1 BL Crown	0.092	0.045	0.173	-0.187	0.239	0.016	-0.185	0.45	-0.179
LP1 MD Crown	0.075	0.095	0.31	-0.038	0.318	0.255	-0.156	0.244	0.657
LP1 MD Cervix	0.129	-0.042	0.189	0.351	-0.089	-0.104	0.594	0.555	-0.069
LM1 MD Crown	0.147	0.293	0.595	-0.214	-0.322	-0.311	-0.29	-0.113	-0.177
LM1 MD Cervix	0.379	0.174	0.088	0.623	0.195	-0.328	-0.203	-0.194	0.016
Eigenvalue	0.896	0.753	0.062	0.025	0.017	0.008	0.007	0.003	0.001
% Variance	50.559	42.512	3.507	1.418	0.978	0.464	0.375	0.16	0.026

Figure 5 provides a graphic representation of the measurements per group arranged according to the degrees of their projections onto the first two principal component axes. There is considerable overlap in the distributions of crown and cervix sizes between the groups, likely due to the wide range of variation among human teeth. Many of the sites are scattered, occupying spots at all four corners on the two axes. The Archaic Age and Ceramic Age groups are primarily clustered in the center of the plot and do not form separate clusters from one another (except for Cueva del Infierno and Chorro de Maíta).

Canímar Abajo OC is mainly concentrated on the upper half in several clusters with both positive and negative eigenvalues for PCI and mostly positive values for PCII. Canímar Abajo YC has only positive values for PCI and mostly positive values for PCII. Cueva del Infierno is closely clustered with mainly positive PCI values and almost all negative PCII values. Playa del Mango and Los Indios have wide ranges of positive and negative values for both components. Punta Candelero is concentrated in the lower half of the figure with both positive and negative PCI values but mainly negative PCII values. Chorro de Maíta has a range of positive and negative PCI values and only positive PCII values. Jelica has a much smaller range and is clustered away from most of the Caribbean groups. All Jelica measurements had negative eigenvalues for PCI and many had negative values for PCII.

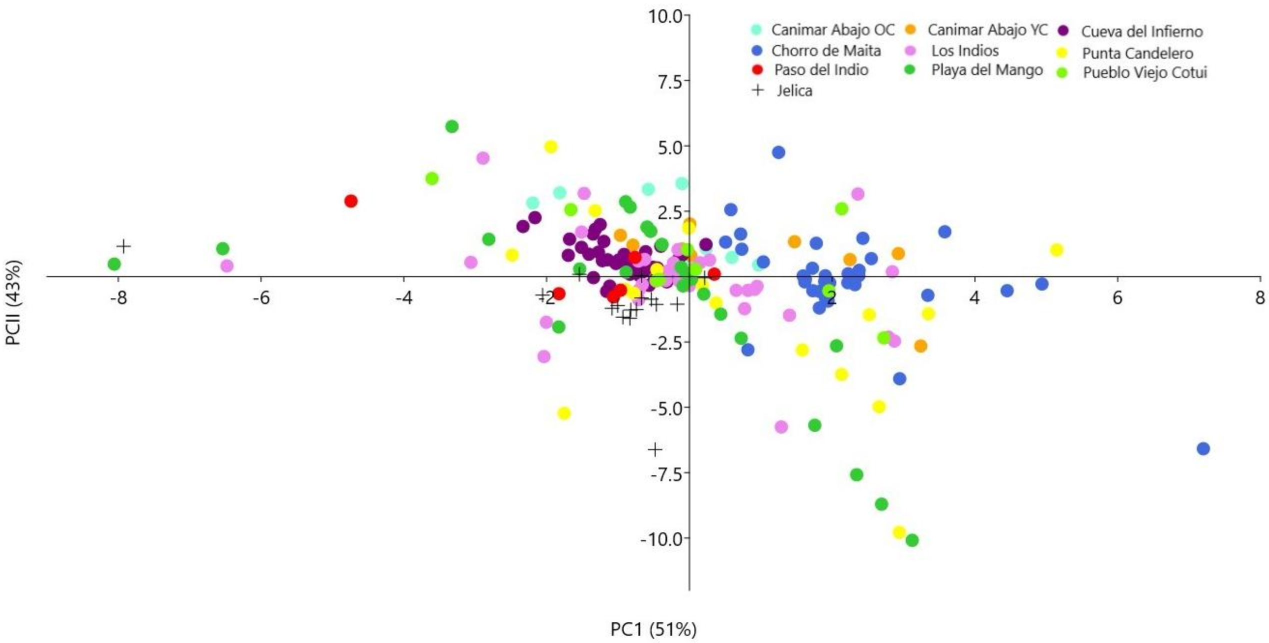

Figure 5: Principal Component Analysis (PCA) scatter plot of 15 tooth crown and cervix measurements.

4.2.2 Statistical Analysis of Non-Metric Dental Traits

A total of 11 non-metric traits were included in the MMD analysis from Canímar Abajo OC and YC, Chorro de Maíta, Jelica, James W. Lee Collection, Los Indios, Punta Candelero, and Playa del Mango (Appendix B Table B.10). Significant distances were observed between the outlier Jelica and all Caribbean groups (Appendix B Table B.11, Figure B.1, and Figure B.2). For the analysis of Caribbean groups, 8 non-metric traits were included in the MMD analysis. The summary can be seen in Table 9 with the number of possible observations (n), the number of positive observations (k), and the relative frequency (%) per trait for each group examined for MMD.

Table 9: Summary information for the 8 dental non-metric traits used in the Mean Measure of Divergence (MMD) including the number of possible observations (n), the number of positive observations (k), and the relative frequency (%) per trait for each group examined.

	Sites																				
	CA OC			**CA YC**			**CM**			**JL**			**LI**			**PC**			**PM**		
Dental Non-Metric Trait (Key Tooth)	n	k	%	n	k	%	N	K	%	n	k	%	n	k	%	n	k	%	n	k	%
Carabelli (UM1)	3	1	33	10	3	30	47	9	19	17	9	53	8	2	25	2	1	50	3	2	67
Metacone (UM2)	4	4	100	8	8	100	62	62	100	16	16	100	12	12	100	3	3	100	10	10	100
Peg-reduced-missing (UM3)	11	5	45	9	2	22	34	7	21	15	11	73	21	8	38	10	2	20	9	1	11
Anterior Fovea (LM1)	2	0	0	4	4	100	21	10	48	7	7	100	15	7	47	10	3	30	3	2	67
Protostylid (LM1)	16	16	100	19	16	84	38	36	95	10	6	60	29	29	100	18	17	94	8	7	88
Cusp 6 (LM1)	4	1	25	5	3	60	29	3	10	8	1	13	16	3	19	11	3	27	3	2	67
Root Number (LM1)	13	0	0	18	0	0	29	2	7	6	4	67	33	0	0	21	1	5	12	0	0
Enamel Extension (LM1)	16	6	38	14	2	14	32	1	3	10	2	20	32	7	22	15	0	0	10	3	30

Site abbreviations= CA OC: Canímar Abajo Old Cemetery, CA YC: Canímar Abajo Young Cemetery, CM: Chorro de Maíta, JL: James W. Lee Collection, LI: Los Indios, PC: Punta Candelero, PM: Playa del Mango.

Table 10: Pairwise MMD values (top) and standard deviation (bottom) based on 8 non-metric dental traits.

	CA_OC	**CA_YC**	**CM**	**JL**	**LI**	**PC**	**PM**
CA_OC		0.353	0.148*	1.058*	0	0	0.015
CA_YC	0.174		0.238*	0.679*	0.155	0.153	0
CM	0.128	0.08		1*	0.055*	0	0.221*
JL	0.157	0.111	0.07		0.971*	0.806*	0.808*
LI	0.142	0.092	0.049	0.079		0	0.05
PC	0.194	0.144	0.106	0.129	0.124		0
PM	0.206	0.157	0.113	0.142	0.126	0.178	

Note. Significant values indicated by *. Site abbreviations= CA OC: Canímar Abajo Old Cemetery, CA YC: Canímar Abajo Young Cemetery, CM: Chorro de Maíta, JL: James W. Lee Collection, LI: Los Indios, PC: Punta Candelero, PM: Playa del Mango.

The MMD values were calculated for 8 non-metric traits (Table 10). Low MMD values indicate similarity between two groups, while higher values imply higher between-group phenotypic distances (Irish, 2010). Several pairwise comparisons returned negative MMD values, it is not possible for two groups to have a biological distance less than 0, therefore the value is set to 0 (Irish, 2010). In addition to the MMD, the overall measure of divergence (MD) was calculated (Appendix B Table B.12). MD is the sum over all the possible couples of samples for a certain trait, it is an indicator for the utility of the given traits in the MMD analysis (Santos, 2018). The anterior fovea of LM1 was the trait with the most discriminatory power between the groups, while the Carabelli cusp of UM1 was the least useful.

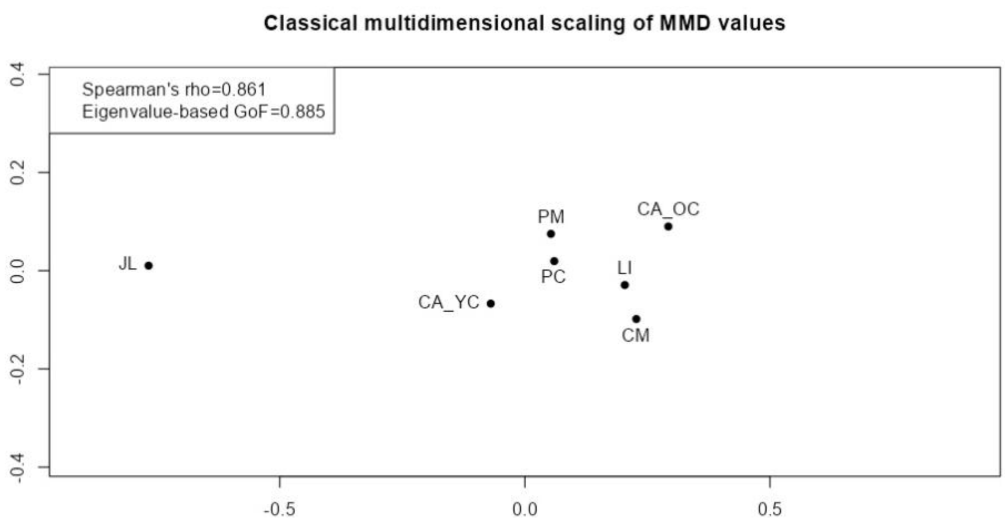

Figure 6: Two-dimensional multidimensional scaling (MDS) plot based on Mean Measure of Divergence (MMD) values. Site abbreviations= CA OC: Canímar Abajo Old Cemetery, CA YC: Canímar Abajo Young Cemetery, CM: Chorro de Maíta, JL: James W. Lee Collection, LI: Los Indios, PC: Punta Candelero, PM: Playa del Mango.

Biological distance among groups is shown in the MDS (Figure 6) and hierarchical clustering using Ward's method (Figure 7). There were non-significant distances between the Archaic Age groups, regardless of geography and chronology. The closest samples were from the most recent Archaic Age groups of Canímar Abajo YC and Playa del Mango (MMD 0), and the largest distance was between the oldest Archaic Age group of Canímar Abajo OC with the later YC (MMD 0.353).

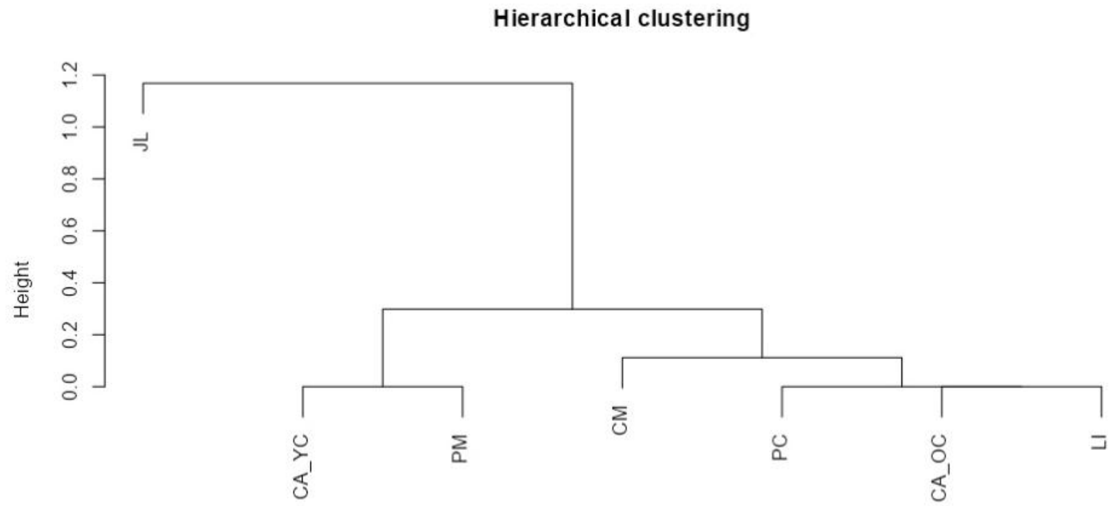

Figure 7: Hierarchical clustering using Ward's Method based on Mean Measure of Divergence (MMD) values. Site abbreviations= CA OC: Canímar Abajo Old Cemetery, CA YC: Canímar Abajo Young Cemetery, CM: Chorro de Maíta, JL: James W. Lee Collection, LI: Los Indios, PC: Punta Candelero, PM: Playa del Mango.

Among the Ceramic Age groups, the MDS plot shows a clear separation between the James W. Lee Collection (significant MMD range 0.806-1) from Jamaica and the other groups located on the neighboring islands of Cuba and Puerto Rico. Chorro de Maíta was significantly different from Los Indios (significant MMD 0.055) and had a non-significant difference with Punta Candelero. There were low non-significant distances between Los Indios and Punta Candelero.

When comparing the Archaic Age and Ceramic Age groups, the James W. Lee Collection was significantly different from the Archaic Age groups (significant MMD range 0.697-1.058). All Archaic Age groups were significantly different from Chorro de Maíta (significant MMD range 0.148-0.238). There were no significant differences between Canímar Abajo OC, Canímar Abajo YC, Playa del Mango, Los Indios, and Punta Candelero.

On the MDS plot of Figure 7 there is a central cluster of Canímar Abajo YC, Playa del Mango, Punta Candelero, Los Indios and Chorro de Maíta. Meanwhile, the groups from Canímar Abajo OC and the James W. Lee Collection are located separately from the central cluster. Spearman's rho (correlation coefficient) measures the strength and direction of association between the rankings of two variables. The associated high Spearman's rho value (0.861) in Figure 6 indicates that the pairwise MMD dissimilarity matrix was well characterized by the two dimensions of the MDS plot. Similarly, in the cluster dendrogram of Figure 7, the James W. Lee Collection branches off from the remainder of the groups. The remainder of the groups form two clusters from the main branch. Punta Candelero, Canímar Abajo OC, and Los Indios are clustered together with a slight separation of Chorro de Maíta, while Canímar Abajo YC and Playa del Mango are located separately from the cluster.

4.2.3 FLEXDIST for Metric and Non-Metric Dental Trait Analysis

For the FLEXDIST analysis, 33 metric and non-metric traits were included from 48 individuals. The individuals were spread amongst Canímar Abajo OC (n=2) and YC (n=4), Chorro de Maíta (n=23), Los Indios (n=1), Punta Candelero (n=2), Playa del Mango (n=3), and Jelica (n=13). The summary statistics of the metric and non-metric traits used for FLEXDIST analysis can be seen in Tables 11 and 12.

Table 11: Summary information of 18 dental metric traits used for FLEXDIST analysis including number of individuals measured (n), mean (M), and standard deviation (SD).

Dental Metric Trait (Key Tooth)	Sites																				
	CA OC			CA YC			CM			LI			PC			PM			Jelica		
	n	M	SD	n	M	SD	n	M	SD	n	M	SD	n	M	SD	n	M	SD	n	M	SD
UC BL Crown	2	7.56	0.37	1	7.62	NA	20	8.51	0.53	1	8.75	NA	2	7.38	0.85	1	7.52	NA	11	8	0.54
UP1 BL Crown	1	8.46	NA	2	8.46	0.46	17	9.31	0.53	0	NA	NA	1	8.12	NA	1	8.73	NA	10	8.34	1.14
UP1 MD Crown	1	7.34	NA	2	6.91	0.09	17	7.29	0.54	0	NA	NA	1	6.38	NA	1	7.25	NA	11	6.65	0.66
UP1 BL Cervix	1	8.19	NA	4	7.98	1.32	17	8.51	0.58	0	NA	NA	0	NA	NA	1	7.86	NA	9	7.57	0.55
UP1 MD Cervix	1	5.06	NA	4	4.91	0.06	14	5.12	0.41	0	NA	NA	0	NA	NA	1	4.54	NA	10	4.76	0.99
UM1 BL Crown	2	11.33	0.08	3	11.85	0.31	18	11.34	0.67	0	NA	NA	0	NA	NA	0	NA	NA	10	10.7	0.47
UM1 MD Crown	2	9.75	0.28	3	10.35	0.14	17	10.53	0.56	0	NA	NA	0	NA	NA	1	10.9	NA	9	9.71	0.47
UM1 MD Cervix	2	7.99	2.29	4	8.2	0.37	14	8.16	0.53	0	NA	NA	0	NA	NA	3	7.37	0.42	9	7.22	0.3
LI2 BL Crown	2	5.82	0.08	4	5.72	0.27	21	6.19	0.39	1	6.17	NA	0	NA	NA	3	5.98	0.14	8	6.01	0.27
LI2 MD Crown	2	6.12	0.24	4	5.6	0.41	21	6.11	0.39	1	6.37	NA	0	NA	NA	3	6.06	0.23	6	5.6	0.17
LI2 BL Cervix	2	5.74	0.075	4	6.07	0.32	21	6.14	0.39	1	6.11	NA	0	NA	NA	3	6.06	0.13	7	5.8	0.24
LI2 MD Cervix	2	3.59	0.2	4	3.84	0.33	21	4.11	0.32	1	3.89	NA	0	NA	NA	3	3.87	0.22	7	3.58	0.22
LC BL Cervix	1	7.41	NA	4	7.89	0.42	17	7.38	0.62	0	NA	NA	0	NA	NA	3	7.62	0.12	10	7.16	0.49
LP1 BL Crown	1	7.27	NA	4	7.71	0.28	16	7.67	0.38	1	7.97	NA	2	7.38	0.24	2	7.09	0.56	11	7.31	0.43
LP1 MD Crown	1	6.99	NA	4	7.09	0.64	15	6.79	0.48	1	7.42	NA	2	6.56	0.4	2	7.04	NA	11	6.49	0.24
LP1 MD Cervix	2	4.75	0.03	4	5.16	0.27	13	5.11	0.75	1	5.63	NA	2	4.89	0.09	1	5.04	NA	9	4.61	0.22
LM1 MD Crown	2	11.1	0.15	2	12.08	0.48	14	11.45	0.42	1	10.6	NA	2	10.8	0.17	2	10.8	0.02	8	10.6	0.35
LM1 MD Cervix	2	9.17	0.19	4	9.64	0.14	11	9.51	0.76	1	8.02	NA	2	8.91	0.14	3	8.88	0.17	8	8.36	0.49

Site abbreviations= CA OC: Canímar Abajo Old Cemetery, CA YC: Canímar Abajo Young Cemetery, CM: Chorro de Maíta, LI: Los Indios, PC: Punta Candelero, PM: Playa del Mango, Jelica: Jelica-Gradina.

Table 12: Summary information of 16 non-metric traits used for FLEXDIST analysis including number of individuals measured (n), and grade of expression.

Dental Non-Metric Trait (Key Tooth)	Scale	Group	n	Grade							
				0	1	2	3	4	5	6	7
Interruption Groove (UI2)	Nominal	CA OC	0	0	0	0	0	0	0		
		CA YC	1	0	1	0	0	0	0		
		CM	26	13	7	0	0	0	0		
		LI	1	0	1	0	0	0	0		
		PC	1	1	0	0	0	0	0		
		PM	0	0	0	0	0	0	0		
		Jelica	7	5	2	0	0	0	0		
Tuberculum Dentale (UC)	Ordinal	CA OC	1	0	1	0	0	0	0	0	
		CA YC	1	1	0	0	0	0	0	0	
		CM	19	14	3	1	1	0	0	0	
		LI	1	0	1	0	0	0	0	0	
		PC	2	1	1	0	0	0	0	0	
		PM	0	0	0	0	0	0	0	0	
		Jelica	10	10	0	0	0	0	0	0	
Carabelli (UM1)	Ordinal	CA OC	2	2	0	0	0	0	0	0	0
		CA YC	3	2	0	0	1	0	0	0	0
		CM	20	8	8	2	0	1	1	0	0
		LI	1	0	0	0	0	0	0	0	0
		PC	0	0	0	0	0	0	0	0	0
		PM	0	0	0	0	0	0	0	0	0
		Jelica	7	5	0	2	0	0	0	0	0
Metacone (UM2)	Ordinal	CA OC	1	0	0	0	0	1	0		
		CA YC	3	0	0	0	0	2	1		
		CM	19	0	0	0	3	16	0		
		LI	1	0	0	0	0	1	0		
		PC	0	0	0	0	0	0	0		
		PM	2	0	0	0	0	2	0		
		Jelica	11	0	0	1	4	6	0		
Hypocone (UM2)	Ordinal	CA OC	1	0	0	0	1	0	0		
		CA YC	3	0	0	1	1	1	0		

		CM	29	0	5	7	10	7	0		
		LI	1	0	0	1	0	0	0		
		PC	0	0	0	0	0	0	0		
		PM	2	0	0	0	2	0	0		
		Jelica	9	0	0	1	6	2	0		
Cusp 5 (UM1)	Ordinal	CA OC	0	0	0	0	0	0	0		
		CA YC	2	2	0	0	0	0	0		
		CM	17	16	1	1	0	0	0		
		LI	0	0	0	0	0	0	0		
		PC	0	0	0	0	0	0	0		
		PM	0	0	0	0	0	0	0		
		Jelica	3	3	0	0	0	0	0		
Peg-Reduced-Missing (UM3)	Nominal	CA OC	1	1	0	0	0				
		CA YC	3	2	1	0	0				
		CM	14	11	3	0	0				
		LI	0	0	0	0	0				
		PC	1	1	0	0	0				
		PM	1	1	0	0	0				
		Jelica	2	2	0	0	0				
Lingual Cusp Variation (LP2)	Ordinal	CA OC	2	0	0	2	0	0	0	0	0
		CA YC	1	0	0	1	0	0	0	0	0
		CM	25	2	2	14	4	2	0	0	0
		LI	0	0	0	0	0	0	0	0	0
		PC	0	0	0	0	0	0	0	0	0
		PM	0	0	0	0	0	0	0	0	0
		Jelica	4	0	0	2	1	1	0	0	0
Deflecting Wrinkle (LM1)	Ordinal	CA OC	1	0	1	0	0				
		CA YC	0	0	0	0	0				
		CM	14	0	7	6	1				
		LI	0	0	0	0	0				
		PC	2	0	1	1	0				
		PM	1	0	0	1	0				
		Jelica	1	1	0	0	0				
Protostylid (LM1)	Ordinal	CA OC	3	0	2	1	0	0	0	0	0
		CA YC	3	0	1	2	0	0	0	0	0
		CM	23	0	18	4	0	0	0	0	0

		LI	0	0	0	0	0	0	0	0	0
		PC	2	0	1	1	0	0	0	0	0
		PM	2	0	2	0	0	0	0	0	0
		Jelica	8	5	3	0	0	0	0	0	0
Cusp 6 (LM1)	Ordinal	CA OC	2	1	1	0	0	0	0		
		CA YC	0	0	0	0	0	0	0		
		CM	19	17	0	1	1	0	0		
		LI	0	0	0	0	0	0	0		
		PC	2	2	0	0	0	0	0		
		PM	0	0	0	0	0	0	0		
		Jelica	3	3	3	0	0	0	0		
Cusp 7 (LM1)	Ordinal	CA OC	2	2	0	0	0	0			
		CA YC	2	2	0	0	0	0			
		CM	20	15	2	2	1	0			
		LI	0	0	0	0	0	0			
		PC	2	1	1	0	0	0			
		PM	1	0	0	1	0	0			
		Jelica	3	3	0	0	0	0			
Root Number (LM1)	Nominal	CA OC	2	2	0	0	0				
		CA YC	3	3	0	0	0				
		CM	17	16	1	0	0				
		LI	0	0	0	0	0				
		PC	2	2	0	0	0				
		PM	3	3	0	0	0				
		Jelica	10	0	0	10	0				
Enamel Extension (LM1)	Ordinal	CA OC	2	0	0	2	0				
		CA YC	4	4	0	0	0				
		CM	19	18	1	0	0				
		LI	0	0	0	0	0				
		PC	2	2	0	0	0				
		PM	3	2	1	0	0				
		Jelica	9	8	1	0	0				
Groove Pattern (LM2)	Nominal	CA OC	1	0	1	0	0				
		CA YC	0	0	0	0	0				
		CM	15	0	12	3	1				

		LI	0	0	0	0	0				
		PC	2	0	1	1	0				
		PM	1	0	0	1	0				
		Jelica	1	1	0	0	0				
Hypoconulid (LM2)	Ordinal	CA OC	1	0	0	0	1	0	0		
		CA YC	1	0	0	1	0	0	0		
		CM	16	13	0	2	1	0	0		
		LI	0	0	0	0	0	0	0		
		PC	1	1	0	0	0	0	0		
		PM	1	0	0	1	0	0	0		
		Jelica	6	6	0	0	0	0	0		

Site abbreviations= CA OC: Canímar Abajo Old Cemetery, CA YC: Canímar Abajo Young Cemetery, CM: Chorro de Maíta, LI: Los Indios, PC: Punta Candelero, PM: Playa del Mango, Jelica: Jelica-Gradina.

The results of the FLEXDIST analysis including Jelica are visualized in Appendix B Figures B.3 and B.4. Jelica is clustered to the left of the other sites with negative PC1 eigenvalues and both positive and negative PC2 values. In Figures 8 and 9, the results of the FLEXDIST analysis demonstrate the inter-individual relationships between the six Greater Antilles groups. In Figure 8, the first two PCAs that accounted for the most variation were plotted on a scatterplot where each individual is visualized as a centroid estimate of the multiple imputed duplicates of that individual with a confidence ellipse around the centroid. Most individuals are clustered in the center of the plot except for individuals CM 16, CM 75A, and CM 80 from Chorro de Maíta.

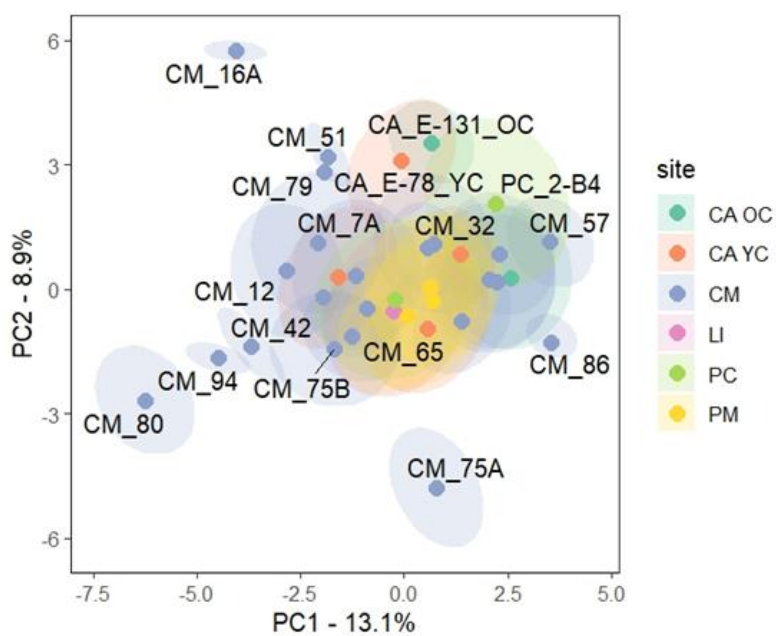

Figure 8: Principal Component Analysis (PCA) plot showing the relatedness between five pre-colonial Caribbean sites estimated with FLEXDIST. Site abbreviations= CA OC: Canímar Abajo Old Cemetery, CA YC: Canímar Abajo Young Cemetery, CM: Chorro de Maíta, LI: Los Indios, PC: Punta Candelero, PM: Playa del Mango.

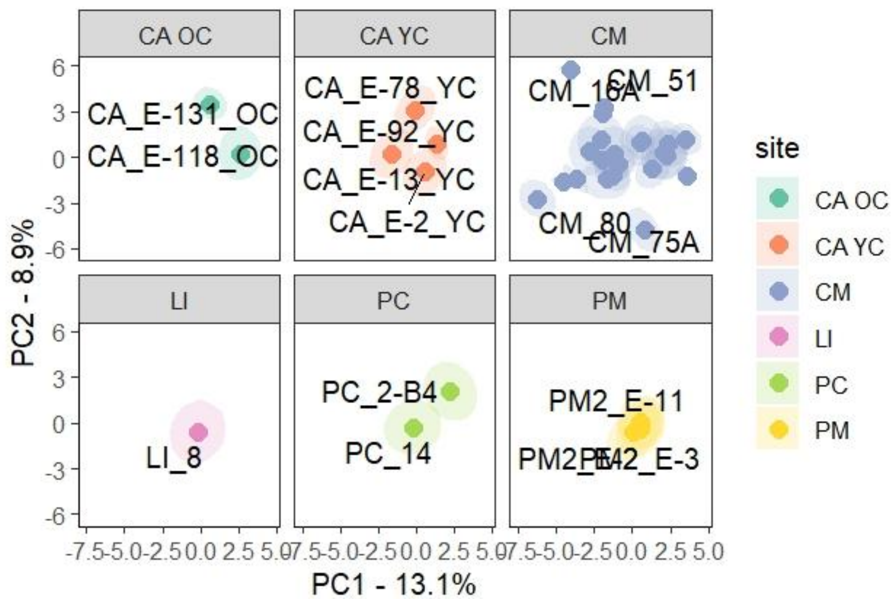

Figure 9: Facet plot showing the relatedness between five pre-colonial Caribbean sites estimated with FLEXDIST. Site abbreviations= CA OC: Canímar Abajo Old Cemetery, CA YC: Canímar Abajo Young Cemetery, CM: Chorro de Maíta, LI: Los Indios, PC: Punta Candelero, PM: Playa del Mango.

Among the Archaic Age individuals, individual CA E-131 from Canímar Abajo OC and CA E-78 from the YC are located at the top of the central cluster, positioned slight apart from the other individuals. Individual CA E-118 from Canímar Abajo OC is located far below CA E-131 and is separate from the other Archaic Age individuals and most Ceramic Age individuals (except those from Chorro de Maíta). Individuals from Playa del Mango are closely clustered together, near CA E-2 from Canímar Abajo YC, but away from the individuals from Canímar Abajo OC. The Ceramic Age individuals from Punta Candelero and Los Indios are closely clustered with Chorro de Maíta and the Archaic Age Playa del Mango, while clustering separately from Canímar Abajo OC and most individuals from Canímar Abajo YC.

Chapter 5 - Discussion

The focus for this research was on answering the following questions: was there biological distance among Archaic Age groups, did Ceramic Age groups share biological affinity, and did Archaic Age and Ceramic Age groups have biological affinity? As well, how did biological diversity between these groups change over time and/or space? The findings of the dental metric and non-metric analyses of the Archaic Age, Ceramic Age, and comparisons of Archaic Age-Ceramic Age will be examined separately to better address the research questions of this study. These results will be placed in the context with available literature and further interpreted. The sample and methodological limitations of this study are discussed, including the impact of these issues on the results.

5.1 Archaic Age Biological Diversity

The first research question, addressing whether there was biological distance among Archaic Age groups, was evaluated using statistical tests of metric and non-metric dental traits from four groups in Cuba. The metric trait analysis showed variation between the Archaic Age groups as the UM1 MD cervix from Playa del Mango was significantly different from all sites and the LM1 MD crown from Cueva del Infierno was significantly different to Canímar Abajo OC and YC. In the non-metric trait analysis, the cemeteries of Canímar Abajo showed the greatest biological distance from each other, and low distances were detected between the remaining groups. The FLEXDIST analysis confirmed the low biological variation among the Archaic Age groups; however, individuals from the cemeteries of Canímar Abajo grouped separately from Playa del Mango indicating distinct differences between them.

The metric, non-metric, and FLEXDIST analyses indicate notable variation between the groups, even though there was a high degree of biological resemblance across all Archaic Age individuals. Low general biological variation is expected among Archaic Age populations in the Greater Antilles (Fernandes et al., 2007), as Indigenous populations in the Americas have lower general genetic diversity compared to other regions (Wang et al., 2007). The Archaic Age groups included in this study shared similar measurements for 13 out of the 15 metric traits, had low non-significant MMD values (except for the cemeteries of Canímar Abajo), and overlapped in the FLEXDIST analysis between the individuals from Playa del Mango with E-2 from Canímar Abajo YC. Despite the low general variation, distinct differences were detected between groups that should not be ignored. There was significant variation among two dental measurements (UM1 MD cervix and LM1 MD crown), and biological distances between the cemeteries of Canímar Abajo were larger than previously observed differences in MMD (Coppa et al., 2008).

Coppa et al. (2008) reported low non-significant differences among Archaic Age groups from Cuba and the Dominican Republic based on non-metric dental traits, regardless of geography and chronology. While at face value, the findings from this current study are similar to Coppa et al. (2008), it is not methodologically comparable as they pooled sixteen Archaic Age groups together as “Ciboney Cuba” to create a larger sample size for statistical analysis. By combining multiple sites into one sample, any inter-site differences were masked, and the distances would be averaged and therefore reduced. Their results are not necessarily reflective of the underlying biological relationships between the “Ciboney sites”, other Archaic sites, and Ceramic sites included in their study.

By analyzing each site as a separate group, although it resulted in sample size limitations that will be discussed later in this chapter, this current study aimed to better assess the underlying biological relationships. When examined together, metric, non-metric, and FLEXDIST analyses demonstrate some significant biological distances among the Archaic Age samples. The non-metric trait results returned larger MMD values reaching 0.353 compared to the 0.023 published by Coppa et al. (2008). The low MMD values detected in Coppa et al. (2008) were likely influenced by unequal sample sizes, as 60% (956 teeth) of the Cuban Archaic Age sample originated from Cueva del Infierno, compared to 398 teeth (25%) from the combined “Ciboney” group (with only 11 teeth from Canímar Abajo), and 233 teeth (15%) from Cueva del Perico I. Potential differences between smaller samples were likely not detected, and the similarities between the groups could have been inflated and resulted in the low MMD values.

The discrepancies between these results suggest there were more complicated relationships among Archaic Age groups than previously thought, and earlier studies may have inadvertently masked these differences through combining their samples together. Unfortunately, Cueva del Infierno was excluded from the MMD analysis in this current study due to an insufficient number of scorable non-metric traits and could not be compared to the results from Coppa et al. (2008). The results from both studies suggest that Archaic Age groups had biological affinity, but large non-significant variations were observed in this current study. These differences suggest site-specific variations between these populations, who likely developed their own biological interaction networks within the island and/or with new immigrants from similar mainland source regions.

5.1.1 Chronological Variation

When comparing the groups chronology, the most biological diversity was found between groups separated by the largest spans of time, even when they belonged to the same general period. The oldest “Archaic” sample population was from Canímar Abajo, which contains one of the earliest cemeteries (2237-845 cal BCE) in the Caribbean and one of the latest cemeteries (332-1222 cal CE) associated with the Archaic Age. Among the Archaic Age groups, the cemeteries of Canímar Abajo had the largest biological distance, with the non-significant MMD value of 0.353 indicating high between-group phenotypic distances. This was further supported in the MDS plot (Figure 6) where Canímar Abajo OC is set aside from the YC, marking the chronological gap of 1,200 years between them. In the FLEXDIST PCA plot (Figure 8), individual CA E-131 from the OC and CA E-78 from the YC cluster separately from the other individuals. Findings from this study showed that YC burials shared biological affinity with the OC. Small sample sizes from the OC may not adequately capture the population variation, and caution against overinterpretation of the observed pattern.

Despite limitations, these observations provide new contributions to our understanding of Canímar Abajo, as previous interdisciplinary studies have been unable to determine the relationship between the cemeteries. Earlier studies combined the cemeteries into a single sample for analysis, which prevented intra-site examinations and comparisons of the individual cemeteries with other sites (Coppa et al., 2008; Syutkina et al., 2021). Prior genetic studies have not detected different ancestries between the cemeteries, although their analyses were limited by small sample sizes (Fernandes et al., 2021; Nägele et al., 2020), which is not unexpected given the low genetic variation in the Americas. More interdisciplinary research is still needed to unpack the biological connections of the two cemeteries.

Close affinity was observed between the nearly contemporaneous Canímar Abajo YC and Playa del Mango (116 BCE- 241 CE) who shared more biological affinity with each other than the earlier Canímar Abajo OC. Even though the resulting MMD of 0 between the two groups may be an artifact of small sample sizes from Playa del Mango. The population of Canímar Abajo OC shared less metric and non-metric similarities with later groups, as seen in the MDS plot (Figure 6), hierarchical clustering (Figure 7), and FLEXDIST PCA (Figure 8) where the OC is positioned away from most YC and Playa del Mango individuals. These differences likely reflect subtle dental phenotypic changes over time due to microevolutionary forces operating within the population(s). Previous studies have not compared the individual cemeteries of Canímar Abajo to Playa del Mango, however significant dietary differences have reported between Playa del Mango and a combined OC-YC sample from Canímar Abajo (Chinique de Armas et al., 2015). Lastly, the findings of this current study build on existing evidence that Canímar Abajo YC was biologically associated with Archaic Age groups (Nägele et al., 2020) and further supports the belief that Archaic Age populations thrived beyond the timeframes traditionally assigned to them (Antczak & Hofman, 2019).

As Cueva del Infierno was only included in the metric trait analyses, it was difficult to reliably predict the temporal relationships with the other groups. Cueva del Infierno (1625-1400 BCE) shared most metric traits and clustered closely in the PCA scatterplot (Figure 5) with Canímar Abajo OC and the later sites of Playa del Mango and Canímar Abajo YC. These findings, although limited, are consistent with the biological affinity reported by Coppa et al. (2008) between Cueva del Infierno and the other Archaic Age groups in their study.

These findings highlight some of the inherent issues with studies in the Greater Antilles as overall genetic variability in the Americas is low and certain haplogroups are wide-spread throughout the continent (Lalueza-Fox et al., 2003; Wang et al., 2007). Further, the results of previous genetic studies have been impacted by small sample sizes (Fernandes et al., 2021; Lalueza-Fox et al., 2003; Nägele et al., 2020). Even if the Archaic Age groups originally came from different continental areas, the results indicate they were closely related due to overall low variability and the sample sizes were insufficient to capture the biological variation within these populations. Therefore, looking at phenotypic dental variation provides additional value in studying biological variation.

5.1.2 Geographic Variation

When comparing the groups geographically, this study was unable to detect the two distinct ancestries in Western Cuba reported by Nägele et al. (2020). Distinct ancestries were detected between Cueva del Perico and other Archaic Age sites by Nägele et al. (2020), but the site was not included in this study. Coppa et al. (2008) included Cueva del Perico in their analyses and found strong affinities with Cueva del Infierno and the combined Ciboney group. Fernandes et al. (2021) did not observe geographic differences in Cuba. These results were surprising as significant cultural and dietary differences are known between Canímar Abajo and nearby contemporaneous sites (Chinique de Armas et al., 2015; Roksandic et al., 2016), but cultural differences are not necessarily associated with biological differences. To develop a fuller picture of the population variation across Cuba, additional studies will need to incorporate sites from different areas of the island.

5.2 Ceramic Age Biological Diversity

The second research question, addressing whether there was biological affinity among Ceramic Age groups, was evaluated using statistical tests of metric and non-metric dental traits from 6 sites across Cuba, Dominican Republic, Jamaica, and Puerto Rico. In the metric trait analysis, Chorro de Maíta had the most variation with other Ceramic Age groups, including the UC BL crown which was significantly different to Paso del Indio, Punta Candelero, and Los Indios sites from Puerto Rico. In the non-metric dental trait analysis, the James W. Lee Collection yielded significant differences with all groups, suggesting Ceramic Age populations from Jamaica were biologically different from neighboring islands, while groups from Puerto Rico shared biological affinity. In the FLEXDIST analysis, the individuals from Chorro de Maíta had the widest distribution out of all groups, but only two individuals had biological affinity with LI 8 from Los Indios and PC 14 from Punta Candelero.

Coppa et al. (2008) also reported differences between Chorro de Maíta and Ceramic Age groups from Puerto Rico. Unfortunately, Coppa et al. (2008) combined three sites from Puerto Rico into a single group labeled as ‘Saladoid’, therefore it was not possible to determine if there were similar inter-site differences between the islands. Comparisons of the two islands returned low but significant biological distances in this study (MMD value 0.055) and Coppa et al. (2008) (MMD 0.074). Similar to the MDS plot in this study (Figure 6), Chorro de Maíta clustered separately from the other Ceramic Age sites in Coppa et al. (2008). As well, Pueblo Viejo de

Cotuí could not be included in the MMD or FLEXDIST analyses due to small sample size, but significant metric trait differences were only detected with Chorro de Maíta. These findings align with non-metric trait results generated by Coppa et al. (2008) that found significant distances when comparing Dominican Republic sites with Chorro de Maíta (MMD 0.061).

5.2.1 Chronological Variation

When comparing the groups chronologically, more biological diversity was found between coeval sites (Los Indios and Chorro de Maíta) at the end of the Late Ceramic Age. Dental trait analyses between Punta Candelero (500-1100 CE), Paso del Indio (800-1400 CE), and Los Indios (820-1370 CE) strongly suggest biological continuity of populations in Puerto Rico throughout the Ceramic Age. This is further supported by previous research by Nieves-Colón et al. (2020) who found no evidence of significant differences in mtDNA diversity among pre-colonial populations from Puerto Rico sites. The James W. Lee Collection was significantly different from all other Ceramic Age groups; however, the skeletal remains have not been reliably dated, and it is unclear where they fall within the chronology of the Late Ceramic Age and early colonial period.

The later sites of Chorro de Maíta (1460-1670 CE) and Los Indios returned significant distances, suggesting biologically different groups were present in the Late Ceramic Age. These findings were somewhat surprising as there were non-significant distances between Chorro de Maíta and the earlier groups from Puerto Rico. Due to the small sample sizes from Punta Candelero and Paso del Indio, biological differences with Chorro de Maíta may not have been detected and likely influenced these results. These findings align with archaeological evidence indicating trends towards cultural differentiation and regionalization of Caribbean populations during the Late Ceramic Age (Nieves-Colón et al., 2020; Rouse, 1992). However, these outcomes are contrary to genetic analyses performed by Fernandes at al. (2021) and cranial morphological comparisons by Syutkina et al. (2021), who reported that Ceramic Age associated individuals were genetically homogenous. The discrepancy between these findings is likely due to sampling differences as Ceramic Age groups from Jamaica and Chorro de Maíta were not included in Fernandes et al. (2021) and Syutkina et al. (2021).

5.2.2 Geographic Variation

When compared geographically, the non-metric data showed a significant divergence between Jamaica and all other regional samples. The settlement of Jamaica is poorly understood, and it remains unclear when the island was first inhabited and by whom (Keegan, 2019). The earliest sites in Jamaica are associated with local varieties of Meillacoid ceramics, which are believed to represent two distinct migrations originating from western Puerto Rico and eastern Dominican Republic (Allsworth-Jones, 2008; Atkinson, 2006). In contrast with the archaeological data, biological relationships were not observed between Jamaica and Puerto Rico in this study. Despite sharing numerous characteristics with communities on neighboring islands, the archaeology of Jamaica is unique, with ceramic vessel shapes and motifs specific to the island (Allsworth-Jones, 2008; Atkinson, 2006).

A limited number of published studies have compared skeletal remains from Jamaica to populations on neighboring islands. Previous studies comparing cranial morphology have produced conflicting results (Giovas et al., 2021; Ross et al., 2020). Ross et al. (2020) reported three clusters of closely related populations: group one (Jamaica, Bahamas, and Hispaniola), group two (Puerto Rico, Venezuela, and Colombia), and group three (Cuban and Yucatan), which represented three migration routes into the insular Caribbean. Giovas et al. (2021) refuted the conclusions of Ross et al. (2020) that the Jamaica-Bahamas-Hispaniola cluster represented a separate migration of Caribs (also known as Kalinago) from Venezuela into the region and instead found no evidence to substantiate a Carib migration 700 years before Columbus' arrival. Instead, Giovas et al. (2021) found that Puerto Rico was closer to Jamaica and Hispaniola than the South American samples. More interdisciplinary research is needed to further investigate the relationships between the Ceramic Age populations within and between islands in the Greater Antilles.

Despite the significant differences observed in this study, these findings should be considered with caution as there were several issues with the James W. Lee Collection. The skeletal remains were primarily found through surface collections and could include non-Indigenous individuals of European or African ancestry in the early colonial period. In the hierarchical clustering with Jelica (Appendix B Figure B.2), the James W. Lee Collection branches off the clade even before the Serbian outlier. It is unlikely that the Indigenous groups in Jamaica were completely isolated from all neighboring islands, as previous studies identified close biological connections with Puerto Rico and Hispaniola (Giovas et al., 2021). Additionally, due to small sample sizes of individual sites, the dental remains were merged into one group for inclusion in this study. This masked potential differences and underlying variation between the groups in Jamaica. Further testing using different bioarchaeological methods may provide more accurate insights into the connections between populations from Jamaica and the rest of the Greater Antilles.

5.3 Comparing Archaic Age and Ceramic Age Groups

The third research question, addressing whether there was biological affinity between Archaic Age and Ceramic Age groups, was evaluated using statistical tests of metric and non-metric dental traits from 6 sites across Cuba, Dominican Republic, Jamaica, and Puerto Rico. In the metric trait analysis, 5 out of the 15 dental trait measurements showed significant differences between Archaic Age and Ceramic Age groups and Los Indios had the most variation with Archaic Age groups. In the non-metric trait analysis, Archaic Age groups shared biological affinity with the Ceramic Age groups in Puerto Rico and had significant biological distances with the Chorro de Maíta and the James W. Lee Collection. In the FLEXDIST analysis, individuals from Punta Candelero, Los Indios, and Chorro de Maíta shared biological affinity with individuals from Playa del Mango and Canímar Abajo YC, while grouping separately from Canímar Abajo OC. These findings indicate a complex picture of biological continuity between most Archaic Age and Ceramic Age populations on neighboring islands, with notable intra-island differences in Cuba.

The findings of this study contradict prior dental metric and non-metric research, that reported remarkably different patterns between Archaic Age and Ceramic Age groups on neighboring islands (Coppa et al., 1992, 1995, 2003, 2008; Cucina et al., 2003). In this study, close biological affinity was detected in the non-metric trait analysis between Playa del Mango, the cemeteries of Canímar Abajo, and the Ceramic Age groups of Los Indios and Punta

Candelero. These results are likely influenced by the low general biological variation in the region; however, separate clustering of Canímar Abajo OC in the MDS plot (Figure 6) and FLEXDIST (Figure 8) away from the Ceramic Age groups indicates some differences between them.

Findings of non-metric trait differences between Cuban Archaic Age and Ceramic Age groups were consistent with earlier research by Coppa et al. (2008). In the non-metric data analysis of this current study, Canímar Abajo and Playa del Mango had significant differences with Chorro de Maíta (MMD range 0.148-0.238), and Cueva del Infierno clustered separately from Chorro de Maíta in the metric trait PCA (Figure 5). Similarly, Coppa et al., (2008) found Archaic Age populations in Cuba were significantly different than Ceramic Age populations of Chorro de Maíta (MMD range 0.175-0.189), suggesting there was no admixture between the groups.

5.3.1 Chronological Variation

When compared chronologically, both statistical approaches detected patterns of general biological continuity between the Archaic Age and Ceramic Age populations in Cuba, Puerto Rico, and the Dominican Republic. The lack of explicit patterning in the metric PCA (Figure 5), especially since the grouping variable is an archaeological observation, could be considered a strong indication of continuity across chronological periods or homogeneity between cultural groups (Roksandic, 1999). The results from the FLEXDIST PCA (Figure 8) indicated a high degree of biological resemblance among the sampled individuals.

The MDS plot (Figure 6) and hierarchical clustering (Figure 7) help to visualize the complex connections among these groups based on their non-metric trait data. In the MDS plot, there is a upside down 'horseshoe-shaped' pattern characteristic of temporal ordering (Greenacre, 1984). The pattern reflects what would be expected from temporal change as the Archaic Age groups of Canímar Abajo YC and Playa del Mango are located on the left, the Early-Late Ceramic Age groups of Punta Candelero and Los Indios are across the top, and the Late Ceramic Age Chorro de Maíta is located on the right. Canímar Abajo OC differs from the horseshoe pattern as it is located at the top right of the plot, demonstrating some level of variation with the Ceramic Age groups. The James W. Lee Collection also deviates from this pattern and is the furthest away from the curve in dimension one, but in dimension two it has less distance with the other groups. As most groups follow this temporal pattern, it can be considered a strong indication of biological continuity of in the Greater Antilles throughout the pre-colonial and into the early colonial period.

Considering the growing evidence of the influence of Archaic Age communities on the development of later Greater Antilles societies (Boomert, 1999; Keegan & Hofman, 2017; Siegel, 1992), it was notable to find strong levels of biological affinity between these groups. These findings contrast with previous bioarchaeological studies that discussed biological differences between Late Ceramic Age and Archaic Age groups (Coppa et al., 2008; Fernandes et al., 2021; Nägele et al., 2020; Syutkina et al., 2021; Valdés Pi, 2009). Studies on cranial morphometric traits and stature estimates in Cuba also reported significant differences (Chinique de Armas & Roksandic, 2019). Further, Archaic-Ceramic genetic admixture was only detected in 3 out of 201 individuals by Fernandes et al. (2021). Whereas Lalueza-Fox et al. (2003) found no substantial differences in the mtDNA between Archaic Age and Ceramic Age populations from Puerto Rico, Hispaniola and Cuba.

Outliers were identified among the earliest and latest samples included in this study. Canímar Abajo OC differed from the other groups, as the sample was located separately from the other groups in the MDS plot (Figure 6), and individual CA E-131 was as an outlier in the FLEXDIST PCA (Figure 8). A recent stable isotope study by Chinique de Armas et al. (2025) also identified this individual was an outlier, based on the oxygen isotope values from first molars and incisors. Interestingly, CA E-77 from the YC was located near CA E-131 in the FLEXDIST PCA and was reported by Chinique de Armas et al. (2025) to have strontium isotope values out of the local range but oxygen isotope values within the population's range of variation. The outliers of CM 16, CM 75A, and CM 80 from Chorro de Maíta were locals of the area and have not been reported as having any differing features in previous studies (Valcárcel Rojas et al., 2011). As most of the burial population from Chorro de Maíta is believed to be from the early colonial period, these individuals could be of mixed European and Indigenous ancestry and reflect differing dental metric and non-metric traits. Further genetic testing will be needed to determine if these individuals were from a different ancestral background than other Greater Antilles groups.

5.3.2 Geographic Variation

Intra-island variation was revealed between the Archaic Age and Ceramic Age groups in Cuba through the MMD and metric traits analyses. Chorro de Maíta differed from the coeval Canímar Abajo YC in the western side of Cuba, which suggests they belonged to different migratory flows. These findings contribute to a mounting collection of research refuting long-held assumptions that Archaic Age groups were completely replaced by Ceramic Age populations (Hofman et al., 2014; Keegan, 2006; Rodríguez Ramos, 2008). These results showed that Canímar Abajo YC maintained biological differences with Ceramic Age groups while coexisting in Cuba for at least 500 years. This is supported by previous dental morphological studies (Coppa et al., 2008), genetic analyses (Fernandes et al., 2021), and cultural differences between the sites (Keegan & Hofman, 2017).

Interestingly, the results indicated that the Archaic Age groups in Cuba shared biological affinity with Ceramic Age populations in Puerto Rico. The first Ceramic Age groups appeared in Puerto Rico around 400 BCE but did not reach Cuba until at least 1000 years later for unknown reasons (Fitzpatrick et al., 2013; Casale et al., 2023). The Early Ceramic Age is believed to have consolidated developments from the Archaic Age, but whether they mark the spread of a distinct group of people (and if so, which cultural groups they are associated with), is still debated (Elliot et al., 2022). Keegan (2006) theorized that the Ostionoid pottery series and associated cultures developed from Archaic Age groups in Hispaniola, later spreading to the surroundings islands. The pottery at Paso del Indio and Los Indios was part of the Ostionoid series, while Punta Candelero had Cuevas style ceramics associated with the Venezuela-derived Saladoid series (Barnes, 2022; Pantel, 2006; Pestle, 2013). Ceramics were notably absent from Chorro de Maíta burials, but Meillacan ceramics (Ostionoid subseries) were found elsewhere at the site (Rouse, 1992). Findings from this current study suggest greater biological similarities between Cuban Archaic Age and Puerto Rican Ceramic Age groups than previously thought, lending support to

Keegan's theory that the spread of Ostionoid pottery and peoples was from movement of Archaic-associated groups and not migrants from the mainland.

Canímar Abajo YC was the only Archaic Age site coeval with the Ceramic Age groups from Puerto Rico and shared some of the strongest biological similarities. Interactions were possible between these communities due to their proficient skills in seafaring (Keegan & Hofman, 2017). The success of early migrations and successive settlements required strong interaction networks with mainland populations throughout the islands (Hofman et al., 2010). These linkages were lifelines during environmental and/or social, fostering trade of food, goods, tools, and suitable marriage partners (Keegan, 2004). In the available genetic studies, one individual from Paso del Indio was reported to have significant Archaic-related admixture by Nägele et al., (2020), but Fernandes et al. (2021) were unable to detect this result (likely due to differences in statistical methods). The results of Nägele et al. (2020) and Fernandes et al. (2021) were influenced by limited sampling coverage of the transitional period between the Archaic Age and Ceramic Age, and more admixtures could be identified from samples dated to that time. Unfortunately, this current study is also limited to primarily Late Ceramic Age dental samples.

Lastly, inter-island variation was observed between Archaic Age groups from Cuba and the James W. Lee Collection from Jamaica. There are currently no known Archaic Age archaeological sites in Jamaica, but Keegan (2019) proposed that the first inhabitants in the island were Archaic Age groups that settled in Jamaica around 600 CE after they developed redware pottery and horticultural practices. The results of the MMD analysis disagree with this proposed origin, as there were significant biological distances between all Archaic Age groups and the James W. Lee Collection. As previously mentioned in this chapter these findings should be considered with caution due to issues related to the Jamaican samples.

5.4 Study Limitations

5.4.1 Sample Size Limitations

One of the most significant limitations in dental anthropological and bioarchaeological studies are small sample sizes. In the Greater Antilles, there are rarely large numbers of skeletal remains recovered during excavations, and the level of preservation is highly variable between sites. Differential preservation of teeth can restrict the number of samples available for use in a study. Another significant issue is finding Archaic Age sites that have skeletal remains, are available for research, and have an adequate number of teeth for analysis. In this study only three Archaic Age sites from Cuba were included, which allowed for comparisons within the island, but limits the extent that these findings can be applied to other Archaic Age populations in the Greater Antilles.

The sample size can interfere with statistical analyses and how accurately the results represent the study populations. The main issue with small sample sizes is the limited amount of data that can be collected. This can ultimately impact the accuracy of the statistical results. In total 2,671 teeth were scored for this study, but there was considerable variation in sample sizes among the groups. Chorro de Maíta had the largest sample size with 808 teeth, but Paso del Indio only had 30 teeth that could be scored for metric and non-metric traits. As well, only a portion of the teeth from Cueva del Infierno, Los Indios, Paso del Indio, Punta Candelero, and Pueblo Viejo de Cotuí were available for study at the University of Winnipeg. The teeth housed at the U of W were pre-selected for other research studies that required an abundance of specific tooth types including canines, premolars, and molars. Therefore, an even distribution of tooth types was not available for the groups housed at the U of W and this sampling bias likely impacted the results to some degree. Sites like Cueva del Infierno had to be excluded from the MMD analysis as certain key tooth types for non-metric traits (e.g., incisors, mandibular premolars, mandibular first molars) were absent or very few teeth were available for analysis. The sample size for all groups was further reduced when data reduction techniques were used to omit teeth that provided little or no data for further analysis.

These sample size limitations resulted in cases where only a small number of teeth represented an entire population. Small sample sizes can also inflate the average value of dental traits and make their prevalence appear greater than they are. This can be seen in the summary statistics for metric and non-metric traits (Tables 5, 9) where less than 10 teeth per trait were present for certain groups. The sample pool for the FLEXDIST analysis was even smaller as the test compares teeth associated with specific individuals and is not able to accommodate isolated teeth without significant statistical issues (Tables 11, 12). Most of the groups examined as part of the FLEXDIST analysis had 4 or less individuals, except for Chorro de Maíta and Jelica. Even though MMD and FLEXDIST are designed to process small sample sizes and have methods to correct for missing data, the results were impacted by small sample sizes.

5.4.2 Methodological Limitations

Dental morphology patterns are variable within and between populations due to random sampling processes, genetic drift, and other factors. Ancient DNA studies, and those that use genetic proxies like dental metrics and non-metrics, can run into issues with accurately estimating relatedness and reconstructing population affinities due to small sample sizes. While additional factors like dental wear, examination techniques, and statistical methods had some impact on the findings of this study.

The confounding effect of dental wear on dental morphology studies is well documented (Burnett et al., 2013), as it progressively removes details from the crown even at mild to moderate levels. There are general recommendations to only score teeth without excessive wear but there are no standards on how much wear is too much and few studies have investigated how wear can obscure individual traits (Burnett et al., 2013). Moderate to severe dental wear was present in almost every group examined and proved to be a major limitation regarding what traits could be reliably scored. Most morphological traits from incisors, canines, and pre-molars were excluded from the final analysis as the scorable features were obliterated. The information from these teeth will remain unknown until more wear-resistant methods can be used in future studies.

For both the metric and non-metric analyses, a significant number of traits had to be excluded from the statistical analyses due to intra-observer error, sexual dimorphism, obliteration by wear, and small sample sizes. For the MMD analysis of non-metric traits, only eight traits were included out of the original thirty-two traits used for scoring. Using a large set of dental traits is not necessarily more reliable, but certain traits have been found to better preserve neutral genomic variation (Rathmann & Reyes-Centeno, 2020). Only two of the five traits identified by Rathmann & Reyes-Centeno (2020), protostylid (LM1) and cusp 6 (LM1), were included in the MMD as a significant number of canines and pre-molars were too worn to score or absent. Additionally, the Carabelli cusp (UM1) was used in the MMD analysis, but its expression may be triggered more by environmental factors rather than natural selection (Mizoguchi, 2013). The remaining non-metric traits are still highly heritable and useful for estimating biological affinity between past groups, but the results should be considered with caution and are not definitive.

Lastly, the FLEXDIST software combined the metric and non-metric datasets into a single analysis, but the results may not fully represent the diversity between the groups. The test was chosen as it combines all dental morphological traits into one test, can handle high levels of missing data, and had a fully automated published R script for use. This method shows great potential for better understanding Archaic Age and Ceramic Age populations, but the samples examined in this study were not well-suited for this test and its requirements. Many groups had only a few teeth present from each known individual and others had isolated teeth with uncertain contextual backgrounds (including Cueva del Infierno) that had to be excluded from the analysis. Out of the eleven groups, only Jelica and Chorro de Maíta had more than four individuals with at least 50% of their teeth that could be included in the FLEXDIST analysis. It is difficult to accurately project the results onto the rest of the populations when so few individuals from each site could be included without sacrificing the effectiveness of the test. This method is still new and should be further used to compare more pre-colonial Greater Antilles sites with larger samples.

Chapter 6 - Conclusions

The first objective of this study was to assess the intra and intergroup biological diversity of Archaic Age and Ceramic Age populations. The second objective was to examine the chronological and spatial patterning of the population variation. Metric and non-metric dental traits from four Archaic Age groups, seven Ceramic Age groups, and an outlier from Serbia were assessed using two statistical approaches. The first approach involved analyzing metric and non-metric data through separate statistical analyses, and the second approach combined the different datatypes into a single analysis.

The differences observed in both statistical approaches support the notion of biological variation among Archaic Age groups. The most biological diversity was found between the cemeteries of Canímar Abajo, and low general variation was detected among the later Archaic Age groups. Variability was observed among the coeval sites at the end of the Late Ceramic Age; however, Ceramic Age groups from Cuba, Puerto Rico, and the Dominican Republic were found to generally share strong biological affinity.

Notable variation was indicated between the oldest Archaic Age site of Canímar Abajo OC with the Ceramic Age groups. Meanwhile, patterns of biological continuity were generally seen throughout the pre-colonial period between the Archaic Age groups from Cuba with the Ceramic Age groups from Puerto Rico and the Dominican Republic. The metric and non-metric analysis differentiated between the Archaic Age and Ceramic Age sites in Cuba, suggesting biologically diverse groups cohabitated on the island. The James W. Lee Collection was significantly different from all other groups, potentially suggesting a separate mainland origin;

however, the dental remains may not be exclusively from Indigenous peoples of the Greater Antilles.

6.1 Further Research

For further insights into the biological affinity and diversity of these past populations, it would be beneficial to include a broader sample of Archaic Age and Ceramic Age sites from other areas in Cuba and the Greater Antilles. Incorporating more samples from the Early Ceramic Age in future studies will help answer several pervasive questions about their initial interactions on the islands. To better understand the mainland origins of these groups, coeval mainland populations should be included for comparison.

It would be beneficial to use dental traits less resistant to wear, a significant limitation of most dental morphological studies, including this study. Future studies incorporating different lines of evidence, including aDNA, stable isotope analysis, dental morphology and skeletal morphology will help researchers better understand variations between Archaic and Ceramic populations and eventually determine their mainland origins. Strontium (Sr) isotope analysis has become a routine method for investigating population movements and this method is now being incorporated into more studies in the Caribbean (Chinique de Armas et al., 2025; Laffoon & Hoogland, 2012; Schulting et al., 2021). Strontium isotope studies, in conjunction with other interdisciplinary methods, will likely become crucial for investigating patterns of mobility and migration in the region.

6.2 Concluding Remarks

Dental metric and non-metric analyses can be useful in highlighting biological relationships within/between islands and identifying biological differences as meaningful population characteristics. While this research was limited in scope to fully understand the biological background of Archaic Age and Ceramic Age sites, due to limited comparative populations from different time periods and islands, this research shows the utility of a metric and non-metric approach to unravel these unclear parts of pre-colonial and early colonial Caribbean population history. When forming the methods of a study, it is necessary to be aware of site-specific differences and avoid combining Archaic Age (and Ceramic Age) skeletal remains into a single group for larger sample pools. As a starting point for future studies using dental anthropology within the Caribbean, this study adds to previous knowledge about these diverse groups and the complex interaction webs they built over thousands of years.

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Appendix A: List of Samples and Archaeological Context

Table A.1: Complete table of samples included in this study, listing age, sex, archaeological context, and radiocarbon dating when known.
*: Individuals with genetically determined sex from Nägele et al. (2020). Radiocarbon dates from Chinique de Armas et al. (2020), Nägele et al. (2020), Pestle (2013), and Roksandic et al. (2015).

Sample ID	Site	Country	Block/ Grid	Level (m)	Sex	Age	Radiocarbon Date	Contents	Teeth Present
CA E-2	Canímar Abajo Old Cemetery	Cuba		1.50-1.60				Loose teeth	LRM1
CA E-9	Canímar Abajo Old Cemetery	Cuba	C-151	2.10-2.20				Loose teeth	LRC, LLP2, LLM1
CA E-11 (1)	Canímar Abajo Old Cemetery	Cuba		1.60-1.70				Loose teeth	ULM3
CA E-12	Canímar Abajo Old Cemetery	Cuba		1.70-1.80				Loose teeth	ULM2
CA E-19	Canímar Abajo Old Cemetery	Cuba			F	Young adult	1130-910 cal BCE	Loose teeth	LRM1, LRM2, ULI2?, LRP1?, LRP2
CA E-88 (42)	Canímar Abajo Old Cemetery	Cuba	C-120	1.57	F	Young adult		Loose teeth	LRM3
CA E-104	Canímar Abajo Old Cemetery	Cuba			F (XX)*		1260 - 1102 cal BCE	Loose teeth	ULM3, LP?
CA E-105(4)	Canímar Abajo Old Cemetery	Cuba	C-117	1.70-1.90	F	Young adult		Portion of maxilla and mandible	LRM1, LLM2, ULI1, URI1, URC, ULP1, ULP2, URM3, URI2, ULI2, ULC, LRI1, LLC, LLP1, LLP2, URP2, URP1, LRP2, LRP1, LRC, LLI2
CA E-106	Canímar Abajo Old Cemetery	Cuba			I	Full adult		Loose teeth	LRM2, LRM3
CA E-107	Canímar Abajo Old Cemetery	Cuba			M	Young adult		Loose teeth	LLM3, LLI1, LLC, LRI1, LRP1
CA E-108	Canímar Abajo Old Cemetery	Cuba		2.10-2.20				Loose teeth	LRI1, LRI2, LRP1
CA E-114/115	Canímar Abajo Old Cemetery	Cuba		2.0-2.20				Loose teeth	ULI1
CA E-116	Canímar Abajo Old Cemetery	Cuba	C-148	1.60-1.70				Loose teeth	UP?, LP?, LLC?
CA E-117	Canímar Abajo Old Cemetery	Cuba						Loose teeth	M3?, incisor root
CA E-118	Canímar Abajo Old Cemetery	Cuba	C-113, C-114, C-148, C-149	1.40-1.50, 1.80-1.90				Loose teeth	LRM1, URM2, ULC, URC, LRC, LRP1, LRP2, LRM1, ULI1, LRI1, LRI2

CA E-119	Canímar Abajo Old Cemetery	Cuba	C-149, C-150, C-115	1.50-1.60, 1.90-2.00	F (XX)*		1371 -1132 cal BCE	Loose teeth	URM3, UI?, UI?, LRI2?, LM?, UP?, UP?, UI?, LRI2?, LLI2?, LP?
CA E-120	Canímar Abajo Old Cemetery	Cuba	C-147, C-148, C-149	1.70-2.20				Loose teeth	molar?, LLM1?, LLM3, LRM1, URP1, 4 roots, URP2?, ULC?, LLP1?, LP?, LLM2, LM3?, URM3?, URM1, URP1?, ULP2?, LRI2?
CA E-124	Canímar Abajo Old Cemetery	Cuba		1.50-1.60				Loose teeth	LM?, URM2, LLM3, LLP2, LLM1, URP2, LRP2, LRM?, ULM?, UM3?, M?, LLC?
CA E-127	Canímar Abajo Old Cemetery	Cuba	C-105	1.4				Loose teeth	LRM3, LRM1, LRP2, LRP1, LRC, LLM3
CA E-129	Canímar Abajo Old Cemetery	Cuba			I	Adult		Sections of mandible and loose teeth	ULM1, LRM2?, URM3?, URM1, URP2?, URC?, URI2?, ULI2?, ULC?, ULP2?, ULM2?, ULM3?, UM3?, LRP?, LRI1?, LLI2?, LLC?
CA E-131	Canímar Abajo Old Cemetery	Cuba	C-103, C-125, C-126,C-159, C-160	1.90-2.00	I	Adult		Portions of maxilla and mandible	LRM1, LRM2, URM3, URM2, LRP2, ULM2, LRI2, ULM2, URI1, ULI1, ULI2, ULC, ULP1,ULM1, LRM3, LLP1, LLP2, LLM1, LLM2 , LLM3
CA C-127	Canímar Abajo Old Cemetery	Cuba	C-127	1.75-1.98				Isolated teeth	URM3, URM1, URP2, URP1, URC
CA C-156	Canímar Abajo Old Cemetery	Cuba	C-156	1.00-1.05				Isolated teeth	LRP1
CA C-158	Canímar Abajo Old Cemetery	Cuba	C-158	1.25-1.30				Isolated teeth	LLM2
CA E-2	Canímar Abajo Young Cemetery	Cuba			M (XY)*	Mature adult		Loose teeth	LLM1?, LRM1, URP1, URM1, URP2, URC, URI2, ULI2, ULC, ULP1, ULP2, ULM1
CA E-4	Canímar Abajo Young Cemetery	Cuba			F	Full adult		Loose teeth	ULI2
CA E-6	Canímar Abajo Young Cemetery	Cuba	B-2/ C-2, C-119		M	Young adult		Fragments of maxilla	LRI1?, ULM1
CA E-7	Canímar Abajo Young Cemetery	Cuba		0.36	M	Full adult		Cranium and loose teeth	LLM2, URP1, ULC, ULP1
CA E-9	Canímar Abajo Young Cemetery	Cuba		0.42	F	Mature adult		Portion of maxilla and mandible	LRM1, LRM2, URM1, ULC, ULP1, ULP2, ULM1, LRC, LLP2, URC, URP1
CA E-10	Canímar Abajo Young Cemetery	Cuba			F(XX)*	Full adult	cal CE 558 - 638	Loose teeth	LLM1, LLC, LLM1, LLP2
CA E-11(2)	Canímar Abajo Young Cemetery	Cuba	C-149	0.85-0.90				Loose teeth	URC, ULM3, URM2, ULM1, ULP1, URM1, ULM2, URM2, ULI1, ULI2, ULC, ULP2

CA E-13	Canímar Abajo Young Cemetery	Cuba			M	Full adult		Portion of maxilla	LLM1, LLM3, URM3, URM1, supernumerary single cusp tooth, URP2, URP1, ULI2, ULC, ULP1, ULM2,
CA E-27	Canímar Abajo Young Cemetery	Cuba		0.50-0.68				Loose teeth	URM1
CA E-33	Canímar Abajo Young Cemetery	Cuba	C-120	0.68				Loose teeth	LLM1
CA E-39 (E-6)	Canímar Abajo Young Cemetery	Cuba	C-115	0.85-0.9				Loose teeth	LRI1?
CA E-75(27a)	Canímar Abajo Young Cemetery	Cuba	C-117	0.72	F	Full adult		Loose teeth	LRI1?, ULI2, ULI1
CA E-75B	Canímar Abajo Young Cemetery	Cuba						Loose teeth	ULI2?
CA E-78	Canímar Abajo Young Cemetery	Cuba		0.40-0.50	M	Young adult		Loose teeth	URM3, URM2, URM1, URP2?, UI?, UI?, ULC, ULP1, ULM1, ULM2, ULM3, LRM3, LRM2, LRM1, LRP2, LRP1, LRC, LRI2, LRI1, LLI1, LLI2, LLP1, LLP2, LLM1, LLM2, LLM3
CA E-79	Canímar Abajo Young Cemetery	Cuba						Loose teeth	LLM1
CA E-80	Canímar Abajo Young Cemetery	Cuba	C-98, C-121	0.7	M	Full adult		Loose teeth	LLC
CA E-83	Canímar Abajo Young Cemetery	Cuba	C-150, C-151	0.53-0.59	F (XX)*	Mature adult	cal CE 533 - 694	Loose teeth	LRM1, LLM3
CA E-84	Canímar Abajo Young Cemetery	Cuba			F	Young adult		Cranium	ULI2, ULP1
CA E-92	Canímar Abajo Young Cemetery	Cuba	C-151	0.65-0.70	F (XX)*	Full adult	cal CE 600-860	Loose teeth	ULM1, ULM3, ULI2, URI1, URM2, URC, ULC, ULP1, ULP2, LRM1, LRP2, LRP1, LLI2, LLC, LLP1, LLP2, LLM2, LLM3, URC,
CA E-94	Canímar Abajo Young Cemetery	Cuba	C-115, 114	0.70-0.85	M (XY)*		cal CE 344 - 422	Mandible	URP1?, URM3, LRC, URM3, LRP1, LRP2,
CA E-98	Canímar Abajo Young Cemetery	Cuba	C-115	0.50-0.60	F (XX)*			Mandible	URC, LLP2?, URM2
CA E-108	Canímar Abajo Young Cemetery	Cuba			F(XX)*			Cranium and mandible	LRP2, LRP1, LRC, LRI2, LRI1, LLI1, LLI2, LLC, LLP1, LLP2

CA E-130	Canímar Abajo Young Cemetery	Cuba						Section of maxilla and mandible	ULM2, ULM1, ULP2, LRM1, LRP2, LRP1, LRC, LRI1, LLI2, LLC, LLP1, LLP2, LLM1
CA C-105	Canímar Abajo Young Cemetery	Cuba	C-105					Isolated teeth	LLI2
CA C-123	Canímar Abajo Young Cemetery	Cuba	C-125					Isolated teeth	LRC?, LLI2
CA C-125	Canímar Abajo Young Cemetery	Cuba	C-125	0.75-0.85				Isolated teeth	LRI2, LLM1, LLM2
CA C-126	Canímar Abajo Young Cemetery	Cuba	C-126	0.45				Isolated teeth	ULM3, URP2, ULP1, ULP2, LRP1, LLP2, LLM1
CA C-149	Canímar Abajo Young Cemetery	Cuba	C-149					Isolated teeth	LLM2, LRP2, LLP2, LLM2, LRP2, LLP2, URI2?, URC, LRI2
CA C-156	Canímar Abajo Young Cemetery	Cuba	B-96/ C-156					Isolated teeth	LRM1
CA C-157	Canímar Abajo Young Cemetery	Cuba	C-157	0.90-0.95				Isolated teeth	URI1
CA C-159	Canímar Abajo Young Cemetery	Cuba	C-159	0.95-1.05				Isolated teeth	ULM1, LRM1, URM1
CA Dentro bolsa	Canímar Abajo Young Cemetery	Cuba						Isolated teeth	ULI2?, LLP1
CA 2-510	Canímar Abajo Young Cemetery	Cuba						Cranium	URM1
CM 2A	Chorro de Maíta	Cuba			F	Adult		Portion of cranium, mandible	LRI1, LRI2, LRC, LRP1, LLP1, LLP2, LLI2, LLI1
CM 2B	Chorro de Maíta	Cuba			I	9-10		Portion of mandible, mixed dentition with partially erupted adult dentition	URC, LLM1, LLP2, LLP1, LRI1, LRM2?
CM 2C	Chorro de Maíta	Cuba						Loose teeth	LRC
CM 3	Chorro de Maíta	Cuba			F	26-35		Mandible	LLC, LLI2 (crown missing)

CM 4	Chorro de Maíta	Cuba			I	46+		Portion of mandible	LRP2
CM 6	Chorro de Maíta	Cuba			I	6-9		Fragments of mandible and maxilla	URI2, URM1, LRI2, lrm2, LRM1, LLP2(developing), LLM2(developing)
CM 7A	Chorro de Maíta	Cuba			I	A		Cranium with teeth and mandible	URM1, ULI1, ULI2, URM2 (possibly from other individual)
CM 8	Chorro de Maíta	Cuba			I	12-13		Cranium with teeth and mandible	ULM2, ULP1, ULC, ULI1, URI1, URI2, URC, URP1, URP2, LLM2, LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP1, LRP2, LRM2
CM 12	Chorro de Maíta	Cuba			I	12-13		Cranium with teeth, portions of mandible	ULM1, ULC, ULI2, ULI1, URI1, URM1, LLM1, LLC, LLI1, LRI1, LRI2, LRM1
CM 14	Chorro de Maíta	Cuba						loose erupting teeth, mandible with decidous teeth	ULC, LRP2
CM 14C	Chorro de Maíta	Cuba						loose teeth	ULC, ULM1, ULM2, LLC, LLM2, LRM1, LRM2, L?P?
CM 16A	Chorro de Maíta	Cuba			M	18-25		Cranium and mandible	URM3, URM2, URM1, URP2, URP1, URC, URI2, URI1, ULI1, ULC, ULP1, ULP2, ULM1, ULM2, ULM3, ULI2, LLM3, LLM2, LLP2, LLC, LLI2, LRC, LRP2, LRM1, LRM2, LRM3.
CM 19	Chorro de Maíta	Cuba			F	18-25		cranium and mandible	URP2, URP1 (root only), URC, ULC, ULM1 (roots), LLP2, LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP1, LRP2, LRM1, LRM1 (roots only).
CM 21	Chorro de Maíta	Cuba			F	46+		cranium and mandible	URI1, URC, LLP2, LLP1, LLC,LRP1
CM 22	Chorro de Maíta	Cuba			M	16-18		cranium and portions of mandible	URM3, URM1, ULP1, ULP2, ULM1, ULM2, ULM3, LLP2, LLP1, LLC, LLI1, LRC, LRP2, LRM1, LRM2
CM 24	Chorro de Maíta	Cuba			I	10-11		portions of maxilla and mandible	URM2, URM1, URI1, ULI2, ULC, ULP1, ULP2, ULM1, ULM2, LLM2, LLP2 (erupting), LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP1, LRP2 (erupting), LRM2
CM 24B?	Chorro de Maíta	Cuba						Loose teeth	ULM3, URI1, URI2, URM2, LRI2
CM 26	Chorro de Maíta	Cuba			M	Adult		partial cranium, mandible	URM2, LLM3, LLP2, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP2, LRM3
CM 26B	Chorro de Maíta	Cuba						Loose teeth	ULI1, ULI2
CM 26C	Chorro de Maíta	Cuba						Loose teeth	URP1, URC, URI1, ULI1, ULI2, ULC, ULM2, LLP1

CM 28	Chorro de Maíta	Cuba			F	Adult		loose teeth	ULI2, URP1, URP2 (all roots developing)
CM 29	Chorro de Maíta	Cuba			M	26-35		cranium and mandible	URM1, URC, ULI1, ULI2, ULC, ULP (crown missing)?, ULM1, ULP1, ULI2, ULI1, URI1, URI2, URC, URP1
CM 30	Chorro de Maíta	Cuba			I	36-45		cranium (no teeth except root tip), mandible	LLM2
CM 32	Chorro de Maíta	Cuba						cranium, mandible	URM1, URI2, URI1, ULI1, ULI2, LLM1, LLI2, LLI1, LRI1, LRI2, LRM2
CM 33	Chorro de Maíta	Cuba			F	26-35		cranium (no teeth remaining), portion of mandible with one tooth root remaining)	LLC? (only roots remaining)
CM 33B? (in box of 36)	Chorro de Maíta	Cuba						Loose teeth	URM1, URM2
CM 33C? (in box of 36)	Chorro de Maíta	Cuba						Loose teeth	LRC, LRP1, LRM1, LRM2
CM 33E? (in box of 36)	Chorro de Maíta	Cuba						Loose teeth	ULM2
CM 34	Chorro de Maíta	Cuba			M	26-35		portion of right mandible and loose teeth	URM3, URM2, URM1, URP2, URP1, URC, ULP2, ULM1, LLM3, LLM2, LLM1, LLP2, LLP1, LRP1, LRM2, LRM3
CM 34B?	Chorro de Maíta	Cuba						cranium and mandible	LRP1, LRP2, LRM1, LRM2, LRM3
CM 34C?	Chorro de Maíta	Cuba						portion of mandible and loose teeth (not clear if teeth were from this mandible, all in a bag together)	LLC, LLP2, LRP1, LRP2
CM 34D?	Chorro de Maíta	Cuba						loose teeth	URM2, ULM1, LLP1, LRI1, LRC
CM 34T/F?	Chorro de Maíta	Cuba						Loose teeth	ULI2
CM 35	Chorro de Maíta	Cuba			F	18-25		Cranium with no teeth remaining. Mandible	LRM2
CM 36	Chorro de Maíta	Cuba			I	14-15		portion of maxilla and	URM2,URM1, URP2, URC, URIC, URI1, ULI1, ULI2, ULC, ULP1, ULP2, ULM1, ULM2,

								mandible, one loose URM2	LLM2, LLM1, LLP2, LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP1, LRP2
CM 36B	Chorro de Maíta	Cuba						Loose teeth	ULM2
CM no es de 36?	Chorro de Maíta	Cuba						Loose teeth	ULM2
CM 37	Chorro de Maíta	Cuba			F	18-25		portion of mandible and loose teeth	URM3, URM2, URP2, URC, URI2, URI1, ULI1, ULC, ULP1, ULP2, ULM2, LRM2
CM 37B	Chorro de Maíta	Cuba						loose teeth	ULM1?, LRM1? (all very worn), LRC
CM 39	Chorro de Maíta	Cuba			M	46+	Cal CE 1420-1670	mandible and loose teeth	URC, ULI1, ULI2, ULC, LLC, LLP1, LLP2
CM 40	Chorro de Maíta	Cuba			M	18+		cranium and mandible	LRM2
CM 41	Chorro de Maíta	Cuba			I	12-13		fragments of cranium, maxilla in two pieces, mandible, bag with loose teeth (not clear if all teeth are from the same individual)	URM3 (developing), URM2, URM1, URP2, URP1, URC, ULI1, ULC, ULP1, ULP2, ULM1, ULM2, ULM3 (developing), LLM3 (developing), LLM2, LLM1, LLP2 (only root tip), LLC, LLI2, LLI1, LRI1,LRI2, LRP1, LRP2, LRM1, LRM2, LRM3 (developing)
CM 42	Chorro de Maíta	Cuba			M	26-35		cranium, mandible	URM2, URM1, URP2, URP1, URC, URI2, ULI1, ULI2, ULC, ULP1, ULP2, ULM1, ULM2, ULM3, LLM2, LLM1, LLP2, LLC, LLI2, LRI1, LRI2, LRC, LRP2, LRM2
CM 45	Chorro de Maíta	Cuba			M	26-35		fragments of maxilla, mandible	URM3, URM2, URM1, URP2, URP1, URC, URI2, ULI1, ULI2, ULC, ULP1, ULP2, ULM2, ULM3, LLM2, LLM1, LLP2, LLP1, LLC, LLI2, LLI1, LRI1, LRP2, LRM1, LRM2
CM 46	Chorro de Maíta	Cuba			F	Adult		cranium, mandible	ULM2, URM3, URM2 (root tip), URP2, LLM2, LLP2, LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRM2
CM 47	Chorro de Maíta	Cuba			M	26-35		mandible and loose tooth, no card to say if another individual	URM3 (root tips/fragments of crown), URM2 (root tips/fragments of crown), URM1, URP2, URP1, URC, URI1, ULI2, ULC, ULP2, ULM1, ULM2, LLM3, LLP2, LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP1, LRP2, LRM1
CM 47B	Chorro de Maíta	Cuba						Cranium and mandible	URM2, LLM2, LLP2, LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRM2
CM 51	Chorro de Maíta	Cuba			M	18-25		pieces of maxilla and mandible	URM3, URM2, URM1, URP2, URP1, URC, URI2, ULI1, ULI2, ULP1, ULP2, ULM2, ULM3, LLM3 (root tips), LLM2, LLM1, LLP2, LLP1, LLC, LLI2, LRI1, LRC, LRP1, LRP2, LRM1, LRM2

CM 53	Chorro de Maíta	Cuba			F	26-35		pieces of maxilla and mandible	URM1, URP2 (root), URP1, URC, URI2, ULI1, ULI2, ULC, ULP1, ULP2, LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP1, LRP2
CM 55	Chorro de Maíta	Cuba			F	26-35		cranium and mandible	URM1, URP2, URP1, URC, URI2?, ULI2? ULC, ULP1, ULP2, UM1, LLM1, LLP1, LRP1, LRP2, LRM1
CM 57	Chorro de Maíta	Cuba			F	26-35		fragment of maxilla, mandible, loose teeth	URM2, URM1, URP2, URP1, URC, URI2, URI1, ULI2, ULC, ULP1, ULP2, ULM1, ULM2, ULM3, URM3, LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP1,LRP2, LRM2
CM 59	Chorro de Maíta	Cuba			M	46+		loose teeth	URM3, URC, ULM2, LLP1 (root tip),LLI2, LRC, LRP1, LRM1, LRM3, P? (worn with caries)
CM 60	Chorro de Maíta	Cuba			I	Adult		loose teeth	URM3, URM2, URM1, ULC, LLM1?, LLM3?
CM 60B	Chorro de Maíta	Cuba						loose teeth	URI1, ULI1, LRI1
CM 61	Chorro de Maíta	Cuba			F	Adult		fragments of maxilla, mandible, loose teeth	URM3, URM2, URM1, URP2, URC, URI2, URI1, ULI1, ULI2, ULC, ULP2, ULM1, ULM2, ULM3, LLM3, LLM2, LLP2, LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP1, LRP2, LRM1, LRM2, LRM3
CM 65	Chorro de Maíta	Cuba			M	18-25		maxilla and mandible	URM1, URP2, URP1, URC, URI2, URI1, ULI1, ULI2, ULC, ULP1, ULP2, ULM1, ULM2, LLM3, LLM2, LLM1, LLP2, LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRM2, LRM3
CM 67	Chorro de Maíta	Cuba			F	18-25		fragments of mandible, loose teeth	URM2, URC, URI1, ULI1, ULI2, ULC, ULP2, ULM1, ULM2, LRM2, LRP2, LRP1, LRC, LLI1, LLI2, LLC, LLP1, LLP2, LLM1, LLM3?
CM 68	Chorro de Maíta	Cuba			F	18-25		cranium and mandible	URP2, URP1, URC, URI1, ULI1, ULI2, ULC, ULP1, ULM2, LLM3, LLM2, LLM1, LLP2, LLP1, LLC, LLI2, LLI1, LRI2, LRC, LRP1, LRP2, LRM1, LRM2, LRM3
CM 70	Chorro de Maíta	Cuba			F	18-25		fragment of maxilla, mandible, loose teeth	ULI1, ULI2, ULC, ULP1, ULP2, ULM1, ULM2, URM3, LLM3, LRC, LRM2, LRM3
CM 72B	Chorro de Maíta	Cuba			F	18-25		cranium, mandible	URM2, URP2, URP1, URC, URI2, UEI1, ULI1, ULI2, ULC, ULP1, ULP2, ULM1, ULM2, ULM3, LLM3, LLM2, LLM1, LLP2, LLC, LLI2, LLI1, LRI2, LRC, LRP1, LRP2, LRM1, LRM2, LRM3
CM 74	Chorro de Maíta	Cuba			M	36-46		cranium, mandible, loose teeth	URM3, URM2, URC, U?I2 (very worn) ULC, ULP1 ULP2, ULM2, ULM3, LLM3, LlM2, LLP2, LLC, LLI2, LRI2, LRC, LRP1, LRP2, LRM2, LRM3

CM 75A	Chorro de Maíta	Cuba			F	14-16		sections of maxilla, mandible, loose teeth	URM3 (developing), URM2, URM1 (root tips), URP2, URP1, URC, URI2, ULI1, ULI2, ULC, ULP1, ULP2, ULM1, ULM2, LLP2-LRP2
CM 75B	Chorro de Maíta	Cuba						section of cranium and mandible	URM3, URM2, URP2, URP1, URC, URI2, ULC, ULP1, ULP2, LLM3, LLM2, LLM1, LLP2, LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP1, LRP2, LRM2, LRM3
CM 75C	Chorro de Maíta	Cuba			M	Adult		loose teeth	ULP1, LRI1, LRI2
CM 77B	Chorro de Maíta	Cuba						single tooth	ULM3
CM 78	Chorro de Maíta	Cuba			M	26-35		portion of cranium, mandible	URC (root tip), URI1, ULP1 (root tips), ULP2, LLM2, LLP1, LLC, LRI2, LRC, LRP1, LRP2, LRM1
CM 79	Chorro de Maíta	Cuba			I	15-18		portions of maxilla, mandible	URM3 (developing), URM2, URP2, URP1, URC. URI2, URI1, ULI1, ULI2, ULC, ULM1, ULM2, ULM3 (developing), LLM3 (developing), LLM2, LLM1, LLP2, LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP1, LRP2, LRM1, LRM2, LRM3 (developing)
CM 80	Chorro de Maíta	Cuba			I	14-16		cranium, fragments of maxilla, mandible, and loose teeth	URM3, URM2, URM1, URP2, URP1, URC, URI2, URI1, ULI2, ULC, ULP2, ULM2, ULM3, LLM3, LLM2, LLP2, LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP2, LRM2, LRM3
CM 81	Chorro de Maíta	Cuba			F	18-25		cranium, mandible	URM2, URM1, URC, URI2, ULC, ULP2, ULM2, LLP2, LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP1, LRP2, LRM1, LRM2
CM 82	Chorro de Maíta	Cuba			F	14-16		cranium, portion of mandible, loose teeth	URM3, URM2, URP2, URP1, URC, UI2, URI1, ULC, ULM1, LLM3, LLM2, LLP1, LLI2, LLI1, LRI1, LRI2, LRC, LRP1, LRP2, LRM1, LRM2
CM 85	Chorro de Maíta	Cuba			I	4-5		portions of mandible	LRM1, rest all developing/ erupting ULM1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP1
CM 86	Chorro de Maíta	Cuba			F	18-25		cranium, portions of mandible	URM2, URM1, URP2, URP1, URC, URI2, ULC, ULP2, ULM2, LLM2, LLM1, LLP2, LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP1, LRP2, LRM1, LRM2
CM 87	Chorro de Maíta	Cuba			F	26-35		portions of maxilla, mandible, and loose teeth	URM1, URP1, URI1, ULI1, ULP1, ULP2, ULM1, unknown root tip
CM 89	Chorro de Maíta	Cuba			M	26-35		mandible, loose teeth	URM3, URM1, URP1, URC, URI1, ULI1, ULC, ULM1, ULM2, ULM3, LLM3 (root tips), LLP1, LLC, LLI2, LRI1, LRI2, LRC, LRP1, LRP2, LRM1, LRM2, LRM3

CM 91	Chorro de Maíta	Cuba			M	46+		cranium, mandible	URP1 (root tips), URC, URI1, ULI1, ULC, ULP2, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP2
CM 92	Chorro de Maíta	Cuba			M	36-45		cranium, mandible	URC, ULI1, ULP2, LLM3, LLP2, LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP2
CM 94	Chorro de Maíta	Cuba			I	9-11		loose teeth, portions of mandible	URM2, URP1, URC, ULI2, ULC, ULP1, ULP2, ULM1, LLM2 (erupting), LLP2 (erupting), LLP1, LLC (erupting), LLI2, LLI1, LRI1, LRI2, LRM1, LRM2
CM 99	Chorro de Maíta	Cuba			F	36-45		pieces of maxilla and mandible	URM2, URP2, URC, ULP2, LLP1, LRI1, LRP2 (impacted), LRM2
CM 100	Chorro de Maíta	Cuba			M	46+		mandible	LLM2
CM 102	Chorro de Maíta	Cuba			I	4-5		pieces of mandible, loose teeth	URM1 , ULM1, LLM1, LLI1, LRM1, all erupting/developing
CM 103	Chorro de Maíta	Cuba			M	36-45		cranium	URP2, URP1, URC, URI2, URI1, ULI1, ULI2, ULC, ULP2, ULM1, ULM2
CM 106	Chorro de Maíta	Cuba			M	46+		mandible, loose teeth	ULM3, ULM2, LLC, ULI1, LLM3 (impacted), LLM2, LLP2, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP1, LRP2 (root tips)
CI 6A/2	Cueva del Infierno	Cuba						Isolated teeth	20 ULM1
CI SA/1	Cueva del Infierno	Cuba						Isolated teeth	23 ULM1
CI Cs	Cueva del Infierno	Cuba						Isolated teeth	8 LRC, 2 LLC5 URC, 3 ULC
CI hB/1	Cueva del Infierno	Cuba						Isolated teeth	24 URP2
CI 16B/2	Cueva del Infierno	Cuba						Isolated teeth	17 LRM3, 1 LLM3
CI 16B/1	Cueva del Infierno	Cuba						Isolated teeth	20 LRM3
CI hA/1	Cueva del Infierno	Cuba						Isolated teeth	23 ULP1
CI 16A/1	Cueva del Infierno	Cuba						Isolated teeth	24 LLM3
CI Blank 2	Cueva del Infierno	Cuba						Isolated teeth	ULC, LLC, ULC, LRC, LRI2, urc, LRI2, ULC, LRC, LLI2, ULC, LRC, LLI2, ULC, LRC, LRC, LRC, LLC, LRI2, UC?, LRC, ULI2, LRC, LLC?, LLC, ULI2, LLC, LLC, ULI1, LLC, LLC, LRI1
CI 1h B/1	Cueva del Infierno	Cuba						Isolated teeth	9 LRM1, 1 LLM1, M?
CI AdultoB E-1	Cueva del Infierno	Cuba				Adult		Loose teeth	URC?

CI E-21	Cueva del Infierno	Cuba						Loose teeth	LRM1
CI E-21C	Cueva del Infierno	Cuba				1		Loose teeth	LRP1 (developing), LRP2 (developing)
CI E-21D	Cueva del Infierno	Cuba				3-4		Loose teeth	ULC, URI2 (crowns formed, roots developing)
CI E-21E	Cueva del Infierno	Cuba				9-11		Loose teeth	ULC, LRP2, LRM3 (roots developing)
CI E-21F	Cueva del Infierno	Cuba				3-7		Loose teeth	LRI2, URC?, ULP2 , URM3
CI E-29	Cueva del Infierno	Cuba						Loose teeth	molar fragmented
CI E-39	Cueva del Infierno	Cuba						Loose teeth	LRM3
CI I-22	Cueva del Infierno	Cuba						Loose teeth	LRM1
CI I-23	Cueva del Infierno	Cuba						Loose teeth	LRM1
CI I-25	Cueva del Infierno	Cuba						Loose teeth	LRM1
CI I-26	Cueva del Infierno	Cuba						Loose teeth	LRM1
CI I-27	Cueva del Infierno	Cuba						Loose teeth	LRM3?
CI I-29	Cueva del Infierno	Cuba				10+		Loose teeth	LRM1
CI I-31	Cueva del Infierno	Cuba				7+		Loose teeth	LRM3 (fragmented and developing)
CI I-40	Cueva del Infierno	Cuba				10+		Loose teeth	LRM1
CI I-41	Cueva del Infierno	Cuba				4-6		Loose teeth	LRM3 (fragmented and developing)
CI I-43	Cueva del Infierno	Cuba				10+		Loose teeth	LRM3 (roots broken)
PM C-E5	Playa del Mango	Cuba	Mound 1/ B1/E5	Level 1	I	Adult		Loose teeth	LLC, LRM1, LRP1, LLC, LLC, LLP2, URM3?
PM C-T4	Playa del Mango	Cuba	Mound 1/B1/T 4	Level 1	I	Adult		Fragments of maxilla and loose teeth	LLP2, LRC, LRM2, LRC, LRM2, LRC, UP?, fragments of roots, ULM3, ULM1, ULP1, LLI2
PM M43	Playa del Mango	Cuba	Mound 1/B1	Level 1	I	Adult		Loose teeth	URP1,URP2, URM1
PM M78	Playa del Mango	Cuba	Mound 1					Loose teeth	URC

PM R4	Playa del Mango	Cuba	Mound 1 B1/R4	Level 1	I	Adult		Loose teeth	LRI1?, LRM3, LLI1, ULP1, URM3, LRM3, LRP1, M?, LRM3
PM R5	Playa del Mango	Cuba	Mound 1					Loose teeth	ULI1
PM Mound 1 Isolated teeth	Playa del Mango	Cuba	Mound 1					Isolated teeth and pieces of mandible	ULM3, ULP1?, LRM2, LLM3, LLC, LLM1, LLM2, URM3, LLM2?, ULM2, LLP1, ULC, LRI2, LLI1?, LLC, LLC, LRC, LRC, URM2, LLM2, LLP1, LRM2, LC?, LRM1, LRP2, LRP1, LRC, LLP1, LLP2, LLM1, LLM2
PM E-1	Playa del Mango	Cuba	Mound 2/B4/C -5, C-14, C-8	0.10-0.25	M	Adult	CE 48-235	pieces of mandible and loose teeth	URM2, URI2?, LRM2, LRM1, LRP2, LRP1, LRC, LRI1?, LLC, LLM3,
PM Associated A1 Cranium	Playa del Mango	Cuba	Mound 2					Loose teeth	URP2?, URI2?, UI?, ULI2?, ULP2?, LRC, LRI2, LRI1, LLI2, LLC
PM E-2	Playa del Mango	Cuba	Mound 2/B4/C -5, C-8	0.10-0.25	F (XX)*	Adult	CE 15-225 CE	fragments of maxilla, mandible, loose teeth	LLM1, LLM2, LM3?, URM1, URM3, URM2, URP2, URP1, URC, URI2, URI1, ULI1, ULI2, ULM3, ULM2, ULM1, ULP2, ULP1, LRM3, LRM2,LRM1, LRP1, LRC, LRI2, LRI1?, LLI1?, LLI1?, LLI2, LLC, LLP2, LLM3, LRP1, LRC, LLP2, LRP1, LLP2, LRP1
PM E-3	Playa del Mango	Cuba	Mound 2/B4/C -11, C-10	0.10-0.25	M (XY)*	Adult	116 BCE - CE 75	pieces of mandible and loose teeth	URM2, URM1, URC?, LRM2, LRP1, LRI2, LRI1, LLI1, LLI2, LLC, LLP2, single cusp supernumerary tooth (no crown), LLM1, LLM2, LLM3, LRM1, LRM3, URM2
PM E-4	Playa del Mango	Cuba	Mound 2/B4/C -11, C-4	0.10-0.25	F	Adult	52 BCE - CE 58	Loose teeth	ULM2
PM E-5	Playa del Mango	Cuba	Mound 2/B4	0.2	M	Adult		Loose teeth	LRI2, LRM3, URM1
PM E-6	Playa del Mango	Cuba	Mound 2/B4	0.15	F (XX)*	Juvenile		Loose teeth	ULM1, LRM1, URM1
PM E-7	Playa del Mango	Cuba	Mound 2/B6/C -I, C-VI	0.10-0.25	M	Adult	CE 57-177	teeth in sections of alveolar bone and loose teeth	LLC, LLP1, LLP2, LLM2
PM E-9	Playa del Mango	Cuba	Mound 2/B6/C -H,C-K	0.10-0.20	F (XX)*	Adult	114 BCE - CE 25	Loose teeth	LLM1, LRM2, LLM3, ULM2, ULM3
PM E-10	Playa del Mango	Cuba	Mound 2/B6/C	0.10-0.25	M (XY)*	Adult	CE 79-216	Loose teeth	LRM3?, LLM2?. LLM3?

			-J, C-III						
PM E-11	Playa del Mango	Cuba	Mound 2/B6	0.10-0.25	M	Adult		teeth in section of mandible and loose teeth	ULC?, URC,ULP1?, LRM2, LRM1, LRP2?, LRC, LLI2, LLP2 , LRM3, LLM1
PM E-13	Playa del Mango	Cuba	Mound 2/B6/C-F, C-VI	0.10-0.25	M	Adult	CE 127-241	Loose teeth	LRC, LLM3, ULM2, URC
PM E-14	Playa del Mango	Cuba	Mound 2/B6/C-III	0.10-0.20	M (XY)*	Adult	CE 47-140	Loose teeth	URM1, LLM3, URM2
PM E-15	Playa del Mango	Cuba	Mound 2/B6/C-J	0.10-0.20	F (XX)*	Adult	3 BCE - CE 81	Loose teeth	LRI2, ULM3, LLM2?, LRM1, LLC, LLP1?, LLP2?
PM Mound 2 Isolated teeth	Playa del Mango	Cuba	Mound 2					Isolated teeth	ULM3, LLM3, UP?, LRM3, ULM3, UM3?, ULM2, LRC, URI1
PM NI	Playa del Mango	Cuba	C-H	0.25				Loose teeth	ULM2
PVC 1	Pueblo Viejo de Cotuí, Cueva de la Lluvia	Dominican Republic	Creek 115	0.20-0.3 MTS				Piece of mandible and loose teeth	URC, URC?, LRM2, LRM1, LLM2, LLM3
PVC 1(E3)	Pueblo Viejo de Cotuí, Estructura Colonial	Dominican Republic						Loose teeth	ULP1, LRI2, LLI1, LLC, LLP2, LLM1
PVC 2	Pueblo Viejo de Cotuí, Cueva de la Lluvia	Dominican Republic	Creek 115	0.10-0.20 MTS				Loose teeth	ULM3, LRP2?, LRM1, LRM3
PVC 2(E2)	Pueblo Viejo de Cotuí, Estructura Colonial	Dominican Republic						Loose teeth	LLM1
PVC 3	Pueblo Viejo de Cotuí, Cueva de la Lluvia	Dominican Republic	Creek 115	0.20-0.30 MTS				Loose teeth	URM3, LLC, LLM3, LP?, LP?
PVC 3(E27)	Pueblo Viejo de Cotuí, Estructura Colonial	Dominican Republic						Piece of mandible and loose teeth	LRI1, LRI2, LRC
PVC 4	Pueblo Viejo de Cotuí, Cueva de la Lluvia	Dominican Republic	Creek 115	0.10-0.20 MTS				Loose teeth	ULC

PVC 5	Pueblo Viejo de Cotuí, Cueva de la Lluvia	Dominican Republic	Creek 115	0.10-0.20 MTS				Loose teeth	ULI1, URI2, LRP2?
PVC 6	Pueblo Viejo de Cotuí, Cueva de la Lluvia	Dominican Republic	Creek 134	0.00-0.10 MTS				Loose teeth	URC, LRM3, LRP2?, LRP1?, LLM2
PVC 7	Pueblo Viejo de Cotuí, Cueva de la Lluvia	Dominican Republic	Creek 115	0.10-0.20 MTS				Loose teeth	ULC, LRM1, LLP2, LLM3
PVC 8	Pueblo Viejo de Cotuí, Cueva San Juan	Dominican Republic	Creek 3	0.50-0.60 MTS				Loose teeth	ULM1, LRI2, LRC, LLP2, LRM3
PVC 9	Pueblo Viejo de Cotuí, Cueva San Juan	Dominican Republic	Creek 7	0.60-0.70 MTS				Loose teeth	ULC, LM?, URM3?, LLC, LRP1?, LLM3
PVC 10	Pueblo Viejo de Cotuí, Cueva San Juan	Dominican Republic	Creek 7	0.40-0.50 MTS				Loose teeth	LLI2, LRI1, LRI2 (in alveolar bone), LLM1
PVC 11	Pueblo Viejo de Cotuí, Cueva San Juan	Dominican Republic	Creek 7	0.20-0.30 MTS				Loose teeth	URM3, URM2, ULP2, ULM1, ULM3
PVC 12	Pueblo Viejo de Cotuí, Cueva San Juan	Dominican Republic	Creek 10	0.30-0.40 MTS				Loose teeth	URI2,ULC, ULM3, LRC, LRM1, LRM2
PVC 13	Pueblo Viejo de Cotuí, Cueva San Juan	Dominican Republic	Creek 6	0.60-0.70 MTS				Pieces of mandible and loose teeth	P?, ULC, LRM1?, LLP2?, LRM2?
PVC 14	Pueblo Viejo de Cotuí, Cueva San Juan	Dominican Republic	Creek 6	0.50-0.60 MTS				Pieces of mandible and loose teeth	LLC, LLP1, LLP2, LLM1, LLM2
PVC 15	Pueblo Viejo de Cotuí, Cueva San Juan	Dominican Republic	Creek 10	0.50-0.60 MTS				Loose teeth	ULC
PVC 16	Pueblo Viejo de Cotuí, Cueva San Juan	Dominican Republic	Creek 10	0.40-0.50 MTS				Loose teeth	LRM3, LRM2?, LRM1?, LRP2?, LLM2
PVC 17	Pueblo Viejo de Cotuí, Cueva Margajita	Dominican Republic	Creek 18	0.10-0.20 MTS				Loose teeth	ULC, LLM1
PVC 18	Pueblo Viejo de Cotuí, Cueva Balaguer	Dominican Republic	Area "C"					Piece of mandible and loose teeth	LLP1
PVC 19	Pueblo Viejo de Cotuí, Cueva Balaguer	Dominican Republic	Area "A"					Loose teeth	LRM2

PVC 20	Pueblo Viejo de Cotuí, Cueva Balaguer	Dominican Republic	Area "B"					Loose teeth	ULM3
PVC 21	Pueblo Viejo de Cotuí, Cueva de los Cacaos	Dominican Republic						Loose teeth	LLM2
PVC 22	Pueblo Viejo de Cotuí, Cueva del Monolito	Dominican Republic		0.00-0.20 MTS				Loose teeth	LLM1
JL K11B0	James W. Lee Collection, Chancery Hall	Jamaica				Juvenile		Loose teeth	LRM1, URM1, URM2, LLM2, LRC, LLC, LRP1, LLP2, LRP2, LLP1, URP1, URP2, URI2, URI1, ULI1, LLI2, LLI1, LRI1, LRI?, LRI2
JL K11B28	James W. Lee Collection, Chancery Hall	Jamaica				Adult		Loose teeth	LRM2, URM3, UP?, LLC
JL AC4B69	James W. Lee Collection, Belle Air Cave	Jamaica						Loose teeth	ULM2, LP?, LRC, LRM1, LC?, LLM1, LP?, LRC, LLM2, LRI2, ULC, ULP1, ULP2, URC, LRM1
JL U1B68	James W. Lee Collection, Belle Air Cave	Jamaica						Loose teeth	ULC, ULP1, ULP2, URC, LRM1
JL Y4B28A	James W. Lee Collection, Rio Nuevo	Jamaica						Sections of mandible and loose teeth	LRM1, LLM1
JL T7B60A	James W. Lee Collection, Pantrepant	Jamaica			F?			Pieces of mandible	LLC, LLP1, LLP2, LLM1
JL WC3B11	James W. Lee Collection, New Mountain	Jamaica						Piece of mandible and loose teeth	LLM1, LLM2
JL JC7B19C.15	James W. Lee Collection, Spot Valley Cave	Jamaica						Mandible	LLM2, LLM3
JL JC7B19C.15B	James W. Lee Collection, Spot Valley Cave	Jamaica						Piece of mandible	LLC
JL JC7B30A	James W. Lee Collection, Spot Valley Cave	Jamaica						Piece of mandible and loose teeth	LLM3
JL JC7B30B	James W. Lee Collection, Spot Valley Cave	Jamaica						Loose teeth	LLI1
JL JC7B3DA	James W. Lee Collection, Spot Valley Cave	Jamaica						Loose teeth	URC

JL Unknown 0.0	James W. Lee Collection	Jamaica				Adult		Cranium	ULM2, ULM1, ULP2, ULP1, URP1, URM1, URM2, URM3
JL Hellshire 1	James W. Lee Collection, Hellshire Hills	Jamaica				Adult		cranium and mandible	ULM2, ULM1, ULP2, URP1, LRM3, LRM2, LRM1, LLP1, LLM1, LLM3
JL CHS 0 [3]-6-01	James W. Lee Collection, Cambridge Hill Caves	Jamaica	Area 3					cranium	URM2, URM1, ULM1, ULM2, ULM3 impacted
JL CHS 0[3]-6-02	James W. Lee Collection, Cambridge Hill Caves	Jamaica	Area 3					cranium	ULP2
JL CHS 0[4]-5-01	James W. Lee Collection, Cambridge Hill Caves	Jamaica	Area 4			Adult		Cranium and loose teeth	URM2, URM1, ULM1, ULM2, ULM3, URP2
JL CHS 0-4-04	James W. Lee Collection, Cambridge Hill Caves	Jamaica						cranium and loose teeth	URM2, URM1, URP2. URP1, URC, URI2, URI1, ULI1, ULC, ULP1, ULP2, ULM1, ULM2
JL CHS 0-5-05	James W. Lee Collection, Cambridge Hill Caves	Jamaica						cranium	ULM2, ULM1, URM2
JL CHS 0-9-2	James W. Lee Collection, Cambridge Hill Caves	Jamaica						cranium	URM3
JL CHS 0-9-3	James W. Lee Collection, Cambridge Hill Caves	Jamaica						cranium	URP1, ULP2, ULM1, ULM2
JL CHS 0-9-4	James W. Lee Collection, Cambridge Hill Caves	Jamaica						cranium	URP2, URM1
JL CHS-0-9-5	James W. Lee Collection, Cambridge Hill Caves	Jamaica				Adult		cranium	URM3, URM2, URM1, URP2, URP1, URC, ULI2, ULC, ULP2, ULM1, ULM2
JL CHS 1-1-13	James W. Lee Collection, Cambridge Hill Caves	Jamaica	Area 1					Isolated teeth	ULC

JL CHS 1-1-66	James W. Lee Collection, Cambridge Hill Caves	Jamaica	Area 1					Isolated teeth	URM1
JL CHS 1-2-24	James W. Lee Collection, Cambridge Hill Caves	Jamaica	Area 1					Piece of mandible	LRM2, LRM1, LRP2
JL CHS 1-2-25	James W. Lee Collection, Cambridge Hill Caves	Jamaica	Area 1					Piece of mandible	LRM3
JL CHS 1-2-26	James W. Lee Collection, Cambridge Hill Caves	Jamaica	Area 1					Piece of maxilla	ULP1, ULM1, ULM2
JL CHS 1-2-35	James W. Lee Collection, Cambridge Hill Caves	Jamaica	Area 1					isolated teeth	URM3
JL CHS 1-2-36	James W. Lee Collection, Cambridge Hill Caves	Jamaica	Area 1					isolated teeth	ULP?
JL CHS 0(4)-6-03	James W. Lee Collection, Cambridge Hill Caves	Jamaica	Area 4					Cranium	URM1, ULM1
JL CHS-0[4]-5-04	James W. Lee Collection, Cambridge Hill Caves	Jamaica	Area 4					cranium	URM1
LI 1	Los Indios	Puerto Rico	Blq 14/SE					Loose teeth	LRM1
LI 3	Los Indios	Puerto Rico	Blq 13.2					Loose teeth	LRM1, LRM3
LI 4	Los Indios	Puerto Rico	Blq 12.8					Loose teeth	LLM1, LRM1
LI 5	Los Indios	Puerto Rico	Blq 12.8					Loose teeth	ULM1, ULM3
LI 7	Los Indios	Puerto Rico	Blq 12.4					Loose teeth	LRM1, URM2
LI 8	Los Indios	Puerto Rico	Blq 12.4					Loose teeth	LRP1, ULI2, LLI2, ULC, ULM1, ULM2
LI 9	Los Indios	Puerto Rico	Blq 12.8					Loose teeth	ULM3, URC, LRI1

LI 11	Los Indios	Puerto Rico	Blq 12.8					Loose teeth	LLM1, URM3
LI 13	Los Indios	Puerto Rico	Blq 12.8					Loose teeth	ULM1, ULM3
LI 15	Los Indios	Puerto Rico	Blq 12.8					Loose teeth	LRM1, LRP2, URC
LI 17	Los Indios	Puerto Rico						Loose teeth	LRM3, LLM1
LI 18	Los Indios	Puerto Rico						Loose teeth	ULI1
LI 22	Los Indios	Puerto Rico	Blq 12.8					Loose teeth	LRM1, URM2
LI 24	Los Indios	Puerto Rico						Loose teeth	LLM1, LLM2, LLM3
LI 25	Los Indios	Puerto Rico	NW					Loose teeth	URM2, ULM1
LI 26	Los Indios	Puerto Rico						Loose teeth	LRM1, URM2
LI 29	Los Indios	Puerto Rico						Loose teeth	ULM2, ULM3
LI 30	Los Indios	Puerto Rico	NW					Loose teeth	LRC, LRM1
LI 33	Los Indios	Puerto Rico						Loose teeth	ULI1, ULC?
LI 40	Los Indios	Puerto Rico						Loose teeth	URI1, LLP2, LLC, LLM?, LRM1
LI 41	Los Indios	Puerto Rico	NE					Loose teeth	URM1, LLM3
LI 42	Los Indios	Puerto Rico	NE					Loose teeth	URM1, ULM3
LI 43	Los Indios	Puerto Rico	NW					Loose teeth	LRM1, LLM3
LI 44	Los Indios	Puerto Rico						Loose teeth	ULM3, ULM2, ULI2
LI 45	Los Indios	Puerto Rico						Loose teeth	URM1, ULM3
LI 46	Los Indios	Puerto Rico	NW					Section of mandible and loose teeth	ULM2, URC, LLM2, LRM3?, LRI1
LI 46C	Los Indios	Puerto Rico	NW					Loose teeth	ULM2
LI 47	Los Indios	Puerto Rico						Loose teeth	ULM1, LRM3
LI 49	Los Indios	Puerto Rico						Loose teeth	ULI1
LI 50	Los Indios	Puerto Rico						Loose teeth	LLM1, URM3, URM1
LI 51	Los Indios	Puerto Rico						Loose teeth	ULM2, LRM1, ULM3
LI 58	Los Indios	Puerto Rico						Loose teeth	LRM1
LI 59	Los Indios	Puerto Rico						Loose teeth	ULC, LRM1, ULM3

LI 60	Los Indios	Puerto Rico	NW					Section of mandible and loose teeth	LRI2, LRC, LRP1, LRP2, LLI1, LRM1
LI 61	Los Indios	Puerto Rico	NE					Loose teeth	LRM1, LRM2
LI 63	Los Indios	Puerto Rico	NE					Loose teeth	LRM3, URM1
LI 66	Los Indios	Puerto Rico						Loose teeth	LLM1, LRM2
LI 69	Los Indios	Puerto Rico						Loose teeth	URM1, LLM2
LI 70	Los Indios	Puerto Rico	NE					Loose teeth	URI1, URM1, URM2
LI 71	Los Indios	Puerto Rico	NE					Loose teeth	ULM2, ULM3
LI 72	Los Indios	Puerto Rico	NE					Loose teeth	LLC
LI 75	Los Indios	Puerto Rico						Loose teeth	ULM2, ULM3
LI 76	Los Indios	Puerto Rico						Loose teeth	LLP1, LLP2, LLM1, LLM2
LI 77	Los Indios	Puerto Rico	NE					Loose teeth	LLM1, URM2
LI 79	Los Indios	Puerto Rico	NE					Loose teeth	LRM1, LRP1
LI 80	Los Indios	Puerto Rico	NE					Loose teeth	ULM3, LLM1
LI 81	Los Indios	Puerto Rico						Loose teeth	LLM1, LLM2
LI 82	Los Indios	Puerto Rico						Loose teeth	ULM3, LRM1, LRM1, LRM2?
LI 87	Los Indios	Puerto Rico	SE					Loose teeth	URI1, ULM1, LRM3, LRI1, LLI2
LI 92	Los Indios	Puerto Rico	SE					Loose teeth	LRM1, LLP1, LRM3, LLM1, LLP2, LRM3
LI 94	Los Indios	Puerto Rico	SW					Loose teeth	LRM1, LRM3
LI 95	Los Indios	Puerto Rico						Loose teeth	LRM2, LRM1?
LI 97	Los Indios	Puerto Rico						Loose teeth	LRM2, LLM3, LLM1
LI 98	Los Indios	Puerto Rico						Loose teeth	ULM1, ULM3
LI 101	Los Indios	Puerto Rico						Loose teeth	URM3
LI 103	Los Indios	Puerto Rico	SW					Section of mandible and loose teeth	LLM1, LLM2, LLM3, LRC
LI 104	Los Indios	Puerto Rico						Loose teeth	LRM1, LRM3
LI 107	Los Indios	Puerto Rico	SW					Loose teeth	URM3, URM1
LI 111	Los Indios	Puerto Rico						Section of maxilla and loose teeth	ULM3, LLM3, LLM1

LI 117	Los Indios	Puerto Rico						Loose teeth	URP2, URM1
LI 119	Los Indios	Puerto Rico						Loose teeth	URM1, URM2, URM3
LI 121	Los Indios	Puerto Rico						Loose teeth	LRP1, LLM1, LLM2, URM3
LI 122	Los Indios	Puerto Rico						Loose teeth	ULC, ULM3
LI 123	Los Indios	Puerto Rico						Loose teeth	LLM1, URM3?, URC
LI 128	Los Indios	Puerto Rico	SE					Loose teeth	LLM1, LLM3, ULI2
PI P7U5-8	Paso del Indio	Puerto Rico	P7/U5		F	Adult		Loose teeth	ULI1, URM1, ULM2
PI P7U4-4d	Paso del Indio	Puerto Rico	P7/U4		F	Adult		Loose teeth	LLM2, LLC
PI P6-U13e-21s-1	Paso del Indio	Puerto Rico	P6/U13/E-21S					Loose teeth	LLI2, UI1?
PI P7U3-4	Paso del Indio	Puerto Rico	P7/U3		M	Adult		Loose teeth	ULM2
PI P7U5-13b	Paso del Indio	Puerto Rico	P7/U5		I	Juvenile		Loose teeth	LRI1, LLM1, LRM1
PI 16a	Paso del Indio	Puerto Rico						Loose teeth	ULM1, URI2
PI P6N-418E-25S-3	Paso del Indio	Puerto Rico	P6N/418E-25S					Loose teeth	ULI1
PI P7U4-3b	Paso del Indio	Puerto Rico	P7/U4		I	Juvenile		Loose teeth	LRM1
PI P7U4-4c	Paso del Indio	Puerto Rico	P7/U-4		M	Adult		Loose teeth	ULI2, ULC, LLI1
PI P7U2-1a	Paso del Indio	Puerto Rico	P7 U2		F	Adult		Loose teeth	LRM1, LLI2, LRI1
PI P6T1-1	Paso del Indio	Puerto Rico	P6T1		F	Adult		Loose teeth	ULM1, URC, LLI2
PI P6-U18E-25S-1	Paso del Indio	Puerto Rico	P6/U18e/25s		F	Adult		Loose teeth	URM2
PI P6-U17e-29s	Paso del Indio	Puerto Rico	P6/U17e/29s					Section of mandible	LRM1
PI 1	Paso del Indio	Puerto Rico						Section of mandible and loose teeth	LRI1, LRI2, LRM1
PI 2	Paso del Indio	Puerto Rico						Loose teeth	ULI1, URM1, ULM2
PI NW-34	Paso del Indio	Puerto Rico	NW					Loose teeth	ULM1, ULM3
PI P7U5-5	Paso del Indio	Puerto Rico	P7/U5					Loose teeth	Unerupted ULM1
PI P6-U18e-21s-2	Paso del Indio	Puerto Rico	P6/U18e/21s		I	Juvenile		Loose teeth	Unerupted URM1 and LLM1
PC 1-A2	Punta Candelero	Puerto Rico	Pozo A-2		M	18-25		Loose teeth	ULM1, URM3

PC 1-A3	Punta Candelero	Puerto Rico	Pozo A-3					Loose teeth	LLC?, LLP1?, LLP2
PC 1-A6	Punta Candelero	Puerto Rico	Pozo A-6		I	5-7		Loose teeth	LLM3, URI1, LLP2, URI2, LLP2, URI2, ULI2, LRM1,
PC 1A-D1	Punta Candelero	Puerto Rico	Pozo D1		F	46+		Loose teeth	ULM2, ULM3, UP?
PC 1-B4	Punta Candelero	Puerto Rico	Pozo B-4		M	46+		Loose teeth	LLM1, LLM2, LLM3, UP?
PC 1-B6	Punta Candelero	Puerto Rico	Pozo B-6		M	46+		Loose teeth	LLM3, LRI2
PC 1-C2	Punta Candelero	Puerto Rico	Pozo C2		I	2-3		Loose teeth	LLM1, UI1 (developing), LI (developing)
PC 1-C3	Punta Candelero	Puerto Rico	Pozo C3		F	26-35		Loose teeth	URM1, UM3?, LLI1
PC 1-D1	Punta Candelero	Puerto Rico	Pozo D-1		M	26-35		Loose teeth	LLI2
PC 1-D1B	Punta Candelero	Puerto Rico	Pozo D-1B					Loose teeth	LRM2, LRM3
PC 1-F1	Punta Candelero	Puerto Rico	Pozo F1		F	26-35		Loose teeth	LRM2
PC 1-J	Punta Candelero	Puerto Rico	Pozo J		I	18-25		Loose teeth	LRP1, LLM1, LRM1
PC 1-M	Punta Candelero	Puerto Rico	Pozo M		I	Adult		Loose teeth	URP2?
PC 1-N5	Punta Candelero	Puerto Rico	Pozo N-5		I	4-5		Loose teeth	LRM1, URI1
PC 1-Q	Punta Candelero	Puerto Rico	Pozo Q		M	36-45		Loose teeth	LRI2, LRP1, LRM3
PC 1-W	Punta Candelero	Puerto Rico	Pozo W		I	Adult		Loose teeth	LRM1, LRM2
PC 1-Y	Punta Candelero	Puerto Rico	Pozo Y		I	26-35		Loose teeth	LLM1
PC 1-Z	Punta Candelero	Puerto Rico	Pozo Z		I	18-25		Loose teeth	LRM1, ULM2, LRI2, URP2
PC 2-A3	Punta Candelero	Puerto Rico	Pozo A-3		I	Adult		Loose teeth	LLM1, LLM3
PC 2-A6	Punta Candelero	Puerto Rico	Pozo A-6		I	Adult		Loose teeth	URM2
PC 2-B4	Punta Candelero	Puerto Rico	Pozo B-4		I	6-7		Loose teeth	LLM1, ULM3, URP1, URC, LRP1
PC 2-L2	Punta Candelero	Puerto Rico	Blq I, Pared L2					Loose teeth	LLM1
PC 3-A6	Punta Candelero	Puerto Rico	Pozo A-6		I	Adult		Loose teeth	ULI1, ULC

PC 3-B3	Punta Candelero	Puerto Rico	Pozo B3		F	Adult		Loose teeth	URM1, URM3, LRM3, LRM1
PC 4-A6	Punta Candelero	Puerto Rico	Pozo A6					Loose teeth	URI2
PC 4-B3	Punta Candelero	Puerto Rico	Pozo B3		F	26-35		Loose teeth	URP2, URM3
PC 6	Punta Candelero	Puerto Rico						Loose teeth	LLM1, LLM2
PC 7-B3	Punta Candelero	Puerto Rico	Pozo B3					Loose teeth	URM1
PC 7-B6	Punta Candelero	Puerto Rico	Pozo B6			46+		Loose teeth	LRI2
PC 9-B3	Punta Candelero	Puerto Rico	Pozo B3		F	36-45		Loose teeth	LRC, LRM1, ULM3, ULM1
PC 13-B1	Punta Candelero	Puerto Rico	Pozo B1		M	26-35		Loose teeth	URM1, URM3
PC 14	Punta Candelero	Puerto Rico						Loose teeth	ULI1, ULI2, LRI2, LRM1, LRM2, URC, URI1, ULI2, LRP1
PC 23-B2	Punta Candelero	Puerto Rico	Pozo B2		I	Adult		Loose teeth	LRM2
PC 24-A4-B4	Punta Candelero	Puerto Rico	Pozo BA-4		F	Adult		Loose teeth	LLM1, LRP2
PC 29-A3	Punta Candelero	Puerto Rico	Pozo A3		M	36-45		Loose teeth	LRI2
PC 30-A2-A3	Punta Candelero	Puerto Rico	Pozo A2/3		M	26-35		Loose teeth	URI1, URM3
PC 32-A2	Punta Candelero	Puerto Rico	Pozo A2					Loose teeth	LLM1, LLM3
PC 33	Punta Candelero	Puerto Rico						Loose teeth	LRI1
PC 33-A2	Punta Candelero	Puerto Rico	Pozo A2					Loose teeth	LRM2, LM3?
PC 33B-A2	Punta Candelero	Puerto Rico	Pozo A2					Loose teeth	ULM1, ULM3
PC 36-A2	Punta Candelero	Puerto Rico	Pozo A2		M	46+		Loose teeth	LLM2, LLM3, LLM1, LM3
PC 40	Punta Candelero	Puerto Rico						Loose teeth	LRM1, ULI1
PC 46-D8	Punta Candelero	Puerto Rico	Pozo D8		M	36-45		Loose teeth	LLC, UP?
PC 48-B4	Punta Candelero	Puerto Rico	Pozo B4		F	26-35		Loose teeth	ULI1, LP?
PC 54-F5	Punta Candelero	Puerto Rico	Pozo F5		M	Adult		Loose teeth	LRM1, LRP2, LRM3

PC 56-A6	Punta Candelero	Puerto Rico	Pozo A6		M	16-18		Loose teeth	LLM1, LLM3, ULM2?
PC 59-A5	Punta Candelero	Puerto Rico	Pozo A-5					Loose teeth	LLM1, LLM3
PC A3	Punta Candelero	Puerto Rico	Blq III		I	Adult		Loose teeth	URP2
Jelica 24	Jelica-Gradina	Serbia			I	Full adult		Pieces of mandible, maxilla, loose teeth	LLM2, LLP1, LLC, LLI2, LLI1, LRI2, LRC, LRP1, LRM3, LRM2, ULI1, ULI2, ULC, ULP1, ULP2, ULM2, ULM3,URI1, URI2, URC, URP1, URM2, URM3
Jelica 6	Jelica-Gradina	Serbia						Maxilla	URP2, URP1, URC, URI2, URI1, ULI1, ULI2, ULC, ULP2, ULM1, ULM3
Jelica 25(b)	Jelica-Gradina	Serbia			M	Full adult		Loose teeth	URM3, URM2, URM1, URC?, ULP?, ULM1, ULM2, LLM3, LRM2, LLM1, LP?, LLC, LRM1, LRM2
Jelica 5	Jelica-Gradina	Serbia			I	11-12		Mandible and pieces of maxilla	LLM3, LLM2, LLP2, LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP1, LRP2, LRM1, LRM2, URM3, URM2, URM1, URP2, URP1, URC, URI2, ULI2, ULC, ULP1, ULP2, ULM2
Jelica 2/10	Jelica-Gradina	Serbia			M	35+		Pieces of mandible	LLM3, LLM2, LLM1, LLP2, LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRP1, LRP2, LRM2, LRM3
Jelica GL Brodu (a)	Jelica-Gradina	Serbia						Piece of mandible	LLM1, LLM2, LRM1, LRM2
Jelica GL Brodu (b)	Jelica-Gradina	Serbia						Piece of mandible and maxilla	LRM1, LRM2, URM1
Jelica 18	Jelica-Gradina	Serbia			M	45+		Section of mandible	LLM2, LLP2, LLP1, LLC
Jelica 17	Jelica-Gradina	Serbia			M	Full adult		mandible and maxilla	LLM1, LLP2, LLP1, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LP2, LRM1, LRM2, URI1, URP1, URP2, URM1, URM2, URM3, ULI1, ULI2, ULC, ULP1, ULP2. ULM1, ULM2, ULM3
Jelica 33	Jelica-Gradina	Serbia			M	45+		Pieces of mandible and maxilla, and loose teeth	LLC, LLI1, LRI1, LRI2, LRC, LRP1, LRP2, LRM1, LRM2, LLM2, URC, URP1, URP2, URM2, UP?
Jelica 32	Jelica-Gradina	Serbia			M	Full adult		mandible, section of maxilla, and loose teeth	LRC, LRP1, LRP2, LRM1, LRM2, LLP1, LLP2, LLM1, LLM2, URC, URP1, LI?, LI? LC? , URM2
Jelica 19	Jelica-Gradina	Serbia			F	20-21		mandible and maxilla	LLM2, LLM2, LLM1, LLP2, LLP1, LLC, LLI2, LRI2, LEC, LRP1, LRP2, LRM1, LRM2, LRM3, URP2, URP1, URC, ULC, ULP1, ULP2, ULM1, ULM2, ULM3
Jelica Bazilika E1 (Skull E)	Jelica-Gradina	Serbia						mandible and maxilla	LLM1, LLP2, LLC, LLI2, LLI1, LRI1, LRI2, LRC, LRP1, LRP2, LRM1, LRM2, ULM3,

									URM2, URM1, URP2, URP1, URC, ULC, ULP1, ULP2, ULM1, ULM2
Jelica Bazilika E 1 (Extra bones)	Jelica-Gradina	Serbia						loose teeth, fragments of maxilla	LM3?, LM3?, URC, URI1, ULI1, ULI2, ULC, ULP1, ULP2, UM1?, ULM2?
Jelica Church "D" grave 1	Jelica-Gradina	Serbia						Pieces of maxilla	URM1, URP2, URP1, URC, URI1, ULC, ULP1
Jelica 22	Jelica-Gradina	Serbia			F	Full adult		mandible, section of maxilla	URI2, URC, URP1, URC, URI2, URI1
Jelica 28 (Ind. I)	Jelica-Gradina	Serbia						loose teeth	URM2, URP1, URC, URI2, URI1, ULI1, ULI2, ULC, ULP1, ULP2, ULM?, LLM2, LLM1, LLP2, LLP1, LLC, LLI2, UI1, LRI2, LRC, LRP1, LRP2, LRM1, LRM2
Jelica 1/14	Jelica-Gradina	Serbia			F	15-19		pieces of maxilla and mandible	ULM1, ULM2, ULM3, LLM2, LLM1, LRC, LRP1, LRP2, LRM2
Jelica 26	Jelica-Gradina	Serbia			F	50-60		mandible and pieces of maxilla	LLC, LLI1, LRI2, LRC, LRP2, LRM2, URM1, URP2, URP1, ULP1
Jelica 2 (Ind. 4)	Jelica-Gradina	Serbia			I	Young adult		loose teeth	UP?
Jelica 2 (Ind. 1)	Jelica-Gradina	Serbia			M	45+		piece of maxilla and loose teeth	ULP1, ULP2, ULM1, ULM2, URM?, URP?, URC, URI2, UI? UI?, ULC, LLP2, LLP1, LI?, LP?, LRM?, LRM2
Jelica 2 (Ind. 3)	Jelica-Gradina	Serbia				7+		loose teeth	UP?, UC?, UM?
Jelica 2 (Ind. 2)	Jelica-Gradina	Serbia			M	60+		loose teeth	UM?, UP1?, ULP1, ULP2?, LLC, LI?, LI?, LRP?
Jelica 30	Jelica-Gradina	Serbia			F	Full adult		mandible and pieces of maxilla	LLM2, LLM1, LLP2, LLP1, LRP1, LRP2, LRM2, LRM3, LC?, ULI2, ULP1, ULP2, ULM1, ULM2, ULM3, URI1, URC. URP2, URM1
Jelica 1/10	Jelica-Gradina	Serbia			F	Full adult		loose teeth	URP2, URP1, URM?, URC, URI2, UI1?, UI?, ULC?, ULI?, ULP1, ULM1, ULM2, LLM2, LLM1, LLP2, LLP1, LLC, LL1, LRI1, LRI2, LRC, LRP1, LRP2, LRM1, LRM2
Jelica 29	Jelica-Gradina	Serbia			I			loose teeth	URI2, URI1, ULI?, ULM?, LM?, URM?
Jelica 04/10 (small bag)	Jelica-Gradina	Serbia				Juvenile		Loose teeth	UM2, UM3
Jelica G-34 (Ind. 1 or 2)	Jelica-Gradina	Serbia			I	Full adult		loose teeth	LM1?

Appendix B: Data Pre-Processing Results and Additional Tables

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Table B.1: Normality tests using Shapiro-Wilk test for intra-observer error metric data.

Dental Metric Trait (Key Tooth)	**Number of Teeth Scored Per Session (n)**	**Shapiro-Wilk W**	**Significance (*p*-value)**
UI1 BL Crown	5	0.950	0.736
UI1 MD Crown	5	0.981	0.939
UI1 BL Cervix	7	0.836	0.092
UI1 MD Cervix	7	0.885	0.247
UC BL Crown	12	0.889	0.115
UC MD Crown	12	0.884	0.098
UC BL Cervix	14	0.942	0.450
UC MD Cervix	15	0.912	0.144
UP1 BL Crown	14	0.956	0.649
UP1 MD Crown	14	0.899	0.108
UP1 BL Cervix	10	0.898	0.210
UP1 MD Cervix	10	0.935	0.499
UM1 BL Crown	16	0.900	0.080
UM1 MD Crown	16	0.881	0.041*
UM1 BL Cervix	14	0.962	0.758
UM1 MD Cervix	14	0.952	0.595
LI2 BL Crown	14	0.815	0.008*
LI2 MD Crown	14	0.936	0.370
LI2 BL Cervix	10	0.915	0.318
LI2 MD Cervix	10	0.926	0.410
LC BL Crown	16	0.941	0.363
LC MD Crown	16	0.958	0.629
LC BL Cervix	16	0.953	0.543
LC MD Cervix	16	0.968	0.810
LP1 BL Crown	16	0.947	0.437
LP1 MD Crown	16	0.975	0.910
LP1 BL Cervix	13	0.951	0.618
LP1 MD Cervix	12	0.807	0.011*
LM1 BL Crown	16	0.943	0.393
LM1 MD Crown	16	0.936	0.306
LM1 BL Cervix	12	0.925	0.325
LM1 MD Cervix	12	0.954	0.696

Note. Significant values indicated by *

Table B.2: Intra-observer error test for dental metric traits using paired Student's *t* test.

Dental Metric Trait (Key Tooth)	**Number of Teeth Scored Per Session (N)**	**t-value**	**Degrees of Freedom (df)**	**Significance (*p*-value)**
UI1 BL Crown	3	0.029	2	0.979
UI1 MD Crown	3	1.080	2	0.393
UI1 BL Cervix	6	1.270	5	0.260
UI1 MD Cervix	6	1.668	5	0.156
UC BL Crown	6	0.196	5	0.852
UC MD Crown	6	-0.518	5	0.627
UC BL Cervix	9	2.498	8	0.037*
UC MD Cervix	9	3.516	8	0.008*
UP1 BL Crown	8	-0.417	7	0.690
UP1 MD Crown	8	-0.428	7	0.682
UP1 BL Cervix	7	1.749	6	0.131
UP1 MD Cervix	7	1.735	6	0.134
UM1 BL Crown	10	-1.016	9	0.336
UM1 BL Cervix	**7**	3.808	6	0.009*
UM1 MD Cervix	8	1.854	7	0.106
LI2 MD Crown	7	-1.311	6	0.238
LI2 BL Cervix	6	1.259	5	0.264
LI2 MD Cervix	6	-0.709	5	0.510
LC BL Crown	10	1.742	9	0.115
LC MD Crown	10	-1.800	9	0.106
LC BL Cervix	10	1.065	9	0.315
LC MD Cervix	10	4.785	9	0.001*
LP1 BL Crown	9	-1.192	8	0.268
LP1 MD Crown	9	-0.987	8	0.353
LP1 BL Cervix	**7**	2.541	6	0.044*
LM1 BL Crown	10	-2.344	9	0.044*
LM1 MD Crown	9	1.987	8	0.082
LM1 BL Cervix	6	1.928	5	0.112
LM1 MD Cervix	6	1.952	5	0.108

Note. Significant values indicated by *

Table B.3: Intra-observer error test for dental metric traits using Mann-Whitney U tests.

Dental Metric Trait (Key Tooth)	**Number of Teeth Scored Per Session (N)**	**Mann-Whitney U**	**Z-score**	**Significance (*p*-value)**
UM1 MD Crown	10	28	0.368	0.713
LI2 BL Crown	8	16	0.968	0.333
LP1 MD Cervix	7	10	1.201	0.230

Table B.4: Intra-observer error test for dental non-metric traits using Cohen's Kappa coefficient.

Dental Non-Metric Trait (Key Tooth)	Absent	Present	Number of Teeth Scored Per Session (n)	Cohen's Kappa (k)
Shoveling (UI1)	0-1	2-7	4	1
Double Shoveling (UI1)	0-1	2-6	6	1
Tuberculum Dentale (UI1)	0	M, D, MD, med	4	0*
Interruption Groove (UI2)	0-1	2-6	8	1
Tuberculum Dentale (UI2)	0-1	2-6	7	1
Peg-reduced (UI2)	0-1	2-6	7	1
Tuberculum Dentale (UC)	0	1-3	5	1
Mesial Ridge (UC)	0-1	2-5	7	1
Distal Accessory Ridge (UC)	0-1	2-5	5	1
Mesial and Distal Accessory Cusps (UP1)	0	1-3	9	0*
Root Number (UP1)	0	1	3	1
Odontome (P1)	0-2	3-5	10	1
Cusp 5 (UM1)	0-2	3-5	6	0.33
Carabelli (UM1)	0-1	2-5	10	0.74
Parastyle (UM1)	0-1	2-7	10	0*
Enamel Extension (UM1)	0-1	2-5	8	1
Metacone (UM2)	0-1	2-5	7	1
Hypocone (UM2)	0	1-3	8	0.71
Root Number (UM2)	0	1-3	6	1
Parastyle (UM2-UM3)	1	2-3	14	0.01*
Peg-reduced-missing (UM3)	1,2	3+	10	0.62
Distal Accessory Ridge (LC)	Normal	P, R	9	0.053*
Root Number (LC)	Normal	P, R, M	4	NA
Tome's Root (LP1)	0-1	2-9	3	NA
Lingual Cusp Variation (LP2)	0-1	2-4	9	1
Anterior Fovea (LM1)	0-1	2-3	9	0.73
Deflecting Wrinkle (LM1)	X, +	Y	10	0.78
Protostylid (LM1)	0	1-7	10	0.62
Hypoconulid (LM1)	0-1	2-5	10	1
Cusp 6 (LM1)	0-1	2-5	9	1
Cusp 7 (LM1)	0	1-5	9	1
Root Number (LM1)	0	1-4	6	1
Enamel Extension (LM1)	0 (one-rooted)	1 (two-rooted)	6	1
Groove Pattern (LM2)	0-3	4-5	10	0.62
Hypoconulid (LM2)	1-2 (one/two-rooted)	3 (three-rooted)	9	1
Root Number (LM2)	1 (one-rooted)	2	9	1

Note. Significant values indicated by *

Table B.5: Normality tests using Shapiro-Wilk test of metric data for 96 individuals (48 male and 48 female).

Dental Metric Trait (Key Tooth)	**Number of Teeth Scored (n)**	**Shapiro-Wilk Statistic**	**Significance (*p*-value)**
UI1 BL Crown	12	0.949	0.628
UI1 MD Crown	11	0.945	0.582
UI1 BL Cervix	32	0.972	0.561
UI1 MD Cervix	30	0.936	0.070
UC BL Crown	29	0.944	0.127
UC MD Crown	27	0.956	0.306
UC BL Cervix	40	0.982	0.763
UC MD Cervix	37	0.952	0.142
UP1 BL Crown	24	0.923	0.067
UP1 MD Crown	23	0.975	0.811
UP1 BL Cervix	30	0.919	0.027*
UP1 MD Cervix	22	0.769	0.001*
UM1 BL Crown	28	0.971	0.603
UM1 MD Crown	30	0.988	0.976
UM1 BL Cervix	36	0.952	0.122
UM1 MD Cervix	30	0.923	0.031*
LI2 BL Crown	37	0.958	0.170
LI2 MD Crown	37	0.916	0.008*
LI2 BL Cervix	40	0.870	0.001*
LI2 MD Cervix	41	0.586	0.001*
LC BL Crown	35	0.941	0.061
LC MD Crown	36	0.980	0.751
LC BL Cervix	41	0.943	0.041*
LC MD Cervix	39	0.979	0.676
LP1 BL Crown	31	0.951	0.164
LP1 MD Crown	29	0.968	0.503
LP1 BL Cervix	32	0.945	0.103
LP1 MD Cervix	30	0.962	0.356
LM1 BL Crown	20	0.961	0.559
LM1 MD Crown	22	0.799	0.001*
LM1 BL Cervix	31	0.947	0.127
LM1 MD Cervix	31	0.971	0.537

Note. Significant values indicated by *

Table B.6: Sexual dimorphism test for metric data using Student's *t*-test.

Dental Metric Trait (Key Tooth)	**Number of Females**	**Number of Males**	**t-value**	**Degrees of Freedom (df)**	**Significance (*p*-value)**
UI1 BL Crown	7	5	0.521	10	0.613
UI1 MD Crown	6	5	-0.453	9	0.661
UI1 BL Cervix	17	15	-0.509	30	0.615
UI1 MD Cervix	16	14	-1.536	28	0.136
UC BL Crown	16	12	-1.22	26	0.232
UC MD Crown	15	11	-1.916	24	0.067
UC BL Cervix	19	21	-3.874	38	0.004*
UC MD Cervix	18	19	-2.341	35	0.020*
UP1 BL Crown	14	10	0.400	22	0.693
UM1 BL Crown	16	13	-0.137	27	0.892
UM1 MD Crown	15	15	-1.024	28	0.314
UM1 BL Cervix	20	16	0.095	34	0.924
LI2 BL Crown	20	17	-0.717	35	0.478
LC BL Crown	18	17	-3.167	33	0.003*
LC MD Crown	18	18	-3.798	34	0.005*
LC BL Cervix	19	22	-1.648	39	0.107
LC MD Cervix	19	20	-4.086	37	0.002*
LP1 BL Crown	17	14	0.169	22	0.867
LP1 MD Crown	17	12	0.404	27	0.689
LP1 BL Cervix	18	14	-1.584	30	0.124
LP1 MD Cervix	18	12	-1.255	28	0.219
LM1 BL Crown	10	10	0.441	18	0.664
LM1 BL Cervix	14	17	-2.657	29	0.013*
LM1 MD Cervix	15	16	-1.824	32	0.078

Note. Significant values indicated by *

Table B.7 Sexual dimorphism tests for metric data using Mann-Whitney U tests.

Dental Metric Trait (Key Tooth)	**Number of Females**	**Number of Males**	**Mann-Whitney U**	**Z-score**	**Significance (*p*-value)**
UP1 BL Cervix	15	15	95	0.405	0.481
UP1 MD Cervix	12	10	37	1.484	0.138
UM1 MD Cervix	17	13	89.5	0.858	0.391

LI2 MD Crown	20	27	113	1.722	0.085
LI2 BL Cervix	20	20	200	0.014	0.989
LI2 MD Cervix	20	21	159.5	1.305	0.192
LM1 MD Crown	11	11	40	1.314	0.189

Table B.8: Sexual dimorphism tests for non-metric traits using Fisher's Exact Test.

Dental Non-Metric Trait (Key Tooth)	**Fisher's Exact Test**		
	Number of Females	**Number of Males**	***p*-Value**
Shoveling (UI1)	6	0	NA
Double Shoveling (UI1)	6	4	1
Tuberculum Dentale (UI1)	8	2	1
Interruption Groove (UI2)	10	6	0.145
Tuberculum Dentale (UI2)	11	2	1
Peg-reduced (UI2)	10	11	1
Tuberculum Dentale (UC)	16	7	0.210
Mesial Ridge (UC)	10	4	1
Distal Accessory Ridge (UC)	7	3	0.500
Mesial and Distal Accessory Cusps (UP1)	9	13	1
Root Number (UP1)	10	10	1
Odontome (P1)	23	16	0.410
Cusp 5 (UM1)	14	9	1
Carabelli (UM1)	15	13	1
Parastyle (UM1)	17	12	0.498
Enamel Extension (UM1)	18	12	0.632
Metacone (UM2)	16	19	1
Hypocone (UM2)	18	17	0.738
Root Number (UM2)	13	11	0.683
Parastyle (UM2-UM3)	24	22	0.491
Peg-reduced-missing (UM3)	21	18	1
Distal Accessory Ridge (LC)	5	11	1
Root Number (LC)	11	17	1
Tome's Root (LP1)	9	12	NA
Lingual Cusp Variation (LP2)	17	12	0.127
Anterior Fovea (LM1)	5	7	1
Deflecting Wrinkle (LM1)	5	7	0.576
Protostylid (LM1)	15	16	1
Hypoconulid (LM1)	10	10	NA
Cusp 6 (LM1)	8	8	1
Cusp 7 (LM1)	9	10	0.087

Root Number (LM1)	15	15	0.221
Enamel Extension (LM1)	17	12	1
Groove Pattern (LM2)	9	6	0.375
Hypoconulid (LM2)	16	13	0.192
Root Number (LM2)	9	7	1

Table B.9 Direct scoring versus photographic scoring method test for non-metric traits using Cohen’s Kappa coefficient.

Dental Non-Metric Trait (Key Tooth)	**Number of Teeth Scored Per Method**	**Cohen's Kappa (k)**
Carabelli (UM1)	10	0.8
Metacone (UM2)	10	1
Hypocone (UM2)	10	0.78
Root Number (UM2)	10	1
Peg-reduced-missing (UM3)	10	0.6
Root Number (LC)	10	NA
Protostylid (LM1)	10	1
Cusp 6 (LM1)	10	0.78
Root Number (LM1)	10	1
Enamel Extension (LM1)	10	1
Root Number (LM2)	10	1

Table B.10: Summary information for the 11 dental non-metric traits used in the Mean Measure of Divergence (MMD) including the number of individual scores (n), the number of positive observations (k), and the relative frequency (%) per trait for each group examined.

Dental Non-Metric Trait (Key Tooth)	**Sites**																							
	CA OC			**CA YC**			**CM**			**Jelica**			**JL**			**LI**			**PC**			**PM**		
	n	k	%	n	k	%	n	k	%	n	k	%	n	k	%	n	k	%	n	k	%	n	k	%
Carabelli (UM1)	3	1	33	10	3	30	47	9	19	9	2	22	17	9	53	8	2	25	2	1	50	3	2	67
Metacone (UM2)	4	4	100	8	8	100	62	62	100	14	13	93	16	6	38	12	12	100	3	3	100	10	10	100
Hypocone (UM2)	5	4	80	8	5	63	55	29	53	12	11	92	15	9	60	11	8	73	2	2	100	9	5	56
Root Number (UM2)	4	1	25	8	7	88	35	18	51	15	13	87	4	4	100	9	8	89	2	2	100	13	10	77
Peg-reduced-missing (UM3)	11	5	45	9	2	22	34	7	21	13	0	0	15	11	73	21	8	38	10	2	20	9	1	11
Root Number (LC)	7	3	42	13	2	15	36	6	17	19	1	5	4	0	0	4	0	0	2	0	0	14	0	0
Protostylid (LM1)	16	16	100	19	16	84	38	36	95	13	5	38	10	6	60	29	29	100	18	17	94	8	7	88
Cusp 6 (LM1)	4	1	25	5	3	60	29	3	10	4	0	0	8	1	13	16	3	19	11	3	27	3	2	67
Root Number (LM1)	13	0	0	18	0	0	29	2	7	19	1	5	6	4	67	33	0	0	21	1	5	12	0	0
Enamel Extension (LM1)	16	6	38	14	2	14	32	1	3	12	2	17	10	2	20	32	7	22	15	0	0	10	3	30
Root Number (LM2)	4	2	50	9	5	56	17	12	71	18	17	94	4	3	75	10	9	90	3	3	100	8	6	75

Site abbreviations= CA OC: Canímar Abajo Old Cemetery, CA YC: Canímar Abajo Young Cemetery, CM:Chorro de Maíta, JL: James W. Lee Collection, LI: Los Indios, PC: Punta Candelero, PM: Playa del Mango, Jelica: Jelica-Gradina

Table B.11: Pairwise MMD values (above) and standard deviation (below) based on 11 non-metric dental traits.

	CA_OC	**CA_YC**	**CM**	**Jelica**	**JL**	**LI**	**PC**	**PM**
CA_OC		0.012	0.052	0.485*	0.61*	0.063	0.111	0.102
CA_YC	0.119		0.078	0.241*	0.458*	0	0	0
CM	0.087	0.056		0.284*	0.623*	0.063*	0.011	0.168*
Jelica	0.113	0.085	0.052		0.499*	0.24*	0	0.24
JL	0.13	0.1	0.073	0.094		0.494*	0.271*	0.48*
LI	0.114	0.082	0.053	0.076	0.099		0	0.01
PC	0.189	0.156	0.127	0.148	0.169	0.157		0
PM	0.137	0.106	0.075	0.104	0.114	0.098	0.169	

Note. Significant values indicated by *. Site abbreviations= CA OC: Canímar Abajo Old Cemetery, CA YC: Canímar Abajo Young Cemetery, CM: Chorro de Maíta, JL: James W. Lee Collection, LI: Los Indios, PC: Punta Candelero, PM: Playa del Mango, Jelica: Jelica-Gradina

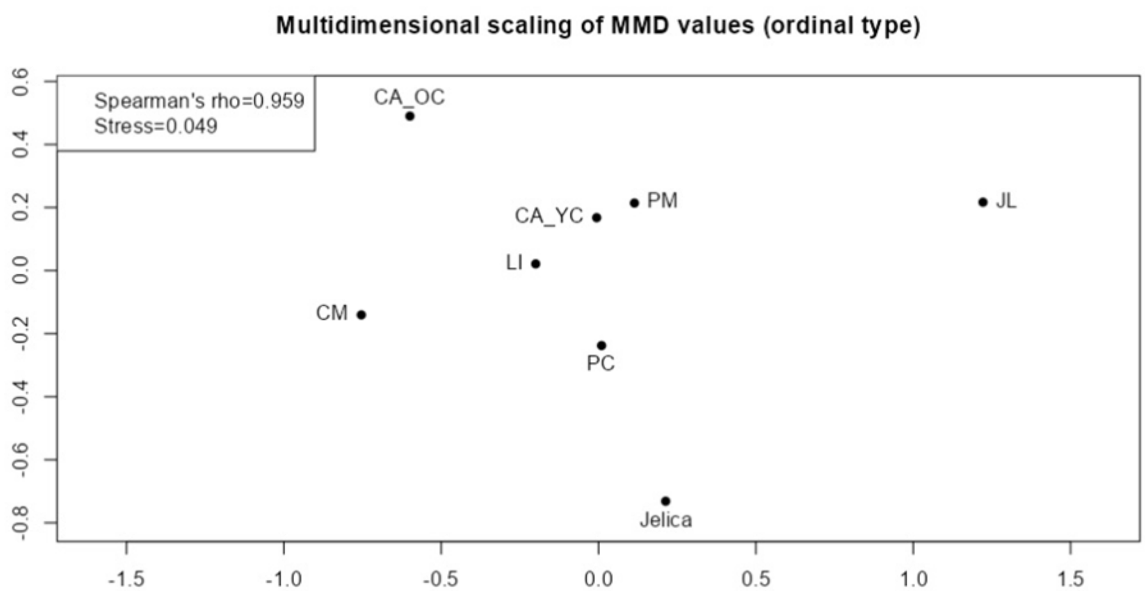

Figure B.1: Two-dimensional multidimensional scaling (MDS) plot based on Mean Measure of Divergence (MMD) values. Site abbreviations= CA OC: Canímar Abajo Old Cemetery, CA YC: Canímar Abajo Young Cemetery, CM: Chorro de Maíta, JL: James W. Lee Collection, LI: Los Indios, PC: Punta Candelero, PM: Playa del Mango, Jelica: Jelica-Gradina.

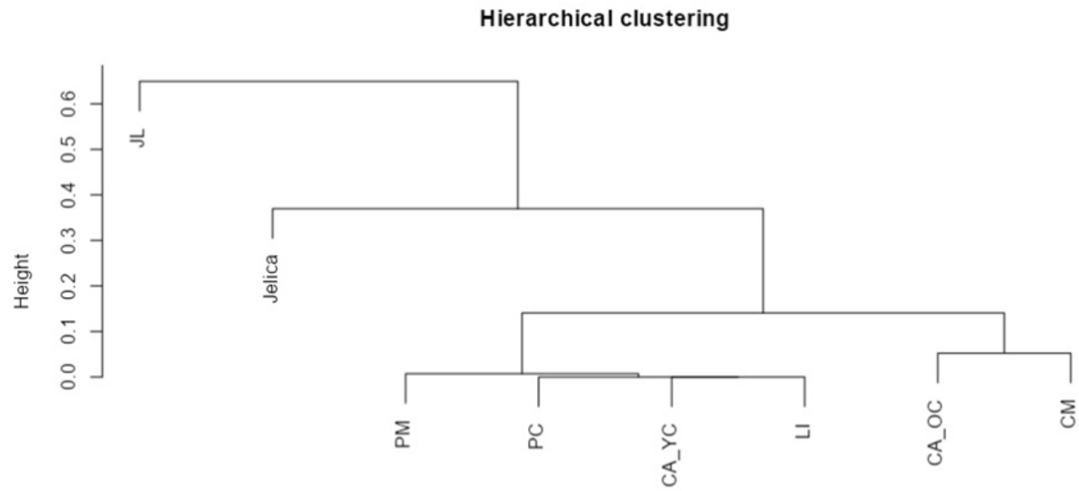

Figure B.2: Hierarchical clustering using Ward's Method based on Mean Measure of Divergence (MMD) values. Site abbreviations= CA OC: Canímar Abajo Old Cemetery, CA YC: Canímar Abajo Young Cemetery, CM: Chorro de Maíta, JL: James W. Lee Collection, LI: Los Indios, PC: Punta Candelero, PM: Playa del Mango, Jelica: Jelica-Gradina.

Table B.12: Overall measure of divergence (MD) for each variable, sorted in decreasing order of discriminatory power.

Dental Non-Metric Trait (Key Tooth)	**Overall MD**
Anterior Fovea (LM1)	17.922
Root Number (LM1)	11.633
Metacone (UM2)	8.296
Enamel Extension (LM1)	4.597
Peg-reduced-missing (UM3)	4.564
Protostylid (LM1)	4.287
Cusp 6 (LM1)	1.546
Carabelli (UM1)	-2.96

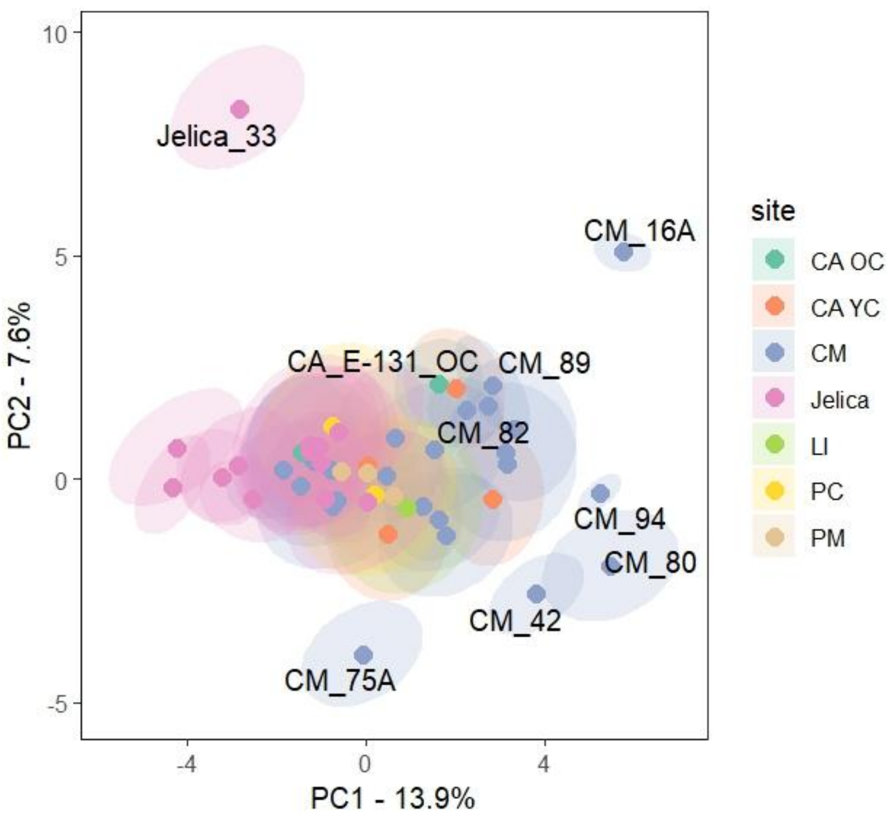

Figure B.3: Principal Component Analysis (PCA) showing the relatedness between the Greater Antilles groups and Jelica-Gradina (Serbia) estimated with FLEXDIST. Site abbreviations= CA OC: Canímar Abajo Old Cemetery, CA YC: Canímar Abajo Young Cemetery, CM: Chorro de Maíta, LI: Los Indios, PC: Punta Candelero, PM: Playa del Mango, Jelica: Jelica-Gradina.

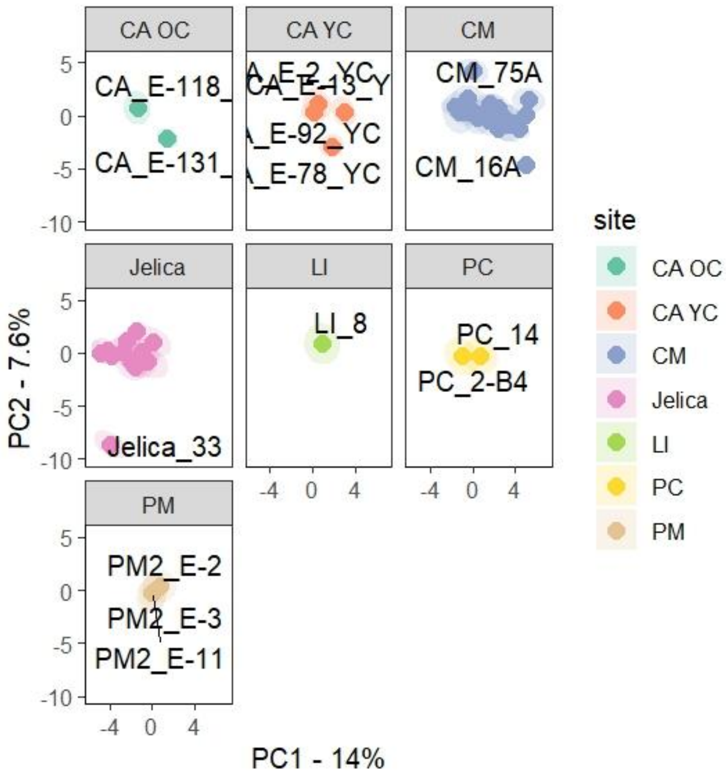

Figure B.4: Facet plot showing the relatedness between the Greater Antilles groups and Jelica-Gradina (outlier) estimated with FLEXDIST. Site abbreviations= CA OC: Canímar Abajo Old Cemetery, CA YC: Canímar Abajo Young Cemetery, CM: Chorro de Maíta, LI: Los Indios, PC: Punta Candelero, PM: Playa del Mango, Jelica: Jelica-Gradina.