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## **Ancestral Analysis of the French Colonial Moran Cemetery, Biloxi, Mississippi**

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## ABSTRACT

### ANCESTRAL ANALYSIS OF THE FRENCH COLONIAL MORAN CEMETERY

BILOXI, MISSISSIPPI

by Danielle Nicole Cook

December 2011

The Moran site (22HR511) in Biloxi, Mississippi, dates from 1719 to 1723 and is the earliest known French Colonial cemetery in the United States. Historical records suggest that those interred likely represent immigrants from Western Europe as well as Africa who were relocated in an effort to colonize the Louisiana Territory. Given the variety of cultural backgrounds at the site, an ancestral analysis of the 25 individuals uncovered has been conducted. Traditional markers such as cranial and tooth morphology and metrics, and enamel composition, were evaluated in all individuals, and DNA was analyzed in five. Stable isotope levels were also assessed to reconstruct diet.

The sample consists of two infants, 21 males and three female adults aged 18 to 45. Results support that most individuals are of European ancestry with strong consensus among those markers employed. Cranial morphology and osteometrics did suggest the presence of two Africans and one possible African. One of these individuals was found with a rosary; the only grave good recovered which leads to the conclusion that slaves were more than likely being converted to Christianity. Thus, data gained from osteological observations, more recently developed analytical techniques, and presence of variant mortuary practices suggest that this French Colonial site exhibited a complex composition of ancestral backgrounds instead of a highly segregated population.

The University of Southern Mississippi

ANCESTRAL ANALYSIS OF THE FRENCH COLONIAL MORAN CEMEMTERY

BILOXI, MISSISSIPPI

by

Danielle Nicole Cook

A Thesis

Submitted to the Graduate School  
of The University of Southern Mississippi  
in Partial Fulfillment of the Requirements  
for the Degree of Master of Arts

Approved:

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Director

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Dean of the Graduate School

December 2011

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## CHAPTER I

### INTRODUCTION

The late 17<sup>th</sup> century was marked by the first successful French exploration of the Gulf of Mexico when Pierre Lemoyne Sieur d'Iberville from Canada was contracted to sail to the region and thwart ongoing Spanish and English encroachment by establishing a permanent French settlement to control access to the Mississippi River. In 1699, he located the mouth of the Mississippi, but found it to be log-jammed and unnavigable (French, 1875). Therefore, d'Iberville sailed east along the coast, until he came across a suitable location in current day Ocean Springs, Mississippi, to build Fort Maurepas. Three years later, he relocated the capital of the Louisiana Colony to the Mobile Bay area, but it eventually returned to Mississippi, this time on the west side of Biloxi Bay in 1720. There at New Biloxi one of the most ambitious and desperately unsuccessful attempts to settle the colony took place (Bellande, n.d.; Carter, 2004).

As part of its efforts to solidify claims to its territory amongst the English and Spanish, France allowed John Law to set up a private company in 1717 which would put in place a new kind of financial power. Launching mass propaganda campaigns that portrayed New France as a wealth of opportunities, Law sold concessions located along the Mississippi River in a bubble-type scheme. Thousands of immigrants from several areas of Europe, as well as captives from Africa, were brought to the New World colony to work these concessions. To ensure success, all the new arrivals were required to work together, often in conjunction with Native American populations. However, many of them were met with inclement conditions,

including occasional local hostilities, disease, cold winters, and hot Gulf Coast days. Since New Biloxi was meant to be only a staging area, crops were never planted. In addition, promised provisions were either rotten upon arrival or never were delivered at all. These conditions resulted in famine and disease, causing the deaths of hundreds of immigrants at New Biloxi by 1722.

The marked cultural differences that existed between Africans and Europeans in life could also be seen in death, reflecting the local social order. For instance, based on the modest rituals of 18th century Europe, only elites would have been buried in caskets, while lower social classes were merely wrapped in burial shrouds without personal effects. On the other hand, Africans normally buried decedents with goods that were either theirs in life or that they might need when they reached Africa, since Africa was the place they returned to when they died. This *ancien régime* of strict adherence to social order would have been in place in France at the time, and many wished to maintain this ideal organization in the colonies as long as possible (Bauman, 2005).

However, other sites in French Colonial America, such as Fort Michilimackinac in Michigan and Saint Peter's Cemetery in New Orleans, suggest this social structure was reconfigured to fit the trying times of early development. The community cemeteries of these early sites have been located and those interred analyzed (Christ, n.d.; Cybulski, 1988; Owsley and Orser, 1984; Shunn, 2005). The historical, archaeological and bioarchaeological records of the cemeteries suggest segregation was less important, especially in death.

A cemetery established at New Biloxi has also been located and has undergone excavation since 2005. It is the purpose of this thesis to examine the demographic background of 31 individuals interred at this cemetery, known as the Moran site (22HR511). A number of methods will be employed in order to establish ancestry, including osteological observations and chemical analyses. This information, combined with an analysis of mortuary practices and colonial documentation, will shed light on who is buried at Moran. This in turn will make it possible to explore population distribution, social order, and relationship structure among the colonial inhabitants, revealing whether the *ancient régime* was practiced under John Law or whether a new order was developed to cope with the wretched conditions encountered at New Biloxi.

## CHAPTER II

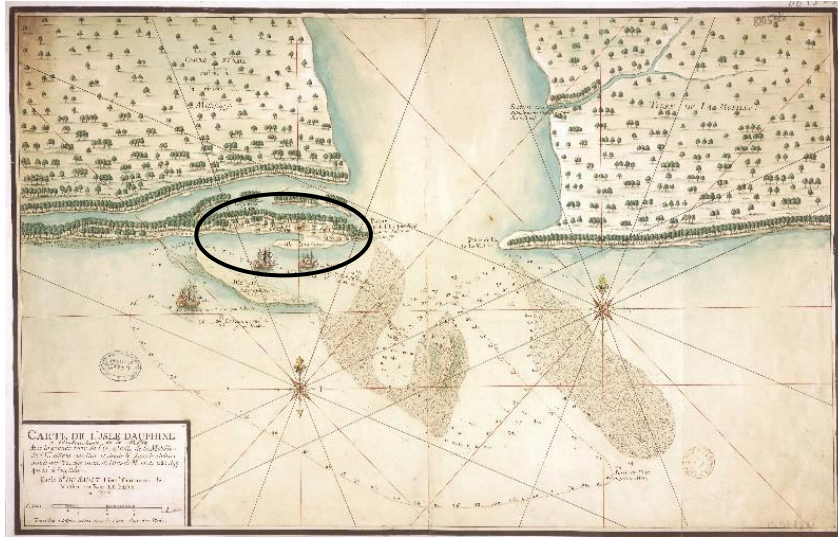
### THE MISSISSIPPI GULF COAST DURING THE EIGHTEENTH CENTURY

This chapter discusses France's exploration of the Gulf Coast and the colonial establishment made by Pierre Le Moyne d'Iberville. In addition, it introduces the eagerness of France and John Law to revitalize financial procedures by creating a new system of paper money and driving the sales of concessions. Also, the chapter explains the impact of Law and the eventual bursting of what came to be known as the Mississippi Bubble. Finally, the mortuary practices of the three ancestral groups present in the colony will be discussed, especially in terms of what those practices revealed about the social organization of the Louisiana colony.

#### Initial Exploration and Settlement of the Gulf Coast

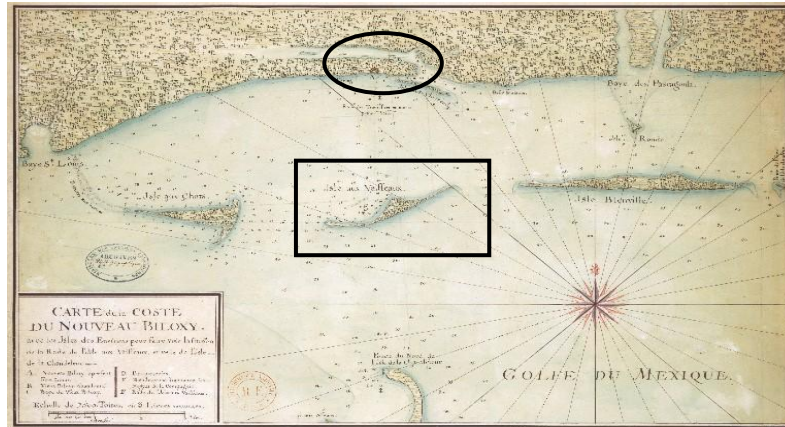
Critical to France's colonization of the New World was locating the mouth of the Mississippi River (Figure 1) since it meant control of the southern-most points of the Mississippi and Illinois Valleys as well as direct access to Canada (Giraud, 1966). An earlier expedition in 1683 by La Salle to discover this critical spot proved disastrous, and the sentiment of the time was that "the mouth of the great river could never be found and that further effort would only result in useless sacrifice of life and vessel" (Greely, 1893:54).

However, it was the French Canadian brothers, Pierre Le Moyne, Sieur d'Iberville, and Jean-Baptiste Le Moyne, Sieur de Bienville, who rose to the challenge issued by the French government.



*Figure 1.* Map of the Mouth of the Mississippi River. Also includes Dauphin Island (circled). *Carte de l'isle Dauphine à l'embouchure de la Mobile avec la grande terre de l'O. et celle de la Mobile de l'E. par le Sr. Du Sault en 1717.*

Their goal was to establish a presence on the northern Gulf of Mexico and lay claim to surrounding areas in the name of France. By October 4, 1698, d'Iberville and his brother had set sail for the New World, and by February 2, 1699, despite losing a ship and encountering the Spanish at Pensacola, d'Iberville, Bienville, and 50 Cadians landed at Ship Island (Figure 2) near modern day Biloxi, Mississippi. The island would continue to serve as the main entrance to French territory in the region, providing both port and storage for ships and their cargo. This initial landing party would frequently travel to and from Biloxi to establish the colony since Ship island was only meant to be a port for the mainland since large ships could not close to shore because of the shallow waters (Greely, 1893). Another harbor which was frequently utilized as a gateway to the area was Dauphin Island, which d'Iberville called Massacre.



*Figure 2.* Map of New Biloxi. Includes New Biloxi (circle) and Ship Island (square) Carte de la coste du nouveau Biloxy avec les isles des environs pour faire voir la situation de la rade de l'isle aux vaisseaux, et celle de l'isle de la Chandeleur (17??).

d'Iberville notes his choice of naming it Massacre in his Gulf Coast journals explaining “because we found on it, at the southwest end, a spot where more than sixty men or women had been slain. We found heads and the rest of the remains along with some of their household belongings” (McWilliams, 1981:38).

At this time d'Iberville's first priority became to build a fort on the eastern banks of Biloxi Bay. Called Ft Maurepas, its position provided fortification for the entrance of the bay. Built in 1699, the fort was outfitted with four bastions, twelve cannons, and thirty five men. After its completion, d'Iberville handed the command over to his brother Bienville and Sauvolle (De La Harpe, 1853). Three years after the construction of Fort Maurepas, provisions were running low and the men were living off corn from Native Americans. The order came to abandon Fort Maurepas and move the capital of Louisiana from Biloxi Bay to Mobile (Giraud, 1966), as Biloxi was never intended to be the capital but merely a temporary settlement anyway (Hamilton, 1911).

In addition to construction of a fort, plans for a warehouse were also mentioned in d'Iberville's journals but only a few times around January, 1702. The warehouse and nearby *magasins* were established on Massacre Island in order to protect goods and supplies that would later be shipped onto the mainland colony of La Mobile (Higginbotham, 1977; McWilliams, 1981). Higginbotham (1977) reports that the primary duty of Le Moyne de Châteaugu , chief in charge of the Massacre Island post, and La Salle, the Massacre clerk, were to see the facility to completion and hire the artisans for construction and inventory. When it was finished, the structure was fifty feet long and twenty-five feet wide (Higginbotham, 1977:37).

The new settlement in Mobile consisted of cross streets named for residents, a church erected by the liberality of Gervaise (named after a pious priest who was unable to come out of the monastery), and a *seminaire* where the priests lived. A fort was also erected to the south of the town. Known as Fort Louis (Figure 3), it was also called de la Mobile (Hamilton, 1911).



Figure 3. 1720 Map of the Gulf Coast. This map portrays major French Colonial landmarks, including New (5) and Old (6) Fort Louis, New Orleans (2), and Dauphin Island (7). Le Mississipi, ou La Louisiane, dans l'Am rique, Septentrionale (Bonnart, 1720).



Once Mobile was established, d'Iberville brought four families to the area, and by 1708, they had settled small farms and were reported as being generally happy and content with the colony. Hamilton (1911) explains that this settlement was unlike any other that had been established in North America as it was not fortified by any walls. Documents from this time express no fear of Native Americans and reveal that Mobile was a center for Indian trade and diplomacy. Even though the center of the settlement was a fort, it was only put into place in order to protect its inhabitants from the other European nations and not indigenous groups. There were, however, a few cases of violence that would lead to the eventual capture of the suspected Native Americans. Those who were taken captive were used as servants throughout the colony and in fact were the most common source of labor, even more so than French "*domestiques*" or African slaves (Hamilton, 1911:27).

It was reported that Africans numbered only 23 individuals in 1713 (Hamilton, 1911). The presence of Africans as well as Native American groups, however, would have meant that Mobile was a diverse community with both Europeans and non-Europeans inhabiting this space. The Europeans who occupied the new capital were not seedy as would be the case with later immigrants, but were said to be honorable families. These first settlers were known as *habitans*, a term also used in Canada to signify French farmers (Hamilton, 1911).

Other Europeans were also shipped to the colony every few years, and often consisted of eligible women from France. Since his initial landing, d'Iberville had continually asked for brides for the Canadian settlers. In a 1701 letter sent to the French minister he wrote, "If you want to make something of this country, it is

absolutely necessary to send this year some families and a few young girls...who will be married off shortly after their arrival” (Margry as cited in Allain, 1988:18). After three years of pleading with the government by d’Iberville, women were finally shipped. The first and most famous delivery were known as the Pelican girls, so named for the ship in which they came over on in 1704. In addition, these girls were also known for bringing a rampant case of yellow fever with them that lasted the summer and killed a number of Europeans and Native Americans (Higginbotham, 1977).

Ranging from 13 to 38 years of age, the women represented all tiers of social life, from criminals to governors’ wives. However, most of the women were described by Allain (1988:20) as parasites, including thieves, prostitutes, and assassins, who usually carried venereal diseases or other such communicable diseases for which they had not been properly treated. On the other hand, some women who entered the colony did so with the specific function of an *engagé* who provided labor such as a seamstress, baker, mender, knitter, or embroiderer, although the majority were washer-women (Allain, 1988). Unlike the initial ladies who came over on the Pelican, some of these *engagées* were already betrothed while still others were married off after arrival.

Colonial women of this time were also known for their unwillingness to eat the cornbread that was introduced to them in the colony (Hamilton, 1911). Nevertheless, this behavior was specific to these women and not characteristic of all colonists, because French cooks in Mobile learned how to prepare indigenous foods, including corn in various forms such as corn meal, succotash, hominy, and fritters.

Additional foods consisted of bear, deer, fish, and fruits such as oranges, strawberries, watermelon, mulberries, and figs. Those who lived in Mobile tilled the earth, hunted, fished, and eventually did not need to rely on provisioning from France as before.

Unfortunately, the colony began to fail in April 1711 at which time a persistent rain flooded the fort and surrounding houses. Higginbotham (1977) reports that nearly two-thirds of the houses were inundated and those inhabitants asked Bienville to move the capital downstream. He immediately complied and began work on the new fort for Mobile, also called Fort Louis, in addition to construction of new houses. Located at present day Mobile, this location was closer to Dauphin Island for the purpose of helping with trade, shipments, and immigration. It was smaller than Old Mobile but proved to be sufficient for the time being (Hamilton, 1911).

While the early colonies were being settled, France in the early 1700s had become depressed with a multitude of debt and high taxes (Moen, 2001). The financial burden of the War of Spanish Succession in 1715 and the death of King Louis XIV prompted his nephew, the Duke of Orleans, to become acting Regent during this time of crisis. Demarest, the new finance minister, reported to him that “whole districts were depopulated, commerce ruined, troops [were] unpaid and ready to revolt” (Thiers, 1969:39). In order to reclaim financial stability, the Duke relied on advice, first from Antoine Crozat (Hester, 2011), one of the wealthiest merchants in France and first proprietor of the Louisiana colony from 1712 to 1717 (Hemard, 2009). Secondly, the Duke turned to an old gambling partner, Scotsman John Law,

who would go on to revolutionize the way France conducted business (Giraud, 1966).

Law's proposal was an arrangement France had never considered before. His financial plan included "a bank which should discount, should collect the national revenues, should carry on national revenues, should carry on commercial monopolies, and afford, at the same time, a plentiful circulation of paper money and a means of profitable investment" (Thiers, 1969:44). However, the Council of Finances, put into place by the acting regent to handle French affairs, was unwilling to comply, so Law's proposition was denied and a compromise was sought.

Eventually Law settled for a bank of discounts, maintaining:

that a bank would increase the currency by the issue of its notes, would render the remittances from one province to another more convenient, would reestablish confidence by the creation of money of a fixed value-bank money; would permit foreigners to make their contracts in France with a basis of fixed and certain value, and would contribute by all means to the restoration of public and private credit. (Thiers, 1969:45)

In addition to the restoration of credit, Law also saw the benefits of uniting the Canadian fur traders and Louisiana commerce. In order to accomplish this goal, he organized in 1717 the *Campagnie d' Occident*, or Company of the West, which was more popularly known as The Mississippi Company (Thiers, 1969). To utilize his plan for Louisiana grants of land, also known as concessions, were made (Giraud, 1966), and "Law rallied, even from the interior of Germany, [to] farmers who went to Brest, [a port city in Northwest France], to embark [for the New World]" (Thiers, 1859:63). In addition, those parts of Louisiana, which were seen as unimproved, were sold at thirty-thousand *livre* per-square-league in order to create efficient establishments. These establishments were typically sold by the French

government as concessions to industrious and useful citizens who would utilize the land for agricultural purposes.

By November 1719, Dauphin Island had become too small to support further immigration. Adding to the already cramped conditions was a “fierce hurricane that had split Dauphine Island in two and created immense sand deposits that rendered the roadstead unnavigable” (Hester, 2011:5) as well as ever increasing Spanish hostilities. Based upon his familiarity with the coast to the west, the commandant suggested a new post on a mainland bluff situated opposite Ship Island and one league west of the original Fort Maurepas across Biloxi Bay. Due to this area’s habitation by the Biloxi Indians, it was decided that the new post would be called New Biloxi (French, 1853).

After a few days rest, the workmen and German soldiers who arrived in Biloxi began clearing the land of grasses and trees. At one point they had set fire to the area, leaving only ash and stumps in order to begin construction of soldiers’ cabins (French, 1853). Once the community had been established, Bienville relocated the provisions, munitions, and merchandise that had been stored at Dauphin Island.

#### Impact of Colonization along the Gulf Coast

The period that followed the creation of The Mississippi Company is popularly known as The Mississippi Bubble. During this time, Law “gave an impetus to colonial immigration never before experienced” (Pritchard, 2004:26). In addition, New Biloxi was being funded unlike any other colonial outpost in France’s New World efforts. To accomplish this, Law distributed engravings that depicted the

arrival of French immigrants to the Mississippi River. The propaganda promised that greeting the colonists would be Native Americans who were said to have admired and respected the French Jesuits and demanded to be baptized. In addition, the colonists were told that they would find mountains filled with gold, silver, copper, lead, and quicksilver (Thiers, 1859:78-79). Over the next few years, around 7,000 European immigrants and 2,000 Africans were brought to Louisiana (Hall, 1992).

This massive wave of newcomers landed at Ship Island and were shuttled to New Biloxi where they had claimed lots of land and erected cabins. Ships also brought women and several concession owners, including John Law, who received land 30 miles north of the Arkansas River, and M. Le Blanc, who was given land on the Yazoo River (French, 1853). Whether or not Le Blanc and Law ever came to actually till their land or have others act in their stead, is unclear. However, the Europeans who were in charge of farming could not endure the labor of working in the field. It was reported that they either burnt up and died under the Louisiana sun or could not overcome the chill of night (De La Harpe, 1853). Their lack of willingness or capability to farm their own food would prove to be disastrous for the residents in the staging community at Biloxi who began to starve when provisions ran low.

Once the settlement provisions began to be depleted, trade with local Native American populations became crucial. “At last, the famine was so severe that a great number died, some from eating herbs they did not know, . . . others from eating oysters, which they went and gathered on the sea shore. Most of those found dead by the heaps of shells were Germans” (French, 1853:21). Finally in December 1719, a cargo vessel delivered rations and provisions to dire colonists.

The settlement at Biloxi only lasted until 1722, at which time the capital was moved again, this time to its permanent location at New Orleans. However, New Biloxi was not officially abandoned until 1728 (Bellande, n.d.). Those remaining at the old capitol most likely consisted of French and French Canadian troops.

### The Biloxi Immigrants

The Mississippi Bubble had served its purpose of bringing people to Louisiana. Those who occupied and immigrated to the shores of Biloxi represented a variety of individuals from varying geographic regions, including Europe, Africa, Canada, as well as the Americas. Each group experienced colonialism differently and contributed unique qualities to the growth and development of New Biloxi.

#### *The Europeans*

During France's control of the colony, "vessels were armed, troops embarked, prostitutes and vagabonds were collected in order to send them to those solitudes which it was attempted to people" (Thiers, 1969:63). Upon arrival on the shores of New Biloxi, Europeans were married almost immediately and were assigned land to cultivate (Hamilton, 1911). However, it has been reported in ships' logs, census records, and personal journals that more than just the dregs of French society were shipped to the colony. For example, the census record from 1721 notes 853 French men, women, and children arriving as well as 178 French *éngages* (domestic servants) (Maduell, 1972). Pritchard (2004) reports that the majority of people who entered the colony were actually servants; less than five percent were free and over 91 percent were prisoners, indentured servants, and soldiers. Of these French

immigrants, 2,000 of them deserted or died during the journey from France and at least half of the European migrants either fled or died by 1726 (Pritchard, 2004:26).

The other European groups that had immigrated, forcefully or otherwise, to the Biloxi area included Swiss (Carter, 2004), Germans, and Canadians (French, 1853). One account claimed that “German colonists were planting new and most successful establishment on [the Mississippi] banks, within five or seven leagues of New Orleans” and that the Canadians and Germans were “the founders of all the establishments in Louisiana” (Champigny, 1776:18).

The variety of people settling the colony represented an assortment of backgrounds, including carpenters, shoemakers, locksmiths, engineers, attorneys (Maduell, 1972), salt smugglers, vagrants, army deserters, tobacco smugglers, rakes, prostitutes, and nuns (Pritchard, 2004). Based on these social titles and vocations, the majority of immigrants would have been men while women were usually brought in only for marriage or religious purposes.

*Monsieur Davion's Death Register.* These general patterns of European immigration are largely confirmed in a register of those who died at Biloxi during the administration of Monsieur Davion from August 8, 1720 until September 25, 1723. This document lists 174 names and death dates along with occasional family affiliation, job title, social standing, age, and nationality. Of those listed 118 are male, 42 female and 14 unidentified. Among the male vocations noted are, cadet, convict, soldier, guard, major, deacon, boat captain, and corporal. Of these positions, soldier is the most predominant (n=21) followed by convict (n=10). Only one nun and deacon were present in the record, which could indicate that they were rare or



else the religious personnel had their own cemetery. It could also mean that their residence in a seminary or convent protected them from disease.

Most of the women on the list are wives (n=22) or daughters (n=5) who usually are noted under the name of their husband, unlike sons who are printed with their own names. Although the record shows most of the women are labeled with their husband's name, it is difficult to determine the role these women would have played within the colony, considering there are no existing diaries and few letters written by them (Allain, 1988). Most of those who were not nuns were brought over for the purpose of supplying men with a wife, but that does not mean they were powerless within the community. In fact, women were quite influential in the social circuit and strived to make the new colony more like the French society they had left (Hamilton, 1911).

The ages that are listed on the death register vary between "child" and 42 years old, with the majority of individuals between the ages of 20 to 30 (n=9) and 30 to 40 (n=7); only three are listed as children. Based on the history of this area, it can be concluded that the individuals older than 15 years probably immigrated to the area because the first Creole individual was not recorded until around 1706, while those under 15 might have been born in Louisiana. Furthermore, census records from 1721 indicate "53 childless families, 27 with one child, 7 with 2, none with 3, and 9 with more than 3" (Allain, 1988:23).

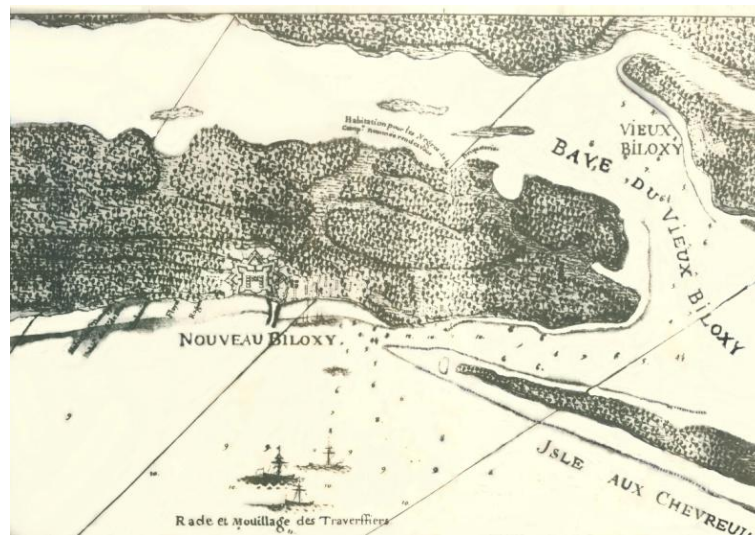
Some of the countries represented on Davion's list are Germany, Switzerland, and Czech lands but are limited to only a few individuals. Certain locations, including Canada or Acadia, and France, are not mentioned. This could be explained

as an error in record keeping, an assumption that if an immigrant were not from a different country he or she were from France, or the fact that people were dying too rapidly to keep up records. The other location not listed is Africa. As will be seen, slavery had already been introduced to the colony by this time and the disregard for Africans in this document could mean that there was a separate list for their deceased, they were not counted as people and might be on the same ledger as livestock inventory, or they were not documented at all.

### *The Africans*

Even though Africans are not mentioned on the Davion register, they are still represented in the colony, with the initial wave of arrival in 1719. One of the first boat loads of Africans came on the frigate *l'Africain*, which deposited 180 people. Over the next few months 574 slaves were left on the shores of Biloxi for the purpose of agricultural work (De La Harpe, 1853:86-88). However, the arriving slaves may not have inhabited the same living space as the European immigrants, and could possibly have resided on another part of the peninsula. Hester (personal communication, 2009) suspects that these individuals might have resided at the African Habitation Site and Adjacent Brickworks, which were depicted on La Blond de la Tour's 1722 map of the area (Figure 4) on the northern shore of the Biloxi peninsula from Keegan's Bayou to Rhode's Point. It is believed that the slaves could have worked at the brickworks, providing labor and materials for the planned (but never constructed) Fort Louis in New Biloxi (Hester, 2011). Evidence for this site, however, has not been located either archaeologically or in other historical records. Pritchard (2004:92) also explains that slaves played a large role in the colony's

subsistence, “transplanting rice cultivation from Senegambia, which gave the colony its first secure cereal grain for consumption by all...eventually, African slaves surpassed Louisiana’s combined European population.”



*Figure 4.* Map of Nouveau Biloxi. Includes African Habitation site (star), Biloxi Bay, Vieux Biloxi, and Nouveau Biloxi. Carte de partie de la coste du Nouveau Biloxi avec les Isles des environs. Les chiffres qui marquent les sondes sont des pieds. / Leblond de la Tour. (Le Blond de La Tour, 1722)

The influx of slaves into Louisiana eventually forced Bienville and local government to create a set of laws called the *Code Noir* in 1724. Even though the code was established after abandonment of Biloxi, these rules were probably followed prior to their formal codification. *The Code Noir* includes over 35 articles of conduct on how slaves should behave, including clothing, European interactions, marriage, and socializing. It also addresses how slaves should be treated and the religion that they should practice. One article specifically addresses intermarriage, stating:

VI. We forbid our white subjects, of both sexes, to marry with the blacks, under the penalty of being fined and subjected to some other arbitrary punishment. We forbid all curates, priests, or missionaries of our secular or regular clergy, and even our chaplains in our navy sanction such marriages.

We also forbid all our white subjects, and even the manumitted or free-born blacks, to live in a state of concubinage with blacks. (French, 1853:89-90)

Based on this article, the appearance of people of mixed ancestry would be unlikely, however not impossible. The article continues to address this issue by making the slave's master pay a fine and the woman and any child he may have sired removed from his ownership.

The *Code Noir* provided such rigid guidelines that strict social segregation between Africans and Europeans most likely would have been followed. However, this code could have been loosely enforced or not followed at all and therefore segregation would also have been less likely observed.

#### *The Native Americans*

The third group, and the one probably the most impacted by colonization, was the Native American tribes. Since the arrival of the French in 1699, the indigenous peoples had endured disease, famine, political harassment, wars, and slavery. The colonies used the knowledge of local people for hunting and settlement locations as well as their naivety to obtain goods at a low price.

D'Iberville relied on Natives from the very beginning of his explorations in order to use them for anti-English diplomacy. The first instance of this involved the Chickasaws and Choctaws who were summoned to a peacemaking conference by d'Iberville in 1699. The basis of the meeting was to convince the groups that the British were using them to war with each other; when the Choctaws had been defeated and Chickasaw power depleted, the English colonists would capture the Chickasaws and sell them into slavery. The plea fell on deaf ears, and the Chickasaw remained under the control of the English (McWilliams, 1981).

War was not uncommon between Native American groups and Europeans, especially between the French and Natchez in the 1710s and 1720s. One account in 1729 detailed a raid on Fort Rosalie in which a European man and woman were killed and scalped by a group of Natchez. During the attack, it was intended that the woman be captured and sold into slavery; however, she fought against her kidnappers, killing one and injuring the other with a knife she had hidden in her shirt. The rest of the natives escaped, but the one who had been stabbed was later hunted down and scalped by a vengeful colonist (French, 1853:43-46). The hostilities ended in 1730 when the French finally defeated the Natchez who then dispersed.

Relations with the indigenous groups were not always centered on war, however, and in fact quite the opposite was commonly seen; marriage between French and Indian occurred frequently. It has been proposed that the French utilized this custom in order to solidify relations with the tribes that they were marrying into (DuVal, 2008; Spear, 2009). It was important for the French “to raise a colony of French-speaking Catholic Indians and half breeds, dressing, eating, living like native-born Frenchmen, in settled villages” (Allain, 1988:19). The reason for this homogenization was not based on peace, but agriculture. The point of mixing the two groups was that the product would be a perfect hybrid; well tilled fields and stocked pastures along with linguistic capability and European mannerisms. French administrators, however, soon realized that they were not going to achieve this goal. Instead of indigenous women accepting French customs, colonial men adopted Indian traditions (Allain, 1988). Great protest rose and the sentiment of Bienville in 1701 was that this type of behavior would not promote the growth of the colony.

From 1712 to 1717 commissioner Dubois Duclos objected to the practice of marriage between French men and Indian women, and saw it as counterproductive, owing to the fact that the Native American women wanted to reside with their own people and would lead their new husbands back to the tribe. He concluded by saying that the only men who wanted to marry Indian women are those who preferred to live like Indians (Allain, 1988).

Marriage or interbreeding between the two groups is evident in these historic documents, but it is unclear whether their offspring, known as *métis*, would have lived with the colonists or with their mother's tribe. DuVal (2008) explains that *métis* groups in Louisiana were small and short lived because the Indian women who were marrying French colonists were usually the product of slavery and would eventually assimilate into the colony.

Enslavement of native peoples was usually the product of war and, based on the tradition of killing male enemies, the majority of slaves in the colonies were women (DuVal, 2008). Some of these women were kept for sexual purposes and concubinage to the extent that moneylenders threatened to enter the debtors' house and take his concubine (DuVal, 2008). As popular as that practice might have been, not all women occupied that role. The majority were put to work cooking meals, keeping the colony's houses clean and orderly, working as laundress and nursemaid, contributing to the food supply by raising chickens and vegetables, or working as field hands (DuVal, 2008:275). Eventually the use of Indian slaves was partially superseded by the importation of Africans who came at a cheaper cost and did not cause rivalry and warfare with local groups.

As the three groups (European, Indian, and African) cohabitated in Louisiana, they were ruled by the French government either voluntarily or forcefully. By entering the rule of the colony, the once individual groups began to homogenize, affecting their customs and rituals, making what was autonomy into conformity, and finally, regardless of protest, handed their destinies over.

#### Eighteenth Century Mortuary Practices

Individuals handed their lives over to colonial rule, and by looking at the mortuary practices and burial record of each group, it can be determined whether they handed their deaths over as well. One expectation is that the laws and regulations established by the French government would have dictated citizens' behavior, no matter from which group they originated and whether they were alive or dead. In order to determine whether or not this was the case, bioarchaeological analysis can provide powerful clues.

One consideration of bioarchaeology is the location, position, and condition of the individual(s) being excavated. By analyzing these traits, a routine burial practice can be potentially observed which would reflect upon the culture that dictates the manner of disposing of the dead. In addition, burial rites reflect the treatment, ideology, and concern for the deceased, at the same time expressing the individual's social position. It is believed that mortuary expression reflects the emotional attachment a group has for an individual; if there is little-to-no care taken with the body, it can be concluded that the group had little-to-no attachment to the deceased (Cannon, 1989). The groups that are represented during French colonization would have had diverse cultural beliefs, making burial analysis a

potentially vital part of identification. If different burial practices occur from one set of interments to another, it could indicate that different groups were disposing of their own members. As it has been shown, the early French colonization would have been comprised of several groups including Europeans, Africans, and Native Americans. Each one has had a long history of burial rituals and unlike objects or personal effects, the knowledge of cultural heritage can be carried regardless of final destination.

#### *Native American Mortuary Practices*

Upon arrival to the New World, one of the first observations d'Iberville made was of the burials he discovered on Massacre Island. His description is one of strewn bodies along the shore, exposed and decaying, although not as the result of a massacre but rather caused by a disturbed shore line midden. Another account of Native American burial practices observed by d'Iberville includes references to burial mounds. Additional reports of the burial practices of the Muscogulge in Alabama describe four square pits dug underneath the person's house in which they placed the decedent in a sitting position with the objects they perceived as most valuable, usually including gun, tomahawk, and pipe. Subsequently, the first wife would then take her share of his belongings with the remaining items being distributed among the rest of his wives (French, 1853:137).

In contrast, the Choctaws erected eighteen to twenty foot high scaffolding for their deceased. The individual was laid on it until their flesh decayed, at which time attendants would scrape the material from the bones and then wash, dry, bundle them and lay them to rest within a "bone-house." Once the charnel house was full, a



communal funeral would occur whereby people would take their respective friend or relative to a public burial location. The individuals were stacked with one another in a pyramidal form and covered with earth (French, 1853:137). This earthen structure could have been the type that had been described by d'Iberville, and therefore suggest that the first group of natives he came in contact with were Choctaws. Based on these two types of burial practices, it can be concluded that mass graves would have been expected for this time period, rather than the single burials common among Europeans.

#### *European Mortuary Practices*

In complete contrast to Native American practices, Europeans were burying their deceased in separate plots. Traditional English Christian burials consisted of individuals in either coffins or shrouds and laid out on an east-west axis with the deceased's head to the west, owing to the belief that the person will be facing sunrise on Judgment Day (Riordan, 1997). The decedent's hands would be crossed either on their chest or waist preventing the arms from taking up unnecessary space. Finally, few to no grave goods would be placed with the individual depending on their social standing and monetary value and based on European traditions.

The traditions followed by Europeans during the 18<sup>th</sup> century were characterized by mortuary restraint (Cannon, 1989). Cannon (1989:438) explains that "differences in mortuary behavior between the rich and the poor were sharply defined and the inflationary spiral of display fueled by emulation had not yet developed." However, the grandeur that was displayed during this time by elite groups was still relatively mild when compared to that of previous and later

generations. One explanation for the lack of material display is that there was a general disregard for the afterlife that accompanied the rationalist attitude of 18th century Europe (Cannon, 1989). Because of these beliefs, it would have been unusual to see anyone who was not high status in coffins, and even among those individuals, elaborate coffin hardware would have been rare. Instead, the remains were laid out and wrapped in a burial shroud with only a pin to fasten it. Sometimes, the decedents were not even buried in clothes. Personal effects would most likely have been kept by the family and reused by another member.

These rituals and the cultural basis for them would have been carried to the new world with the arriving settlers. Traditions would not have been expected to be pushed aside only because the landscape had changed.

#### *African Mortuary Practices*

Africans, brought over as slaves, would have also had their own burial rites and beliefs. Unfortunately, their position as property might not have let them practice traditions from their native tribe or country. By the 1750s, slaves were being imported into the New World from countries such as Cameroon, Nigeria, Sierra Leone, Windward, and the Gold Coast. It was during this time that, despite their status, slaves actually had control over their own deceased. One account made by the Reverend John Sharpe in New York complained that slaves “are buried in the common by those of their country and complexion without the office; on the contrary the Heathenish rites are performed at the grave by their countrymen” (Jamieson, 1995:47). One group outside of New York was also allowed to dispose of their dead according to their homeland traditions. Both Barbados and Jamestown slaves were

responsible for the location of burials and would often distinguish between type of death and proximity to living quarters. Jamieson (1995:47) explains, “In some African societies those who died a ‘natural death’ were distinguished from those who died in childbirth, from infectious disease, from being struck by lightning, from committing suicide, and as victims of murder or drowning.” This too was seen at Jamestown, as slaves were buried away from living quarters. In addition, “slaves in Jamaica in the late 18th century were said “sometimes” to bury family members under the bed in their house” (Jamieson, 1995:48). It was not only location that African slaves dictated, but also the material goods that accompanied the body.

The function of material objects with a decedent served a number of purposes that were not considered a status symbol. The first is seen with the Nankanse of Ghana, who believed the dead should be buried with the objects they owned in life in order to set their soul free. This process is said to release the person’s soul if it had been trapped by the grave (Ucko, 1969:265). The ritual of burying a corpse with their possessions is a popular belief and is also seen at Houlof cemetery located in Cameroon. Originally excavated by Augustine Holl this cemetery dates to A.D. 1500-1600. There are also reports of this practice at the El Mina cemetery in Ghana, dating from 17<sup>th</sup> to late 19<sup>th</sup> century, which held 200 individuals in domestic sub-floor burials where individuals were found with “the inclusion of a smoking pipe, lots of stone tools, copper artifacts, and a large number of imported carnelian beads, with a maximum of 174 beads in one tomb...ceramic vessels, beads, and tobacco pipes” (Jamieson, 1995:49).

A second role that material objects play is a utilitarian one whereby the slaves believed that death meant a return to Africa. The person was then buried with objects that they would need when they returned home again. One report made by an American slave in the South during the 1830s states that the son of an African-born man was buried with

small bow and arrows; a little bag of parched meal; a miniature canoe and a little paddle (with which he said it would cross the ocean to his own country). . . and a piece of white muslin with several curious figures painted on it . . . , by which . . . his countrymen would know the infant to be his son. (Charles Ball quoted in Roediger, 1981:178)

Based on these traditions it would be expected to find individuals of African ancestry with some burial goods unless their disposal was being handled by European colonists. If Europeans are burying their slaves, then it is probably unlikely they are doing too according to African traditions.

#### Early French Colonial Cemeteries in the New World

In addition to the Mississippi and Alabama Gulf Coast, the French had established colonies in other parts of North America including Louisiana, Quebec, Michigan, and Maine. These settlements date from 1609 to 1788 and vary in function from military posts to established colonial capitals. This section discusses these French sites, their excavation history, and demographics of the human remains that were interred there since they will provide comparable data to help better understand experiences at Biloxi.

##### *Saint Peter's Cemetery*

Saint Peter's, also known as Toulouse Cemetery, was originally identified in 1984 when construction on the northern edge of New Orleans's French Quarter

unearthed human remains. Analysis of historical records suggested that it was New Orleans's first official cemetery, which had been established in 1725 and later closed in 1788. There likely had been earlier cemeteries situated along the river bank, but their locations are unknown. St. Peter's was only used for "the more influential inhabitants of the city" (Huber as cited in Owsley and Orser, 1984:19). The fact that it was a European cemetery resonated throughout the local community when it was discovered and citizens came to claim the remains of ancestors. In the midst of this controversy, the Archdiocese of New Orleans was contacted because of "the Church's initial association with the cemetery and because of the religious issues involved in the excavation and the study of historic-period, European burials" (Owsley and Orser, 1984:9).

Owsley and Orser recovered 29 individuals varying in age, sex, and ancestry from the cemetery. Ancestral determination was possible for 18 of the burials; however, methods for determining ancestry were not given in the original report. Three of the individuals were European, 13 African, three possible admixtures of European and Indian, and the other two were possible admixtures of African and European. Their results closely match the social demographic records kept by the Catholic Church (Owsley et al., 1987), which reported demographic information about the deceased, including race, social condition (whether free or slave), and degree of admixture including "mulatto," "griffe" (African mulatto), quadroon (one-quarter African - offspring of mulatto and white)" (Owsley and Orser, 1984:112). Census records from 1732 also show 958 individuals, 709 white and 249 black (all of

whom were slaves). By 1778, the population grew to 3000 inhabitants with categories of mixed blood being recognized (Owsley and Orser, 1984).

Owsley and Orser presumed religious affiliation by an individual found with a rosary and another with a religious medallion. The rosary is described as having:

63 black, wooden beads held together by a fine silver-plated chain. Two Roman Catholic medals were contained as part of the rosary and held to it by an intricate design of metal mesh. Although the figures on both sides of the medals could not be identified with any certainty, one is perhaps a Madonna and Child while another is perhaps St. Christopher or similar religious figure. A longer chain, containing at least one bead and terminating with a wooden cross, was inlaid into an etched, silver plated setting. The wood exhibited 7 small, circular indentations that suggest that it once contained semi-precious stones. (Owsley and Orser, 1984:83)

The census records and burial information proved to be of the utmost importance when trying to determine the true population and social interactions of the people. The data also show that the ideal social structure, organization, and planning of New Orleans as “a regular grid that ordered social space hierarchically, and the separation of public and private areas” (Dawdy 2008:72), established by the French government and architects, diverged when it came to colonial reality. On a 1731 map of New Orleans, the city is a grid in which the slave quarters are separated from the European residential areas by a wall, portraying the city as a segregated space for free whites with outlying areas for Africans (Dawdy, 2008:147). However, by looking at Saint Peter’s Cemetery in New Orleans, a very different picture is seen in which Africans were buried alongside Europeans, and no part of the cemetery was demarcated for slaves or segregated (Owsley, 1984). Particularly interesting about the burial services of this time is, “those who declined Catholic burial would assume that their wills would be questioned in court” (Deville, 1968:11), and slaves were

rarely baptized. Dawdy (2008:72-73) points out, “Most of these towns rapidly grew away from their planned symmetry.”

### *Fort Michilimackinac*

Fort Michilimackinac, built in 1715 and occupied until 1781, is located near present-day Mackinac City on the northern tip of Michigan's Lower Peninsula and south of the Straits of Mackinac. Originally established by the French to control the fur trade, it consisted of a square stockade with four bastions military housing, guard houses, and missions (Stone, 1974). Later, the fort expanded with the addition of further structures and became a center for a variety of social activities.

One of the most significant uses was for religious purposes, especially when The Church of St. Anne de Michilimackinac was established by the Jesuits in the early 1740's (Shunn, 2005:5). It was utilized for baptisms, marriages, and a burial location for a number of individuals. According to records, some of these individuals include those with Native American sounding names, or who are referred to as “savage.” Among indigenous tribes present were the Ottawa, Huron, Tionontates, Ojibwas, Iroquois, and Potawatomi (Shunn, 2005:4). Some of these groups, including the Ojibwas and Huron, relied on the fort for trade and protection and in return, occasionally fought next to the French against the English and allied Iroquois nation (Stone, 1974).

In addition to indigenous and French occupants, some inhabitants at Fort Michilimackinac owned black slaves (Armour, 1967). However, slaves had minimal presence within New France colonies due to the lack of labor that required them. Typically, slaves were owned by rich elites who used them for housework and not for the manual field labor like the rest of the colonies (Pritchard, 2004). It was also

reported that it was typical for people of the upper class to own at least one Native American slave (Sleeper-Smith as cited in Shunn, 2005). Whether that was in addition to, or instead of, African slaves is unclear. The relationship that was held with indigenous groups was one of dependency whereby the French relied on them for food, protection, and trade. Also, the underdeveloped military presence, only 35 soldiers, required that colonists rely on surrounding Native Americans for protection.

The colonists who occupied Fort Michilimackinac consisted of the 35 soldiers, their families, an additional 30 traders, and their families outside of the fort walls (Stone, 1974). Of those living within the walls, three were reported as having mixed ancestry, also known as *métis* (Shunn, 2005). Even though it is unclear as how the individuals were mixed, it would be safe to assume that they would have been a combination of Indian and European, since the *Code Noir* banned European and African affairs and African slaves were limited in number. Furthermore, this period of administration was one who pushed for the unity of colonists and natives, more precisely French men and indigenous women. It was believed that this policy would strengthen ties and in turn trade with local groups (Spear, 2009). The outcome of this administrative influence is seen in the Mackinac Register from 1698 through 1765 that recorded 48% of marriages were between Canadian men and Native American or *métis* women, and 32% were between Canadian men and Canadian women (Peterson as quoted in Shunn, 2005).

The 15 remains that were found under the Church are believed to represent these varying ancestries. An analysis of cranial metrics by Dr. Russell Nelson at the University of Michigan in 1996 concluded that three of the six individuals tested



were Native American, two were European, and one was of mixed European and Native American ancestry (Shunn, 2005). The mtDNA analysis that was later conducted by Shunn (2005) showed some evidence in support of Nelson's results but also produced a number of contradictions. For example, those individuals who were determined to be of European ancestry by Russell did in fact belong to a European mtDNA haplogroup. On the other hand, those who were identified as Native American or mixed ancestry often times either had indeterminate mtDNA or did not belong to an American Indian haplogroups (Shunn, 2005). None of the individuals were found with burial goods that could suggest religious or cultural affiliation.

#### *Quebec City*

Excavations in 1986 and 1987 of the fortification wall at the western front of the old Quebec City, which delimits parts of "Parc de L'Esplanade," produced 50 mid-18th century burials. Under the direction of Gis le Pi dalue and with the help of the Canadian Parks Service, Quebec Region, these burials were believed to be Protestant prisoners of war from New England, New York, England, and Scotland seized in 1746-1747 during raids by the French and their Indian allies (Cybulski, 1988).

Analysis of archaeological remains consisted of several shallow pits, which were determined to be unmarked graves containing 50 individuals: 45 males, three or four females, and one child (Cybulski, 1988:61). Preservation ranged from mostly complete individuals to some only represented by a few elements. The majority of burials were single individuals extended on their backs, while six were reported to be face down and two were found buried on top of one another. Based on the recovery

of copper shroud pins and the fact that some remains were found face down, it is believed that the bodies were wrapped in shrouds or burial sacks. In addition to pins, French made glass bottles were discovered near one of the burial sites. No other artifacts were found.

Ancestral analysis consisted of dental morphology, and cranial measurements and morphological analysis. Results show a prevalence of Caucasoid features, especially in terms of long, narrow skull vaults and facial skeletons, very flat faces, and narrow nasal openings. Nonmetric variables also point to Caucasoid origins: rounded sagittal skull contours, sharp lower nasal margins, and parabolic palates with jagged palatine sutures (Cybulski, 1988:67-68).

Dental analysis conducted showed a number of ancestral morphological features including crowding, rotation, and displacement which are common to people of European ancestry. Shoveled incisors were also noted, with 19 individuals showing some level of that trait. Cybulski (1988) believes that even though this trait, which is predominantly associated with Native Americans, is evident in this population, it does not reflect the presence of any indigenous people, and is not a distinct indicator of ancestry. Based on cranial and dental traits, it was determined that all remains were that of European descent. Coupled with historic diaries from this time, it could also be concluded that the burials reflect people that are “Dutch, Irish, German, or Norwegian” (Cybulski, 1988:64) and are of Catholic faith.

#### *St. Croix Island*

The death of 35 French pioneers in the winter of 1604-1605 was originally reported by Marc Lescarbot in 1609. This contemporary of Samuel de Champlain

did not spend that winter on the St. Croix Island settlement, but published the account after being told about the deaths by survivors (Crist, n.d.). These remains would later be excavated in 1950 by Wendell S. Hadlock who had been contracted by the National Park Service (Hadlock, 1950; Harrington and Hadlock, 1951). Hadlock and his team uncovered two burials but failed to photograph or analyze them. However, it was noted that one burial was flexed and not extended like the other one (Crist, n.d.).

The next series of excavations took place in 1969 by Temple University under the direction of Jacob W. Gruber. This field season exposed 23 burials, which were generally left *in situ* once exposed, due to preservation and time issues. No metric data were collected, and a select few were chosen to be transported to Temple for further analysis. The remains included mandibles and associated mandibular dentition from 19 individuals and the incomplete dentition with mandibular fragments or without mandibles from four other burials. Also recovered were four crania, two of which were intact but eroded, a complete palate without the remainder of the cranium from one burial, and long bones from five individuals; of the individuals whose long bones were recovered, two also included the crania. The cervical vertebrae, metatarsals, and tarsals from several of the burials, as well as one set of long bones from a single individual, were unlabeled (Crist, n.d.). After the analysis of these lab samples, Crist (n.d.) returned to the site in 2003 to exhume the remains of those who had been stored in the lab in 1969. Data collection of these burials took place *in situ* with as little disturbance to the remains as possible.

Demographic results show all but three individuals were male; however, these three remains were indeterminate because they only consisted of teeth. Of the 25 burials, two were 18-20 years, six 20-25 years, nine 25-30 years, three 30-40 years and three 20+ years (Crist, n.d.). Ancestral analysis was based on cranial and dental morphology (DNA has also been conducted but no data are available yet). Of the 25 individuals recovered, four had shovelings, four had Carabelli's cusp, and two had pegged molars. All were determined to be European, with the exception of one individual (Burial 21) who exhibited epipteric (extrasutural) bones, shovelings, pegged molars, and a Carabelli's cusp. Burial 21's placement was also unique to St. Croix, with both his hands placed on top of his manubrium and adjacent to one another. According to Crist (n.d.), this could be the only individual who does not represent someone of European ancestry.

In summary, these cemeteries represent some of the many important sets of remains from French colonial history. Overall, these sites consist of individuals buried in either a shroud or sack with little to no evidence of coffins. In addition, French colonial individuals represent people who were typically impoverished or soldiers, and were not found to be buried with any artifacts, save the handful of religious iconography. Cemeteries from this time consisted of a mixed group of ancestral backgrounds and usually included European, African, and Native American remains. Finally, burial positions ranged from face up to face down, extended to supine, and individual to mass internments.

*Expectations for Burial Practices at New Biloxi*

Based on the practices seen at other sites, some similarities can be expected in New Biloxi. Since Europeans were the predominant culture it would have been easy for them to have followed the same cultural practices that they had in France, namely lower socioeconomic individuals in shrouds without personal items and higher class individuals in coffins. Religious ritual of burial orientation would also have been practiced, so as to expect individuals oriented east-west with their heads in the west and arms crossed.

Unfortunately, expectations for Africans would not be as uniform since their burial was up to the discretion of the colony. For instance, the *Code Noir* determined religious practice in which all slaves would conduct themselves in a Christian manner, subscribe to Christian ideology, and be supervised only by a Christian. There is also one article that states, “XI. Masters shall have their Christian slaves buried in consecrated ground” (French, 1853:89). Whether or not this meant in the same ground as other Christians or just other Christian slaves is not addressed.

To be treated and buried as a Christian meant eventually control would have been taken by owners who would have to have baptized their slaves, thereby preventing them from being able to practice their native traditions. Evidence of this can be seen in New Orleans, where by 1724 all slaves had been baptized Christian. This rite required all slave burials to be excavated and reburied in a Christian manner including being oriented with head placement in the west (Jamieson, 1995). The practice of baptism did not mean that slaves were to be given coffins as some Europeans had; instead, shrouds, demonstrated at El Mina, would have been

customary at the time. One European group in Barbados during “[the] 17<sup>th</sup> through early 19th centuries, supplied coffins by plantation owners as a final reward for devoted slaves, and were thus an incentive toward acceptance of the dominant European ideology” (Jamieson, 1995:53). Despite this attempt at coercing slaves, coffins were still rare among most groups in the New World.

As it is seen with the *Code Noir*, the French ruling power had established a set of social norms, which everyone in the colony were expected to follow. This idea of normalcy included everything from religion to clothes, and affected everyone from slaves to Bienville himself. However, Dawdy (2008), using Owsley’s (1984) analysis of Saint Peter’s Cemetery as evidence, argues that these customary behaviors and expected social patterns were not followed by inhabitants of the new colony. One example of an unrealized social expectation was that of religion.

Deville (1968:11) explains:

The Catholic Church held an imposing position in state and society. Louis’ subjects were supposed to follow their monarch in matters of religion and be good Catholics. They were expected to attend mass, pay their tithes and dues, and resort to the church at the crucial junctures of their lives. Frenchmen should be baptized, and be buried as Catholics.

On the other hand, if slaves were given the right to follow their cultural practices, then the burial record would appear to be quite different. However, some controversy has arisen over what is the standard African practice. Some (Vlach, 1978) suggest that head to the west represents the rising sun; others (Handler and Lange, 1978) say that there is no standard and that some groups orient toward the sea while others face away from their village. In addition, it would be expected to find

individuals with utilitarian burial goods placed there by other slaves for the journey home.

Comparable to Africans, Native American burials too would most likely depend on the European culture, unless they were being returned to their tribal nation for burial. Although this would not be unexpected since the two groups relied on each other for trade, alliances, and marriage. Such European style Native American burials were found at St. Croix and Fort Michilimackinac and included internment of both in the same area.

On the other hand, assuming that Native Americans would be buried in a Christian manner leads to the belief that these individuals were being baptized, although not unexpected. The presence of missionaries and priests within the colony often provided religious service for European colonists as well as missionary work for nearby Native Americans. For instance, Reverend Father Marest of the Society of Jesus, Missionary was reported to be living among the Nadouesioux (McWilliams, 1981) in 1698. The cohabitation of Christian leaders and indigenous groups could potentially infer that these people had adopted European religion, explaining why a missionary was welcome and some Native Americans are buried in a Christian manner.

Based on a number of historic records which have survived from this time and other French Colonial site, certain burial patterns are expected for each ancestral group within the colony. Accompanying these expectations is a picture of the environment in which the inhabitants of New Biloxi would have lived. In addition, it is through bioarchaeological analysis that we confirm these expectations and begin to

understand who those buried at the Moran cemetery really are and in turn who the people of the colony might have been.



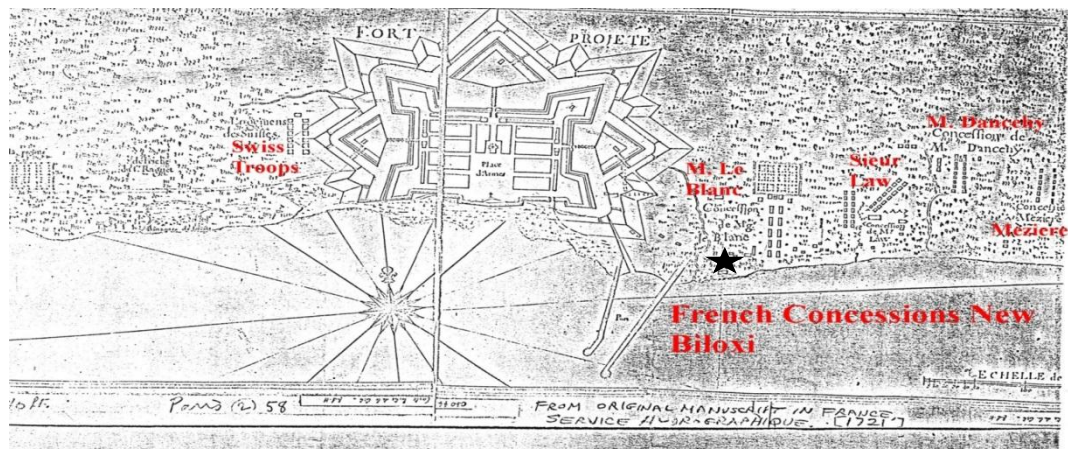
## CHAPTER III

### THE MORAN SITE

This chapter focuses on the prior work that has been conducted at the Moran site, including initial discovery of the cemetery in 1914 and excavation conducted through 2009. The chapter also presents results of previous analysis that has taken place with the skeletal series, such as basic sex and age determination as well as more in-depth isotope evaluation and Carbon-14 dating. Finally, mortuary practices of the cemetery are addressed.

#### Prior Excavations

Located within close proximity to the Mississippi Sound water line and about 100 yards northwest of the Biloxi Lighthouse, the Moran site is remarkably near where New Biloxi and more precisely, the Le Blanc concession, would have been found (Figure 5) about 1720.



*Figure 5. Map of Le Blanc Concession and Moran Site (star). Carte de partie de la coste du Nouveau Biloxi avec les Isles des environs. Les chiffres qui marquent les sondes sont des pieds. (Le Blond de La Tour, 1722).*

The first indication of a cemetery in the area originally was uncovered during land grading of the property immediately south of the Moran site in 1914. Four

skulls and numerous postcranial bones were exposed, and speculations abounded as to whom they belonged. The Biloxi Sun Herald (1914:1) reported, “They evidently were those of Indians who were buried there at some time in the remote past in one of the old burial mounds.” A week later the Herald (1914:1) noted that citizens suspected “a famous Spanish pirate brought a chest of gold to the coast near Biloxi, killed four slaves who accompanied him and buried the gold and their bodies nearby.” The remains were reported to have been reburied at the time and no other skeletal material appears to have been uncovered on the property until Hurricane Camille’s damage to the Moran home and art studio in 1969 yielded 12 to 13 burials when repairs were being made to the foundation.

At this time, a formal excavation was conducted by Drs. Richard Marshall and Charles Pine, anthropologists at Mississippi State University, and local archaeologist, Dale Greenwell, a resident of Biloxi. It became known as the Moran site and was recorded as 22HR511. Initial interviews conducted by Greenwell (2008) unearthed a number of local histories that contributed to the estimation of how large the cemetery was expected to be. Local elders revealed that trolley and road construction between 1900 and 1920 claimed the southern edge of the graveyard whose occupants were excavated and reburied. Also, it was reported that bones would wash up on the gulf shore after a severe storm, and some residents remembered seeing up to 11 sets of remains on the beach. Another man recalled that four people were dug up in his backyard during construction. Each of these observations was made no more than 100 yards from the present day Moran

cemetery and could potentially have been part of all the same burial ground (Greenwell, 2008).

Dr. Charles Pine conducted *in situ* skeletal analysis. Eight of the 12 individuals were measured and observed for specific ancestral and sexually dimorphic characteristics. The reported results noted that six, all males, were European, and two, both females, exhibited some Indian characteristics (Greenwell, 2008:3). Unfortunately, there is no description of what methods were utilized in order to conclude ancestral affiliation. The only burial accompaniment was a two-inch metal pin was also discovered during the initial excavation. This pin, likely from a shroud, was later sent to Dr. Stanley South of the University of South Carolina for dating analysis. He concluded, based on comparison of the design with those seen in historic documents that the pin was likely made from 1680 to 1720 and could be of French origin.

Once analysis was complete, the remains were left interred in the ground below the Moran Art studio, but kept exposed so that the public could view them through a Plexiglas window (Greenwell, 2008); the tourist attraction was well-known locally and eventually appeared in the 2008 edition of *Ripley's Believe it or Not!* (Ripley's Inc, 2007). In order to preserve the remains, the Moran family took it upon themselves to coat the burials with shellac, which pooled around the bones and indiscriminately adhered to bone and sand alike. This caused some of the elements to conglomerate, turning these individuals into cherry finished blocks of sand and bone.

The Moran site would later be revisited in 2003 by Dr. Marie Danforth and physical anthropology graduate students from The University of Southern Mississippi (USM) when the family gave permission to analyze the remains. During this time, graduates conducted metric analysis on eight *in situ* skeletons to address age and sex. Four other sets of remains recorded in 1969 had evidently been destroyed when a chain wall was put into place south of the foundation. The work by USM was inhibited since the space below the house was cramped and crowded, limiting analysis. The family did permit the group to bring two postcranial sets of remains and six crania back to the USM physical anthropology laboratory.

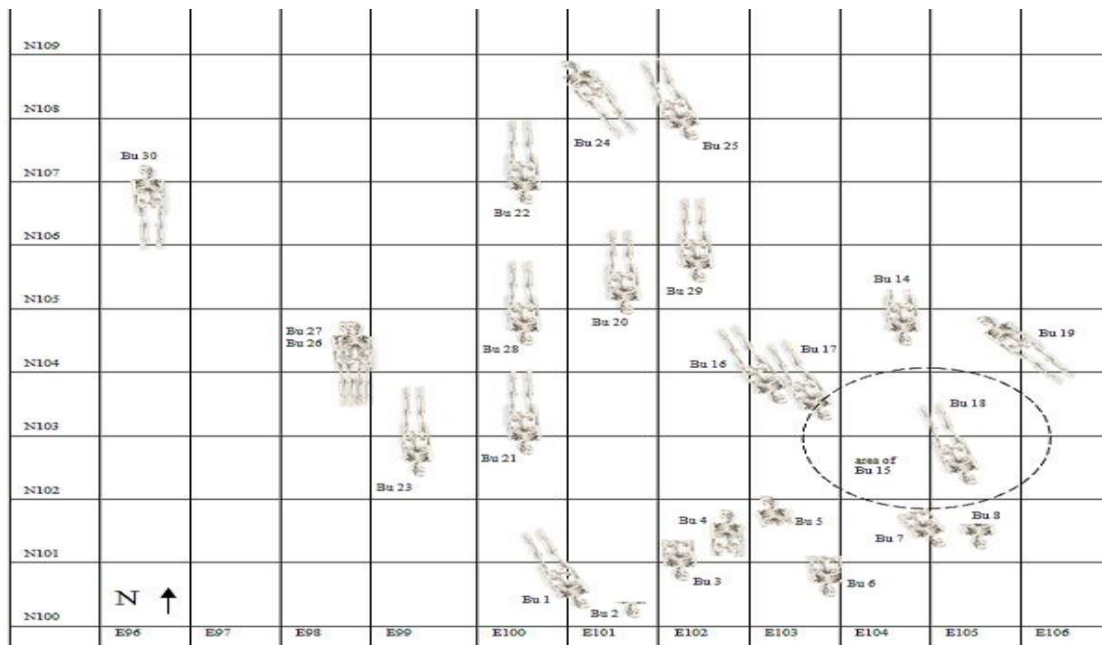
The more in-depth analysis conducted there, as well as the *in situ* evaluation, indicated that seven individuals were male and one was female, all being between the ages of 20 and 50 years. Using craniometrics and utilizing Fordisc (Jantz and Ousley, 2003), this study suggested that six of the eight were Caucasian. The ancestries of two were indeterminate (Carter et al., 2004:47). In addition, they also assessed general osteological conditions including stature, caries, antemortem tooth loss, liner enamel hypoplasia, and anemia. A Carbon-14 analysis was also conducted, which dated the remains to A.D. 1450-1660, and the results of stable isotope analysis for diet in two individuals indicated they subsisted on a temperate grass, such as wheat, rather than maize. The results of this study supported Greenwell and Pine's initial identification of a European cemetery, but results were only preliminary since it was difficult to obtain accurate measurements with remains covered in shellac.

The opportunity to conduct further research took place when, in 2005, the Moran Art studio and property were ravaged by Hurricane Katrina with the buildings

being entirely destroyed. The still exposed burials had unfortunately been muddled and shuffled by gulf waters, and house debris was littered throughout the site. A recovery team, led by Dr. Danforth and USM students, was asked to salvage the remains. At this point, the shellac proved to be beneficial since it prevented some elements, such as the ulna and radius, from being separated, and even helped some crania keep their structural integrity. The presence of the bones in shellac and sand blocks also weighted them down somewhat, preventing them from floating away. All exposed skeletal material was removed from the site and transported back to the USM's physical anthropology laboratory.

In December 2007 parts of the concrete drive way and slab foundation were removed, exposing the sub-occupational sand layer and eliminating the largest obstacle. Excavations of these undisturbed areas of the site were allowed, and took place during the 2007 through 2009 field schools. These field seasons exposed an additional 15 burials, bringing the total number of individuals buried at the site to 30 (Figure 6). Further laboratory analysis resulted in an additional two individuals being found mixed in with previously excavated material. Thus, the Moran site so far has yielded 32 burials of varying preservation and representation.

As may be seen in Figure 6, Burials 1 through 8, which were previously identified in 1969 and 2003, were greatly disturbed by Hurricane Katrina. Laboratory analysis of these individuals consisted of ossuary techniques; including minimum number of individuals (MNI) and comparative analysis of elements in order to find reconstruct skeletons.



*Figure 6.* 2008 Moran Burial Map. (Map provided by Barbara Hester).

This was carried out by obtaining measurements, matching color consistency and corresponding state of degradation. Again, Burials 9 through 12 were lost during post-Camille construction, and it was determined that Burial 13 had never existed despite being reported in local news stories of the time (McIntyre 1970). On the other hand, Burials 14 through 31 were undisturbed and articulated, being protected underneath the concrete slab and driveway.

Each skeleton is represented by a variety of elements with long bones and teeth being the best preserved. Unfortunately, the close proximity to the Gulf Coast provides a constant inundation of water over the bones, causing the minerals to be leached and weakening the overall structure of each element. The effect of the water washing over the individuals has caused many of the fragile bones to be compromised and eventually destroyed. On top of leaching minerals from bone, the water also removed any signs of a grave shaft by draining away any organic material

which could stain the soil. The absence of a shaft outline made burial identification only possible when actual bone was exposed during excavation.

Regardless of condition, sufficient elements have survived to determine orientation and position of the individuals. The preservation of carpals and phalanges indicated that all individuals had their hands crossed across their pelvis or thoracic cavity, a practice also seen in the Spanish at St. Michael's Cemetery in Pensacola, unlike the English who had arms positioned at their sides (Strugfield, personal communication). However, orientation was not so uniform. Among those for whom it could be determined, all but one was supine and extended; three had their head to the southeast, six were head to the north, 12 with head to the south. There was one prone burial whose head was oriented in the southeast.

The prone position (Figure 7), although rare, has been exhibited in both European and African burials and was seen at the French Colonial cemetery on St Croix Island (Crist, n.d.). At times one who is accused of witchcraft is buried face down in an attempt to confuse the spirit into going the wrong way. Another display of prone burials is during a repetition of family childhood deaths. The last child to die is buried face down in order for the next child to live (Jamieson, 1995); however, the individual in this burial is not a juvenile. Unfortunately, there is no satisfactory explanation of why this individual was buried prone. General limb arrangement with hands over pelvis seems to be carefully placed, and does not suggest a hasty or careless burial preparation but might have been mistakenly placed that way, especially if they were completely wrapped in a shroud.



*Figure 7. Prone Position of Burial 25*

Based on the prone burial, as well as variation in other placement attributes, including varying depths and irregular spacing, there does not seem to have been any overall systematic grid or orientation used for those buried at Moran. This seemingly careless mortuary tradition could be interpreted in three ways. First, it could indicate that people were dying at a rapid rate, which could have prevented grave diggers from being concerned with burial placement. Second, it is possible that this was merely a burial disposal ground, and not an established cemetery; people without any affiliation to the society at large could have been buried here. Third, and final, is that the people at Moran did not adhere to standard Christian burial practices and might not be European, although this seems unlikely.

In accordance with expectations of burial traditions of Europe and burial traditions seen at the time, 29 of the 31 individuals were found without evidence of a



coffin (Figure 8). The discovery of two burials with shroud pins in 1969, described by Charles Pine from Mississippi State University as a “wire-wound head pin typical of the eighteenth century” (Greenwell, 2008:3), along with an additional pin found in 2007, suggests that the majority of these interments were probably buried naked, wrapped only in cloth, since no articles of clothes have been recovered. This interpretation is loosely corroborated by the account of elderly locals interviewed by Greenwell in 1976; when asked, they could not remember seeing any type of coffin or other container around the remains that had either been washed on shore or disturbed by construction (Greenwell, 2008).



*Figure 8.* Nail Outline of Burial 26. Nail outline indicative of an individual interred within a coffin.

Burials 26 and 30 were the only two to be found within coffins, which were represented by slight soil staining and a ferrous nail outline. Due to the wet sandy soil, staining is rare and was only noticed around one other burial, 28, but no coffins

remains were found. The discoloration could potentially represent organic decay of wood, or decomposed flesh, which has been contained by the coffin and prevented from dissolving throughout the ground. No other artifacts were found with these individuals; however, upon further excavation, another burial was discovered under Burial 26. This individual was not in a casket and was missing both his skull and lumbar vertebrae. One potential explanation could be that trenches had been dug in order to retrieve the rope used to lower the casket into the shaft; none of the missing elements were found around the burial, so it is also possible that the head was removed prior to burial and just not restored to the owner. This stacked burial is the only one that has been unearthed at Moran.

In addition to the shroud pins and coffin nails, the only other artifact to be found was a cross and three wooden rosary beads (Figure 9) around the midsection of Burial 14. Despite good preservation of the beads, the copper cross was badly corroded and was sent to The Archaeological Preservation Research Laboratory at Texas A&M University for ionized cleaning. Once restored, the cross depicted a crucified Jesus with a halo and beaded outline. On the reverse side is an image of the Blessed Virgin and the words JESUS and MARIA. It was determined that the style in which the cross was stamped was similar to a design found at the French Fort Michilimackinac in Michigan (Stone, 1974) and the Bloodhound site in Louisiana (Brain, 1988). The beads were also analyzed by Dr. Mac Alford (personal communication, 2006) of the Department of Biological Sciences at the University of Southern Mississippi, who determined them to be made of wood, most likely from the European spindle tree.

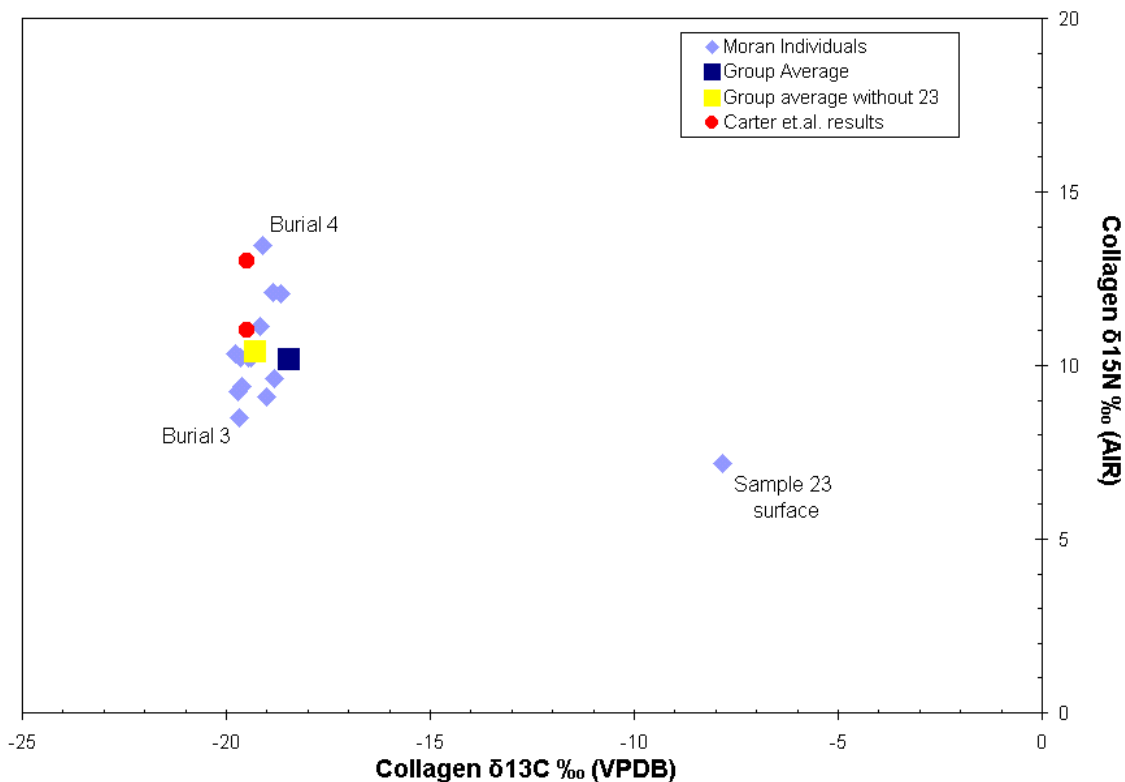


*Figure 9.* Copper Cross found with Burial 14. This cross represents the only personal effect found on site: Burial 14.

Based on the lack of artifacts and coffins found with individuals, it can be shown that those immigrating into the French colony were most likely poor and either brought nothing with them, or passed their belongings onto a family member at the time of their demise. The preservation of the pins, cross, beads, and nails shows that preservation of non-human materials is good, and it would have been likely that if the Moran individuals had been buried with anything, there would have been some vestige of it left.

Furthermore, careful field excavations, including 1/16th inch screening would have ensured that little personal items would be retrieved. Rigorous collecting techniques were also applied to the skeletal remains as observations such as in-field osteometrics and morphology were recorded. Furthermore, well preserved elements, such as legs and arms, were collected, and more fragile ones, including the thoracic cavity and skull, were removed in blocks for the purpose of laboratory excavation. Once brought to the lab these sections were delicately and painstakingly cleaned with small brushes. No water was applied to any of the remains because the structural integrity had already been compromised and water would have destroyed the bones.

Until the present analysis, the previous work with the Moran population consisted of initial cataloging and inventorying as well as a second Carbon 14 test to collagen date the bones, which confirmed the C-14 results of 2003 (Cook et al., 2010). Additionally a study was conducted by Page (2007) addressing stable isotope analysis to determine primary dietary intake. She assessed 23 samples taken from four of the *in situ* burials identified in 1969, a more recently excavated burial, and numerous surface samples previously excavated; great care was taken not to duplicate any individuals. These samples were then analyzed by Page in the laboratory of Dr. Mark Schurr at the University of Notre Dame for carbon and nitrogen analysis. A CarloErba Model EA 1108-Elemental Analyzer interfacing to a mass spectrometer was used. Her results show that nearly all of the individuals had a C3 diet indicative of wheat (Figure 10). Only one sample resulted in a possible C4 corn diet, which was a random surface sample that was not able to be associated with any one burial (Page, 2007:57). Additional samples from burials that were excavated after the initial round of sampling by Page were sent to the Stable Isotope Laboratory at the University of Georgia. Results from both assessments suggested that all those interred consumed a C3 diet, suggesting they were from Europe because carbon isotopes have a long shelf life. These individuals would have had to eat maize for at least twenty years for it to be present in their skeletal structure.



*Figure 10.* Carbon and Nitrogen Isotopes Results. (Page, 2007:53)

Based on the previous excavations and analyses that have been conducted, we can begin to better understand those who are buried at Moran. The culture's burial practices, age and sex distribution, and dietary intake have established. However, only part of the story has been told; the rest relies on the ancestral and geographic origins of the colonists, which will give insight as to the detailed group composition and dynamic that can only be addressed through the colony's assigned racial differences.

## CHAPTER IV

### ANTHROPOLOGICAL APPROACHES TO ANCESTRY

This chapter will address how ancestry can be approached through skeletal analysis. It will open with a general discussion of the relative strengths and weaknesses of ancestral identification, especially concerning the concept of race. Then, the methods commonly employed both today and in the past, including cranial morphology and metrics, tooth morphology and metrics, stable isotope analysis, and mtDNA analysis, will be addressed.

#### Historic Approach to Ancestry

Originally, racial assessment was used as a form of legal and social suppression of individuals seen as “savage” compared to colonizing Europeans. Early beliefs stemmed from “folk classifications that were interchangeable with concepts like nation, type, or stock” (Baker, 1998:11) and not based on scientific assessment, which would gain credibility in the mid-18th to early-20th centuries. One key researcher in early scientific evaluation of race was Johann Blumenbach, whose work revolved around three truths:

The plurality of races of man; the importance of the characteristics deduced from the conformation of the head; and the necessity of not placing in the same rank all the divisions of mankind, which bear the common title of races, in spite of the unequal importance of their anatomical, physiological, and let us also add, psychological characteristics. (Bendyshe, 1865:xi)

It was these three fundamental principles that he applied to identifying his four varieties of humans. Admittedly derived from Linnaeus’s original four varieties, Blumenbach redefined them by assigning new geographical boundaries. In addition

to geographic area, the other criteria he used in classifying these “races” were skin color, stature, cranial conformation, and hair texture.

The first group was Europeans, whom he believed were most important and advanced. According to Blumenbach, Europeans occupied “Asia this side of the Ganges, and all the country situated to the north of the Amoor, together with that part of North America” (Bendyshe, 1865:99). The second variety includes the other individuals from parts of Asia and Australia. These humans are said to have snub noses, dark complexions, winking eyelids, and stiff hair. The third is from Africa, for whom he does not include a physical description, and the fourth variety is the remaining groups of the Americas (Bendyshe, 1865). It was this new scientific way of assessing the differences between humans, which solidified the idea of the inferior savage as a biological “fact.”

Anthropologists in the 19th century further promoted the idea of superiority with studies that focused primarily on cranial capacity. For example, Samuel Morton, a Philadelphia physician, ranked groups of people based on the mean capacity of their crania and believed some races to be superior over others. Furthermore, he thought these groups were unchanging over time leading him to conclude that these groups potentially represented different species. His work would later be as the basis of the scientific foundation of racial inequality and utilized by other anthropologists, such as Nott and Gliddon, to support that idea (Lieberman, 2001). Together Nott, Gliddon, and Morton were seen as the “nucleus of the American school of Anthropology” (Erickson, 1997:65, as quoted in Lieberman 2001). Much of this

research was also applied to Jim Crow segregation and provided justification to the exploitation of African Americans (Lieberman, 2001).

Another famous application of cranial morphology is attributed to Franz Boas. When conducting his study, Boas aimed his attention at ancestral background and in doing so emphasized measurements of the cranium that were seen as essential to racial typing. He paid particular attention to the length and width ratio of head, commonly known as cephalic index, “which has always been considered as one of the most stable and permanent characteristics of human races” (Boas, 1910:61), along with width of face, stature, and weight. Based on this study Boas concluded that head shape was in actuality a response to environment and not related to race, which was one of the first major cracks in the bedrock foundation of belief in the validity of racial classification.

By 1916 a committee of prominent physical anthropologists, including Earnest Hooton and Aleš Hrdlička, was assembled to address the science of race. The purpose of the National Research Committee was to take an anthropometric survey of soldiers in order to regulate methods of measurement and to reassess physical requirements for service. In addition to the war effort, Hrdlička’s intentions were to also use this data to assist in the eugenics movement of the early 1900s (Caspari, 2009).

A few years after Boas’s study, the NRC became primarily focused on the “American Negro,” and a number of studies assessing skeletal features of the group were produced (e.g., Holmes, 1918; Hooton, 1918; Hrdlicka, 1918). Such research included craniology, long bone measurements, stature, nasion placement, and linear



dimensions of the skull. However, “[the] scientific anthropology of the American Negro [was] still barely above its beginnings” (Hrdlicka, 1927:216), and it would not be until 1930 that a more thorough analysis of African Americans would be undertaken.

The study, conducted by Todd and Tracey (1930), was a quantitative analysis focusing on the differences between white and black crania, in order to assess racial admixture among Black Americans. Pulling from work originally conducted by Hrdlicka, Todd and Tracey (1930:55) made determinations based on five criteria: (a) Development of the supraorbital ridges, (b) Upper orbital margin morphology, (c) Size of glabella, (d) Morphology of the fronto-nasal junction (plain vs. beetling), and (e) Interorbital distance along with cephalic index. Through this work, it was argued that there are consistent features that distinguish African and European crania, but “because of the infinite variations possible, no feature can be used as an unequivocal indicator of Stock and what we may call typical Negro and White skulls are merely individual specimens at the extremes of the range” (Todd and Tracey, 1930:74).

Building off these earlier studies, many of Hooton’s students in the 1950s and 60s focused on the definition, formation, and number of races. Researchers like Coon and Garn pushed for an evolutionary view of race rather than simply describing human types. This evolutionary foundation was further supported by Washburn who organized the 15th Annual Cold Spring Harbor Symposium where he introduced a new generation of physical anthropology that studied clinal distributions and populations instead of race (Caspari, 2003). However, some researchers (e.g., George, 1962) continued to cling to racist ideas, prompting the American

Association of Anthropology (AAA) to issue a statement preventing nonprofessional anthropologists from using anthropological information in a way the AAA deemed false (Jackson as cited in Caspari, 2003).

Even though earlier studies predominantly focused on cranial structure for racial determination, this new physical anthropology ushered in a wave of redesigned research in the 1970s and 80s, which branched out to include a greater range of physical features and incorporate more ancestral groups. Furthermore, the term “race” became replaced as anthropologists focused on specific geographic ancestral origins.

Of these studies, Eveleth (1978) examined limb length and sitting height among Germans, Aborigines, Japanese, and African Americans. Not only were comparisons made among the four groups, but intergroup assessments were also made. This investigation concluded that, “Australian Aborigines have longest legs to sitting height” and the shortest relative legs are found among the Japanese. In addition, “Afro-Americans have somewhat longer legs to sitting height than Africans” probably owing to environmental conditions (Eveleth, 1978:381). This investigation and subsequent ones, including Meredith (1979) and Feldesman (1992), concluded that there is a statistical difference between the femoral length and stature estimates of the three different geographic populations (Asia, Europe, and Africa). However, with only 43-67% accuracy (Feldesman, 1992:219), Feldesman concluded that there are no discrete groups and a large amount of overlapping between the groups is present. As with earlier studies, these provide a cautionary post-script

about the difficulties of ancestral determination and implore further research be conducted.

The belief that race existed among humans had begun to lose favor among scholars as research expanded (Lieberman, 2003; Martin and Lueng, 2003). For instance, Lieberman's (1989:67) survey of anthropologists show "acceptance [of race] by 50% of biological anthropologists and 31% of cultural anthropologists, while 42% of the former and 52% of the latter reject the concept." Furthermore, scientific articles that focused on race declined from 78% in 1931, 36% in 1965, and 28% in 1996 (Lieberman, 2003:111). By the latter part of the 20th century, race was being referred to as a biological myth (Caspari, 2003) and instead being described as a cultural construction.

Contemporary studies of ancestral analysis have evolved to encompass multiple lines of evidence, including traditional cranial morphology as well as more modern techniques such as specific DNA markers and discriminant function analysis. Such methods have brought back ancestral typing as a research topic with applications in forensic science and medico-law. Despite decreasing beliefs in the ability to classify humans into races, forensic science continues to rely on this system in order to assess human remains. However, the term race could simply refer to ancestral origins and a clinal gradation associated with that geographic region (Sauer, 1992:110). The previous classificatory methods discussed are applied to these groups with some success, since they represent environmentally distinct populations whom evolved to specific conditions over time.

In addition, archaeologists also use the idea of race to conceptualize a social structure reflecting economic status. In order to do this, an “other” is defined, usually through physical characteristics, which has the potential to imply knowledge of lineage and kinship (Leone et al., 2005). This allows the archaeologist to reconstruct the past, in which “race” played a key role in the dynamics of people and society.

In conclusion, the concept of race has evolved throughout history, transforming from a fact applied to scientific inquiry to a dying theory on the verge of extinction. The majority of anthropologists reject the idea and refers to genetic any differences seen between populations, as an ancestral adaptation to geographically specific environments. Any differences that are discussed now are not about the superiority of one group over another, but merely what traits some groups acquired and continue to be seen in present populations.

#### Commonly Assessed Markers of Ancestry in the Skeleton

Most studies evaluating ancestral background generally attempt to sort individuals into three groupings: Europeans, or those individuals who originated from Europe, the Middle East, and North Africa; Africans, who have ancestral ties to Sub-Saharan Africa; and Asians, who have a geographic origin of Asia or are of American Indian descent. Each of these groups has certain markers which occur in greater frequencies compared to those seen in other groups; however, White (1991:328) explains that “no human skeletal markers correspond perfectly to geographic origin.”

Two types of analysis can be conducted on the crania to determine origins. The first is metric, which requires a set of spreading calipers, sliding calipers, and a mandibulometer. Considered in conjunction with measurements is the second method: observational morphology. This method is more subjective than the former and requires the observer to be familiar with sometimes subtle structural differences in facial bones. A metric analysis is thought by some to be more accurate than mere observations, owing to the fact that numbers are absolute and can be inserted into statistic based equations. On the other hand, others still feel that a trained eye assessing all indicators as a single unit is best.

#### *Cranial Metrics and Morphology*

As previously mentioned, the cranium is considered the most reliable part of the skeleton for determination of ancestry (Bass, 1995), and as a result is the only part of the skeletal structure that is widely used (Bass, 1995; White, 1991). Krogman (1978) concludes that the skull is accurate 85-90% of the time.

Assessment of morphological traits is used especially when measurements cannot be taken. According to Gill (1990), nonmetric analysis had a 90% accuracy rating when identifying Europeans from other groups. A number of facial features are considered. One of the most frequently evaluated traits used is orbit shape, affecting orbital borders; Africans have more rectangular orbits, Europeans slightly tilted, and Native Americans almost diamond-shaped.

Another suite of characteristics is the morphology of the mid- and lower face. One of the most easily observed traits is prognathism, which refers to the degree of facial sloping in this region that an individual displays. Typically, an obtuse angle is

more associated with Africans and 90-degree angle more associated with Europeans and Asians. Europeans are further classified by retreating zygomatics in which the midline of the face comes to a point rather than one that is broader. Conversely, Asians are characterized by prominent cheek bones and flaring zygomatics whereas Africans are not recognized for unique zygomatic traits.

The third set of traits is associated with the nose, and includes nasal shape, which has been found to correspond to the mean temperature and area of ancestral origin (Noback, 2011). Steegmann (1972) cites Thomson's Rule, which explains that people from dry cold areas will have a pointed nose and those from hot wet areas will exhibit a broad flat nose. The soft tissue features reflected in this rule are also exhibited in the bony structure. For instance, the nasal aperture and interorbital breadth typical of African populations is broader than in Asians and Europeans.

Based on the pointedness and length of a Caucasian nose, there is generally a nasal sill, located at the base of the nasal aperture, that supports the fleshy structure; Africans, on the other hand, display nasal guttering (Bass, 1995; Brooks, 1990; Brues, 1990; Curran, 1990; Gill, 1990; Hinkes, 1990; Krogman, 1978; Rhine, 1990; White, 1991). Lastly, nasal overgrowth is commonly attributed to Asian groups and is seen as the nasal bone projecting past the maxilla (Bass, 1995). Other traits that are a part of the skull which can be considered in ancestral estimation are incomplete closure of the metopic suture and a triangular appearance of the palate (Ubelaker, 1989), which are more likely to be present in Europeans versus a more rectangular shaped palate in Africans and a parabolic shaped palate in Native Americans (Bass, 1995).

When cranial metric analysis is being conducted, particular attention is given to facial bones, which are a more reliable indicator of ancestry (Bass, 1995).

However, some vault differences are seen. According to Stewart (1979), Asians will have a wider facial breadth than head breadth. In addition, Europeans and typically Africans will have a longer narrower head (dolichocranic) when compared to Asians, who are cranially short and wide (brachycranial). When compared to Europeans, Africans exhibit a greater head circumference (Kamin, 1998).

One program that utilizes cranial measurements in order to determine ancestry is FORDISC. Created by Richard Jantz and Douglas Ousley (2005) at the University of Tennessee, this software employs multiple discriminant function analysis to construct a classification matrix on cranial measurements. By using this method, the program can obtain specific classifications of ancestral origins and assign an adult cranium into one of the sample populations used to generate the functions. Sample populations used by this program consist of 11 populations from the Forensic Anthropology Data Bank and 28 from Howells' (1989) world wide data bank (Freid, 2005:103). The user selects what they believe to be the appropriate population(s) to cross compare their unknown sample with.

Recently FORDISC has come under scrutiny by a number of anthropologists (Elliot and Collard, 2009; Kosiba, 2000; Sanders, 2002; Williams et al., 2005) for its inaccuracy and unreliability to assign unknown samples and for providing a false confidence in ancestral identification. FORDISC only identified ancestry and sex accurately 81% of the time when measurements from people of known background were run (Sanders, 2002). The accuracy of population assignment depended on both

the number of skeletal measurements evaluated, and the probability that the unknown sample was in fact from one of the 39 populations present (Elliot and Collard, 2009). It was found that during testing, people of African heritage were commonly grouped with Europeans (Sanders, 2002) and ancestral assignment was likely to change depending on the sex of the individual (Elliot and Collard, 2009). In response to these criticisms, Freid and Jantz (2005:103) state, “Disputed results are often due to inappropriate reference samples and failure to properly evaluate the typicality and posterior probabilities provided by the program.” They argue the inaccuracy observed in associated studies suggest user error rather than the program being unreliable. This is a probable justification considering the complex nature of FORDISC results and input variability.

#### *Dental Morphology and Metrics*

Originally based on Aristotelian logic, tooth morphology was a way to obtain the essence of ethnic groups through essential properties. For example, systematists such as Linneaus saw the essence of a tooth as its width and length (Hrdlicka, 1918). This belief would eventually evolve into the concept of analytical entities. By 1874, the first known human odontometric study was conducted by Muhlreiter (Hrdlicka, 1921), this study as well as many later studies (Griffin, 1989; Harris, 2005; Kieser, 1990; Scott and Turner, 1987, 1997) found that morphological traits and measurements are population specific and have the potential to discriminate among major geographic groups with such accuracy that one trait alone would suffice. “Comparative odontometry yields measures of affinity and dissimilarity in the same way as other metrical and nonmetrical traits do” (Kieser, 1990:31), and “[is] a well-



established basis for assessing presumable genetic relationships between skeletal populations” (Jackson, 2006:151). As with other inherited traits, some distinct shapes of dental crowns (e.g., cusp patterns) occur more often in particular regions, ethnic groups, and families than in others.

These results are supported by Kieser (1990) who has conducted extensive research on human odontometrics, including sexual dimorphism, asymmetry, general measurements, and their probability for inheritance, as well as a comparative analysis conducted on world populations. His work also discusses potential problems with dental metrics and how external sources can affect dentition. The results show that dental metrics are sexually dimorphic and that some traits are linked to ancestry including shoveled incisors, and cusp patterns.

Among the population variations noted, previous studies (Harris and Rathburn, 1991; Hillson, 1996) have determined that the largest dentition is found among Australian Aborigines, and the smallest in Asian and European groups. Harris and Rathburn’s (1991) factor analysis of mean crown diameters indicated that Africans and Australians had shorter and broader anterior teeth, and longer and narrower posterior teeth, compared to Europeans who exhibited narrower anterior teeth and broader posterior teeth.

One multivariate method to assess dental metrics is the robusticity index (Hillson, 1996). Mesiodistal and buccolingual measurements are taken, and their averages multiplied by one another to obtain robust indices. The robust index does not pinpoint ancestry, but rather, it indicates whether an individual is within the

typical group range. This could prove advantageous if, for instance, the group is shown to be European; an outlier could likely be an individual from another region.

In addition to metric traits, certain morphological ones will also occur in some ancestries more frequently than in others, including bite position, overbite, wear patterns, cusp size, eruption age, and extra cusps (Garn, 1971; Griffin, 1981; Harris, 2005; Scott and Turner, 1997; Stewart, 1979; Ubelaker, 1989). Dental bite is expected to be edge to edge for Native Americans, with a slight overbite in Europeans. Large cusp size has been observed in Australian Aborigines and small cusps in Lapps, revealing that the trait has nothing to do with overall body size of the population (Garn, 1971). It has also been pointed out that Africans will have third molar tooth eruption as early as 13 years old as compared to age 18 in other groups (Garn, 1971; Gillet, 1998), but Bogin (1999) suggests that the poor social economic sections of these groups cause teeth to fall out prematurely, which promotes early tooth growth of adult teeth.

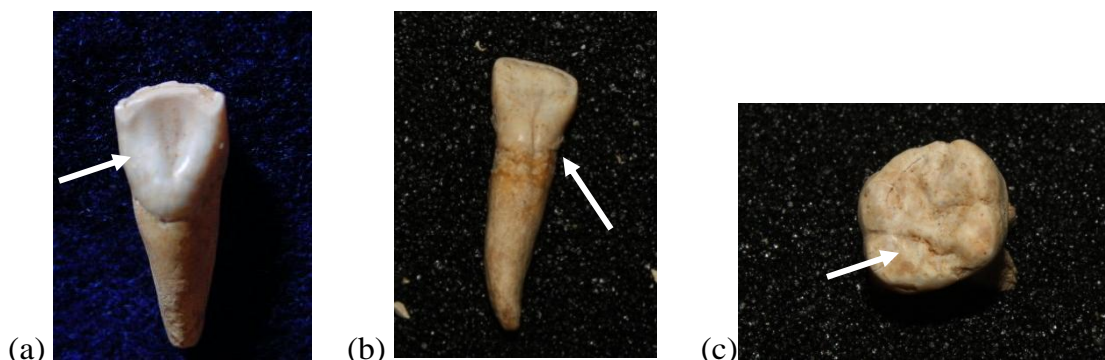
Other traits used in ancestry assessment have been identified by Scott and Turner (1997). Each trait was observed in multiple populations, with variable levels of frequency within and among each geographic regions. For their analysis, they have categorized geographic regions based on linguistic origins and similarities, including Western Eurasia, Sub-Saharan Africa, Sino-Americas, Sunda-Pacific, Sahul-Pacific. Their analysis as well as that of others (Griffin, 1989; Harris, 2005; Hellman, 1928; Jackson, 2006; Lease, 2003; Scott and Turner, 1988) suggests these traits have been found to vary by population in their frequencies. Individually, these traits include:

1. *Shoveling* (Figure 11a), found on upper incisors, is seen predominantly (60-90%) in people of Asian descent, specifically East and North Asia; it also occurs with high frequency in American Indians (mean = 83%). Low frequency groups (0-15%) are seen in Western Eurasia and Subharian Africa. The occurrence of shoveling in European (0-15%) and African groups are said by Scott and Turner (1997) to be so subtle that it would not be a useful trait to distinguish between the two. These low frequency numbers are also supported by Hrdlicka (1920) who reports 8.4% in American Whites and 12.5% in American Blacks. Therefore, if shoveling occurs there would be an overwhelming expectation that the person was of Native American or Asian descent.

2. *Mesial canine ridge* (Bushman Canine) is seen almost exclusively in the San (23-48%) and Sub-Saharan Africans (12-35%). On the other hand this trait is rarely seen in any other group, including Native Americans and Europeans (0-7%). According to Turner et al. (1997:91), groups throughout the world do not exceed 10% expression of the Bushman canine. The fact that the Bushman canine is uncommon among any group other than Sub-Saharans makes it a strong marker of African ancestry (Scott and Turner 1997).

3. *Interruption grooves* (Figure 11b) seen on lateral incisors are not considered rare in any regional group, but are seen less often in Sub-Saharan and Sahul Pacific groups (10-20%). Native Americans are said to have one of the highest frequencies (60-75%), while Western Europeans fall in the mid range (35-50%) (Kieser, 1990:189). However, it has been reported by Scott

and Turner (1997) that this trait is frequently overlooked or not scored which could skew population frequencies.



*Figure 11. Dental Morphologies Related to Ancestry. (a) Shoveled Incisors. (b) Interruption Groove on incisor. (c) Hypocone on maxillary molar.*

4. *Hypocone* or the 4<sup>th</sup> cusp (Figure 11c) on upper molars is generally recorded as present or absent, but actually occurs with varying degrees of expression. First molars in particular are under greater genetic control than the other molars (Griffin, 1989), which are less stable and subject to more variability in morphology based on field theory (Butler, 1939) and clone theory (Osborn, 1978). Because of this, the first molars are less likely to be scored. The absence of M1 4th cusp is least commonly seen (around 10%) in Sub-Saharan groups with Asian and occurrences in Native American groups only slightly higher (10-20%). Europeans subsequently have the highest rates with Western Europeans at 20-35% and Northern Europeans at 15-25% (Scott and Turner, 1997). Since all of the groups seem to be relatively close to one another in frequency, hypocone variability seems to aid other indicators in ancestral identification rather than be a single determinant.

5. *Carabelli's cusp* located on upper molars, is one of the most researched dental traits and also one of the most contested. Some studies (Jackson, 2005;

Lease, 2003; Scott and Turner, 1997; Turner and Hawkey, 1998) have concluded that this trait occurs in smaller frequency across all groups. Scott and Turner (1997:201) found that the world range was only 1.9-36% with American Indians at 10% and Western Eurasians at 20-30%. Turner and Hawkey also concluded that Europeans ranged from 20 to 79% while Africans ranged from 48 to 58% (as cited in Lease, 2003:8). However, Hillson (1996:91) states that Carabelli's cusp is most common in Europeans (75-85%) with occurrence in Africans being slight and Native Americans falling in between. Based on information gained from casual conversations, most researchers appear to regard the trait as European in nature and would assign ancestry based on its presence. Regardless of the debate, the frequencies in various populations presented are not significantly different, making Carabelli's cusp a poor indicator of ancestral difference.

6. *Cusp 5* on the upper first molar is reported by Scott and Turner (1997) to have split the world into three major clusters. The first group which has the lowest frequency (10-25%) includes Western Eurasians, and Sino-Americans. The next is Sunda-Pacific and Sub-Saharan Africans (30-40%), followed by the Sahul Pacific (40-60%). The reason for the discrepancy between the two African frequencies is based on the fact that different Sub-Saharan groups present different rates. West Africans have a high frequency (45-80%), while South Africans have an intermediate frequency (15-23%) (Scott and Turner, 1997:202-204). Even though Africans present a range of trait occurrence, both regions have frequencies that are higher than those seen in Europeans and

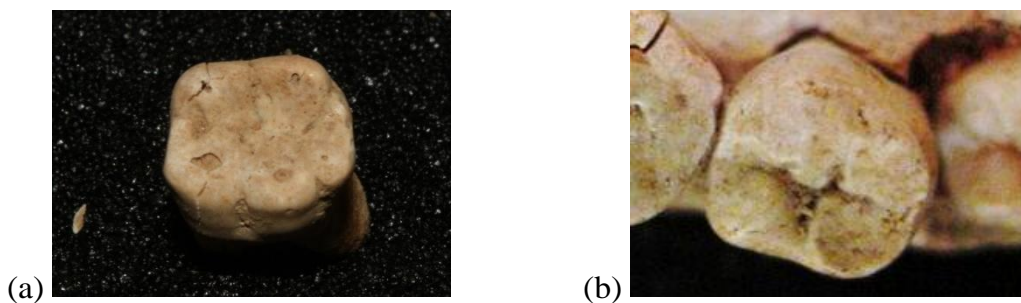
Native Americans, which allows the 5<sup>th</sup> cusp to potentially differentiate among the three groups.

7. *Hypoconulid*, or the 5<sup>th</sup> (Figure 12a) cusp on the lower first and second molars, is seen at high frequencies in almost every group. However, Western Eurasians have a high occurrence (65-85%) of four cusped (or lack of hypoconulid) lower second molars. In contrast, Native American groups, the San, Australians, and Siberians exhibit the lowest frequencies (<10%) with Africans at the very lowest at around 5% (Scott and Turner, 1997). These polar extremes between Eurasians and the rest of the world make this trait among the more useful in determining ancestry.

8. *Y pattern* (Figure 12b) on the second mandibular molar is also referred to as the *Dryopithecus* pattern (Hellman, 1928). Originally, it was believed that this was a primitive trait that showed reduction over time. The trait was used in a study conducted by Hellman (1928) to demonstrate that Whites were more evolutionarily advanced than Africans because the Y pattern was seen less often in them. However, later studies have shown that this trait, although seen more often in the San (60-70%) compared to others (Western Eurasians and Sino-Americans 5-20% and East and South Africa 25-40%), “does not exhibit a pattern of geographic variation that clearly differentiates human populations” (Scott and Turner, 1997:211). Even though Scott and Turner found little variation throughout the world because all groups are capable of displaying a Y-pattern molar, the fact that the San exhibit such high

frequencies might establish the expectation that this trait would indicate someone of that ancestry.

9. *Three-rooted upper second molars* are seen most often in Africans and Australians at a rate of 80-85%. At the low end of the spectrum are Northwest North Americans (35-45%), with Western Eurasians (50-70%) at the mid-range (Scott and Turner, 1997). The high rate of occurrence in all groups makes the three-rooted molar a poor determinant for ancestry and should be combined with other indicators instead of being used as a primary trait.



*Figure 12. Dental Morphologies Related to Ancestry. (a) five cusped mandibular first molar. (b) Y-Pattern on second mandibular molar.*

Based on dental morphological traits, the potential to reflect the genetic composition and ancestral background is highly likely. These traits allow regional variability to be expressed, and identified in the burial record because “over varying periods of time and to varying degrees, [these traits have] maintained endogamous breeding” (Kraus, 1953:554). Therefore, it would be most beneficial to focus on shoveled-incisors, Y-pattern molars, interruption grooves, Bushman canines, and hypoconulid.

### *DNA Analysis*

The analysis of mtDNA has become a valuable tool for bioarchaeologists over the last decade (Kaestle, 2002). The field has grown from a few geneticists who had only isolated occasional segments of mitochondrial DNA to assess into a massive industry, which analyzes ancient populations and has sequenced whole mitochondrial DNA strands (Willerslev, 2005).

Most studies evaluate mitochondrial DNA due to its rapid rate of mutation and generally better preservation compared to nuclear DNA. It is also ideal for isolating a geographic origin in a skeletal sample, owing to the fact that mtDNA is passed only through the maternal line. This transmission from mother to child allows distinct geographic signatures to exist, with the expectation that prior to colonization; little to no trans-continental interactions were taking place. However, mtDNA is by no means a pure line to origin, and many populations often share the same mtDNA signatures.

To determine origin and in turn region, an mtDNA haplogroup is sequenced and typed. A haplogroup is a series of single nucleotide polymorphisms (SNP) within a larger section of short tandem repeats (STR). To obtain these from the DNA, an enzyme synthesis known as a polymerase chain reaction (PCR) was conducted on the samples. This process allows for the amplification of very small segments:

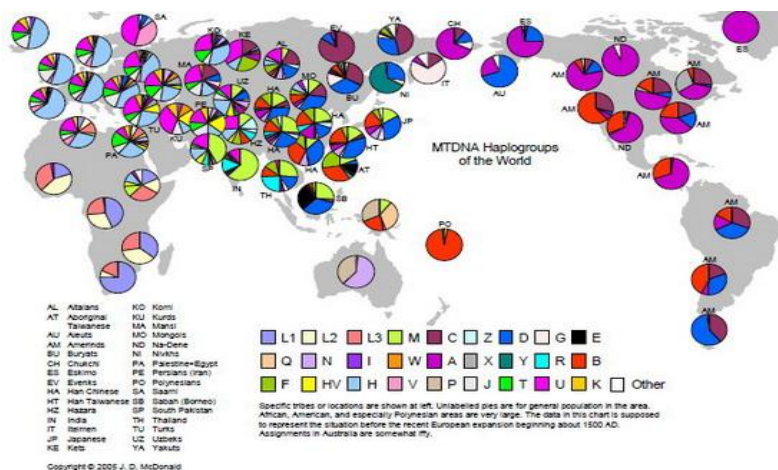
[The] exact sequence to be amplified is specified by two primers, short molecules of single-stranded DNA designed to match opposite ends of the two complementary strands of the target DNA, bounding the fragment to be replicated. Repeated cycles of denaturation, annealing of the primers to the target DNA and extension of the segment between the primers by a DNA polymerase, result in the exponential accumulation of the target DNA



fragment that can then be sequenced by conventional techniques. (Hagelberg, 1991:399)

This procedure is essential when dealing with ancient DNA, which undergoes damaging processes like spontaneous hydrolysis and oxidation that degrade cells (Willerslev, 2005). The expected outcome is that DNA will be severely damaged with very little material remaining (Hagelberg, 1991; Mulligan, 2006; Willerslev, 2005). The outcome of PCR allows geneticists to rapidly replicate DNA from a small sample, to one that is large enough for the sequencing of SNPs.

The SNPs within a haplogroup vary from person to person, and even though varieties of overlapping haplogroups are found in all populations, some are geographically predominant. This predominance is represented by Ancestry Informative Markers (AIMs). These markers have higher frequencies in some geographic areas than others (National Human Genome Research Institute, 2006; DNA Reference Laboratory, 2006) (Figure 13), allowing for the probable scenario that the individual is descended from individuals originating in that region and not one of the rare individuals in another group, who might exhibit the same haplotype.



*Figure 13.* World Map of Mitochondrial Haplogroups. This map displays the relative dispersal of mtDNA by geographic region (McDonald, 2005).

Africa is said to have the most genetic diversity of any region in the world, and is typically associated with DNA Haplogroups L1, L2, and L3 (Chen, 1995). This lineage of mtDNA is considered to be mitochondrial Eve, since it is the most ancient line of DNA discovered (Cann et al., 1987). It has been determined that these haplogroups originated in Sub-Saharan Africa and spread north and westward toward the rest of the continent (Wills, 1996).

However, one study (Rando et al., 1998), recently reanalyzed L3, recategorized it as U6. Based on this, they concluded that this haplogroup could have originated in the Middle East or northeast Africa, with sequences of it being found in parts of Europe, the Canary Islands, Morocco, Mauritania, and Sub-Sahara. More specifically, “this subgroup seems to constitute a North African counterpart to the widespread European-specific subgroup U5 of haplogroup U” (Rando et al., 1998:538). In addition to haplogroup L and U6, Ennafaa et al. (2009) have shown that the dominant (42%) haplogroup in North Africa is H1 and includes Western Sahara and Mauritania.

Haplogroups A, B, C, D, and X make up 100% of New World populations, as well as a significant part of Asian groups (Mishmar et al., 2003; Torroni, 1993). These five Old World haplogroups have assisted in possible migration patterns and timing of Amerindian groups. For instance, haplogroups A, C, and D have been shown to compose 58% of Siberian populations, and could be indicative of a Bering migration (Mishmar et al., 2003:171). In contrast, Haplogroup B is rare among Siberians, but has been seen in high frequencies along the coast of Asia and could support a coastal route theory (Mishmar, 2003; Torroni, 1993).

Those of European ancestry typically belong to Haplogroups H, J, K, U, and pre-V (DNA Reference Laboratory, 2006). Haplogroup H comprises 40-50% of European mtDNA (Torroni et al., 2006). Haplogroup J is believed to have originated in Mesopotamia or Anatolia approximately 10,000 years before present, but had migrated into Neolithic Europe 8,000 years before present (BP) (Herrnstadt, 2002; Mishmar, 2003; Sykes, 1999). It is now found throughout Europe with particularly high concentrations around the eastern Baltic Sea, Russia, and the Caucasus. It has an estimated average frequency highest in the Near East (12%), followed by Europe (11%), and considered to be one of the primary European haplogroups. However, some of these are also found in small to moderate quantities in populations from the Middle East, Asia, Europe, the Americas, and Africa. J2 specifically is more localized around the Mediterranean, Greece, Italy/Sardinia, and Spain (Skyles, 2008:6). Haplogroup U was originally composed of five subgroups; U1 through U5 are predominantly European.

Most mtDNA studies use femoral fragments (Kaestle, 2002; Kolman, 2000) as samples due to the thickness of midshafts cortical bone, which provides a protective covering for the DNA encased. *In situ* molars can also be used, as the dental arcade and compact enamel surrounding the tooth's cusp provide a bony protection for the DNA. The genetic material found in teeth is no less accurate than the DNA from femoral samples; however, some environments, including water, could wash away any viable sample from femoral shafts, making teeth the best place to obtain a sample in some cases.

### *Isotope Analysis for Dietary Reconstruction*

Another line of data that can be individually used to evaluate ancestry under certain circumstances is stable isotope analysis. This method analyzes stable nitrogen and carbon isotopes to reconstruct diet and determine the primary food intake of individuals. Isotope studies provide results that distinguish between a number of food types including C<sub>3</sub> and C<sub>4</sub> plants, as well as marine and terrestrial animals (Figure 14). Based on the two diverse staple crops, maize and wheat, and coastal versus inland protein, there is the potential to identify between groups who were utilizing different environmental resources.

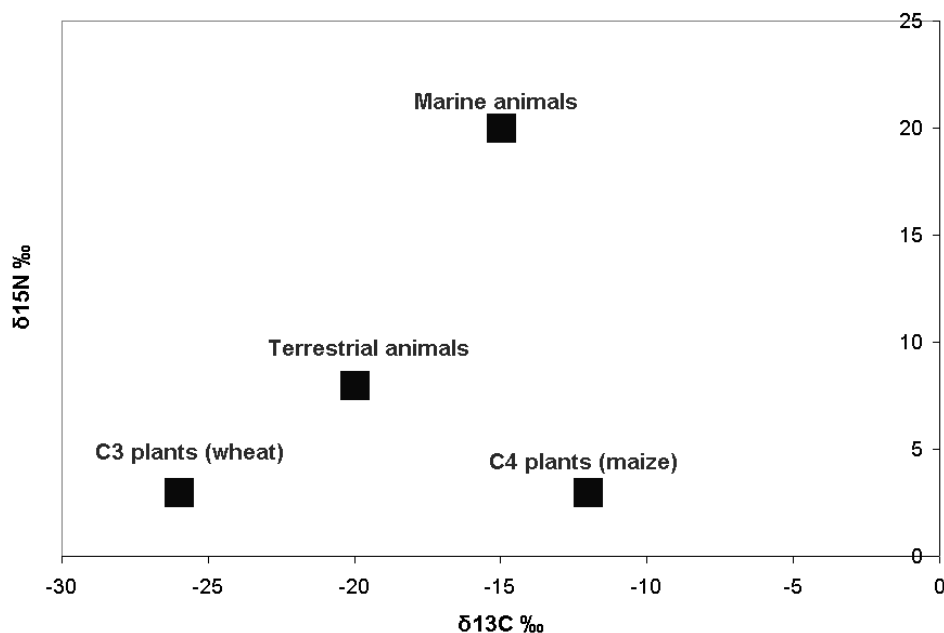


Figure 14. Carbon and Nitrogen Isotope Bivariate within the Natural Environment (Page, 2007:28).

Carbon exists in two forms, <sup>12</sup>C and <sup>13</sup>C, which bind with oxygen to form atmospheric carbon dioxide (CO<sub>2</sub>). The absorption of CO<sub>2</sub> by plants aids in photosynthesis, which depletes <sup>13</sup>C while increasing <sup>12</sup>C. Once CO<sub>2</sub> enters the plants the isotopes are fractionated against <sup>13</sup>C according to two major photosynthetic

pathways:  $C_3$  and  $C_4$  (Page, 2007:32). The two photosynthetic pathways create their own negative isotopic signature, which can then identify specific plant species within the person's diet (Smith and Epstein, 1971). Carbon can be found in collagen and bioapatite in bone mineral of an organism and has the potential to indicate different aspects of diet. For example, carbon rates found in apatite represents an individual's entire diet while carbon rates in collagen signify only the protein intake (Page, 2007; Ubelaker and Owsley, 2003). Subsequently, the space between these two rates indicate trophic level of the consumer with herbivores having a greater distance between the two numbers, while top of the food chain consists of a smaller gap (Ubelaker and Owsley, 2003).

$C_3$  plants include shrubs, trees and most leafy-type plants that grow primarily in temperate climates (Ubelaker and Owsley, 2003:130), including many Old World grains such as wheat and rye (Page, 2007; Tieszen, 1983), and produce a carbon value of -20‰ (Katzenberg, 1992, 2000; Schoeninger et al., 1984; Ubelaker et al., 1995; Ubelaker and Owsley, 2003:130).  $C_4$  plants, on the other hand, are a category which includes plants such as millet, maize, and sugarcane that have adapted to hot and dry climates and produce a carbon value as low as -6‰ (Ubelaker and Owsley, 2003:130).

Nitrogen also exists in two stable forms,  $^{14}\text{N}$  and  $^{15}\text{N}$ , and occurs in the atmosphere as  $\text{N}_2$  gas. However,  $\text{N}_2$  must adhere to an alternative nitrogen-containing compound for living tissue to use it, such as ammonia ( $\text{NH}_4^+$ ) and nitrate ( $\text{NO}_3^-$ ) (Zumdahl and Zumdahl, 2000). These two compounds enter living organisms through either soil or ocean absorption, or nitrogen-fixing bacteria found in legume

roots and green algae (cyanobacteria). As the organism excretes waste,  $^{14}\text{N}$  is disposed of and  $^{15}\text{N}$  is retained (Page, 2007). Nitrogen also has the potential to indicate trophic levels, where by plants have the lowest value of nitrogen (maize = 9.6%), while seafood has a higher value (15%) (Ubelaker and Owsley, 2003:131).

This line of analysis can lead to ancestral identification based on expectations of food access and tradition. For instance, C3 plants are largely native to Europe and parts of Africa, whereas C4 plants have a substantial presence in the Americas. Even though colonists had access to both types of food, Page (2007:72) points out that corn was seen by the French as a “poor man, savage, animal fodder” food, and unlikely to be eaten by those who could afford otherwise. Furthermore, bone replaces itself every 10 years and would not have had time to turn over from the exposure to new food until the time of death.

#### *Isotope Analysis for Determination of Area of Origin*

Strontium and oxygen are also recognized as valuable ancestral indicators based on the fact that no geographic region contains the same amount of these elements (Bentley 2006). More work has been done with strontium, which occurs in “discrete geochemical environments” (Latkoczy, 1998:561). Therefore, it provides for regional variation from one population to the next (Turekian, 1956) and would be an indicator of childhood habitation, potential migration, and food intake (Bentley, 2006; Montgomery, 2007; Hoppe, 2003). The ability to establish an individual’s environmental origin makes this line of evidence particularly appealing for ancestral determination. The expectation of diverse values is high when colonists were coming from distinct locations such as West Africa and Europe.

Geologically, Sr is an alkaline metal and exists as a ratio of its isotopes,  $^{87}\text{Sr}/^{86}\text{Sr}$ , as a result of the radioactive  $^{87}\text{Rb}$  to  $^{87}\text{Sr}$   $\beta$ -decay. With a valence of +2 and an ionic radius only slightly larger than that of calcium, it is common for strontium to substitute for calcium in minerals such as apatite. The similarity can also be seen “during dietary uptake, internal bodily distribution, and excretion” (Latkoczy, 1998:561). This substitution allows for the absorption of Sr during skeletal and tissue formation and will be stored similarly to calcium within individual elements.

Environmentally, the occurrence of strontium has been described as a system of inputs and outputs (Bentley, 2006) with Sr being contributed by the atmosphere, and rocks while at the same time being carried away by streams and ground water which eventually deposit into the ocean. The water which contains levels of strontium will be absorbed by plants which will be consumed by herbivores that could eventually be eaten by humans causing strontium to be passed from one organism to the next.

In order to measure the amount of strontium in a sample, a mass spectrometer converts it to ions so that the strontium can be manipulated by an external electrical fields. These ions can then be measured and displayed on a readout (Breci, n.d.). One study from Mesoamerica (White, 2007) uses a strontium and oxygen ratio to determine the origins of people used in sacrificial burials. Her conclusions show that these individuals were from foreign lands and that one group of victims had been in Teotihuacan a short time while the other group had lived there significantly longer. Another study (Bentley et al., 2003), uses Sr analysis in a Neolithic population from Vaihingen, Germany to determine mobility and social differences within the group.

His results show that those buried in a ditch outside the settlement were non-local and those inside the settlement were local and that there was a social difference between the two groups (Bentley et al., 2003:484).

Unfortunately, there is still some debate over this line of evidence. One previous research (Turekian, 1954) has shown regions of the world having inconsistent strontium levels and that the results that are seen can be based on either an area as large as a country or a region as small as a state. Others (personal communication, Ford 2008) have seen a marked difference in strontium levels. For instance, Native North Americans are reported as having high levels where as Europeans have low (personal communication, Ford 2008) amounts of Sr. In order to combat this debate Bentley (2006) suggests that local wild life be tested prior to human samples in order to obtain specific Sr quantities in that region. Thus this method can only work well when the possible areas of origin are limited in number.

Ancestral analysis, whether called race, or geographic origin, has always been a controversial topic among physical anthropologists. The racial differences once assessed using relatively crude research techniques have evolved into studies of ancestral background, utilizing technologically advanced analytical systems and some historic methods. Regardless, each approach has worked at addressing different morphological, metric, and/or chemical differences seen between populations for the use in scientific or legal investigation.



## CHAPTER V

### MATERIALS AND METHODS

This chapter outlines the materials and methods that were employed for aging, sexing, and ancestral determination in the Moran series. However, due to variable preservation, not all methods within each category were used for each burial. Instead, only those who had the appropriate elements (e.g., crania and teeth) could be analyzed using each technique. Due to the cost of DNA analysis, only a select few were tested, being chosen on the basis of inconclusive morphological traits. Conversely, stable isotope analyses were applied to all burials except one.

In order to assess individual traits, a number of corrective measures had to be taken. Prior to measurements, any broken skull pieces were glued together with Elmer's Glue. In addition, broken long bones were also glued together to obtain measurements of maximum length and midshaft. For those elements too poorly preserved to be assessed in the laboratory, *in situ* measurements were used.

#### Estimation of Age of Death

In order to estimate the age of each individual, the following methods were applied to all relevant and present skeletal material. Some primary age markers, such as pubic symphysis morphology, could not be employed, so several more secondary indicators of age were used.

#### *Auricular Surface*

The auricular surface of os coxae was scored using the eight phases which describe the systematic age-related changes in Buikstra and Ubelaker (1997:25):

***Phase 1.*** Transverse billowing and very fine granularity. Auricular surface displays fine granular texture and marked transverse organization. There is no porosity, retroauricular

or apical activity. The surface appears youthful because of broad and well organized billows, which impart the definitive transverse organization. Raised transverse billows are well defined and cover most of the surface. Any subchondral defects are smooth edged and rounded. (Age: 20-24)

**Phase 2.** Reduction of billowing but retention of youthful appearance. Changes from the previous phase are not marked and are mostly reflected in slight to moderate loss of billowing, with replacement by striae. There is no apical activity, porosity, or retroauricular activity. The surface still appears youthful owing to marked transverse organization. Granulation is slightly more coarse. (Age: 25-29)

**Phase 3.** General loss of billowing, replacement by striae, and distinct coarsening of granularity. Both demifaces are largely quiescent with some loss of transverse organization. Billowing is much reduced and replaced by striae. The surface is more coarsely and recognizably granular than in the previous phase, with no significant changes at apex. Small areas of microporosity may appear. Slight retroauricular activity may occasionally be present. In general, coarse granulation supersedes and replaces billowing. Note smoothing of surface by replacement of billows with fine striae, but distinct retention of slight billowing. Loss of transverse organization and coarsening of granularity is evident. (Age: 30-34)

**Phase 4.** Uniform, coarse granularity. Both faces are coarsely and uniformly granulated, with marked reduction of both billowing and striae, but striae may still be present. Transverse organization is present but poorly defined. There is some activity in the retroauricular area, but this is usually slight. Minimal changes are seen at the apex, microporosity is slight, and there is no macroporosity. (Age: 35-39)

**Phase 5.** Transition from coarse granularity to dense surface. No billowing is seen. Striae may be present but are very vague. The face is still partially (coarsely) granular and there is a marked loss of transverse organization. Partial densification of the surface with commensurate loss of granularity. Slight to moderate activity in the retroauricular area. Occasional macroporosity is seen, but this is not typical. Slight changes are usually present at the apex. Some increase in macroporosity, depending on degree of densification. (Age: 40-44)

**Phase 6.** Completion of densification with complete loss of granularity. Significant loss of granulation is seen in most specimens, with replacement by dense bone. No billows or striae are present. Changes at apex are slight to moderate, but are almost always present. There is a distinct tendency for the surface to become dense. No transverse organization is evident. Most or all of the microporosity is lost to densification. There is increased irregularity of margins with moderate retroauricular activity and little or no macroporosity. (Age: 45-49)

**Phase 7.** Dense irregular surface of rugged topography and moderate to marked activity in periauricular areas. This is a further elaboration of the previous morphology, in which marked surface irregularity becomes the paramount feature. Topography, however,

shows no transverse or other form of organization. Moderate granulation is only occasionally retained. The inferior face is generally lipped at the inferior terminus. Apical changes are almost invariable and may be marked. Increasing irregularity of margins is seen. Macroporosity is present in some cases. Retroauricular activity is moderate to marked in most cases. (Age: 50-59)

**Phase 8.** Breakdown with marginal lipping, macroporosity, increased irregularity, and marked activity in periauricular areas. The paramount feature is a nongranular, irregular surface, with distinct signs of subchondral destruction. No transverse organization is seen and there is a distinct absence of any youthful criteria. Macroporosity is present in about one third of all cases. Apical activity is usually marked, but is not requisite. Margins become dramatically irregular and lipped, with typical degenerative joint change. Retroauricular area becomes well defined with profuse osteophytes of low to moderate relief. There is clear destruction of subchondral bone, absence of transverse organization, and increased irregularity. (Age: 60+).

### *Suture Closure*

Suture closure is another form of fusion but occurs in the skull rather than long bones, and is less reliable. This method has also produced contradictory results and can be affected by a number of factors, including health, injury, and genetics (Kirk, 2007). The methodology employed was developed by Buikstra and Ubelaker (1997:32-35) and included the sutures of the ectocranial and palatine sutures which typically fuse anteriorly and work their way posteriorly. For instance, by young adulthood the incisive suture is closed while the transverse palatine is showing evidence of activity.

### *Vertebral Epiphyseal Fusion*

Use of vertebral epiphyseal fusion in aging was developed by Albert and Maples (1995:624-625) who used a three stage scoring standard to assess union with the centrum:

- 0= no union.
- 1= beginning union (early Stage 1) or progressing union (late State 1).
- 2= almost complete union (early Stage 2) or Recently complete union (late Stage 2).

3= complete union.

Age may then be determined by comparison with the standards given in Table 1.

Table 1

*Earliest and Latest Ages for Observed Stages of Single Vertebrae*

Stage Determination	Age Noted in a Single Female Vertebra	Age Noted in a Single Male Vertebra
Stage 0 early	Under 14 years	Under 16 years 4 months
Stage 0 late	17 years 3 months	20 years 8 months
Stage 1 early	14 years	16 years 4 months
Stage 1 late	19 years 11 months	20 years 8 months
Stage 2 early	17 years 3 months	17 years 8 months
Stage 2 late	26 years 10 months	26 years 4 months
Stage 3 early	18 years	18 years 9 months
Stage 3 late	25 years	24 years 2 months

*Union of Long Bone Epiphyses*

This method proves most useful when trying to determine the age of adolescents since bone growth and fusion occur at a steady and predictable rate, unless growth becomes arrested. All postcranial long bones present were scored for epiphyseal closure using three stages described by Buikstra and Ubelaker (1997:1):

- 0 = open, epiphysis and diaphysis completely separated; no bony union.
- 1 = partial union: some union has occurred.
- 2 = complete union: all visible aspects of the epiphysis are united.

These scores were then compared to growth charts cataloging the stages of long bone epiphyseal fusion (Baker et al., 2005).

### *Dental Eruption*

Aging dental eruption was based on standards presented by Ubelaker (1978:Figure 62) (Figure 15). Based on the predictability and consistency of dental eruption prior to the age of 18, this method is the most accurate marker in juvenile age estimation. However, timing of eruption is slightly affected by “degree of fatness” and height, in which heavier and taller individuals have advanced dental development. On the other hand, correlations are not high and can not be associated with any particular age or stage of tooth development (Garn, 1965).

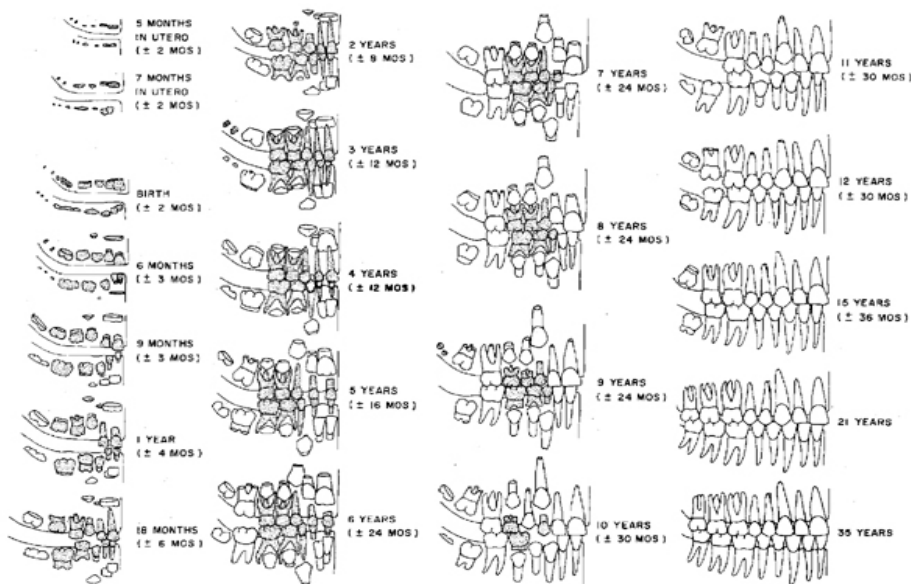


Figure 15. Dental Eruption Chart. (Ubelaker 1978:Figure 62).

### *Dental Wear*

Dentition can be further aged after full eruption based on occlusal surface wear. Methodological techniques used were from Lovejoy's work (1985:49-50) on the Libben population, a prehistoric hunter-gatherer group from Ohio. Even though this group likely had heavier wear than the agriculturalists at Moran, the technique still should allow for a general determination of a younger versus older adult.

## Estimation of Sex

The sexing of individuals was accomplished primarily through assessment of pelvic morphological indicators, cranial morphological features, development of muscle attachment points, and overall robusticity of long bones.

### *Pelvic Indicators*

Morphological differences seen in the pelvis were addressed using standards outlined in Buikstra and Ubelaker (1997:18-19). This region of the skeleton is considered the most effective for sexing based on functional differences of males and females. Unfortunately, this area is also fragile and frequently missing from the osteological record. The pubic region is the most accurate indicator of sex, but it was not available in any of the individuals recovered at Moran. Consequently the methods used included evaluation of the greater sciatic notch, which are wider in females compared to males, and the preauricular sulcus, which appears to be longer and deeper in females and often times is missing in males.

### *Cranial Morphology*

Although cranial traits are not quite as accurate as those of the pelvis in estimation of sex, they are still regarded highly. Degree of development of the following morphological features was assessed using standards established by Acsadi and Nemeskeri (1970) and outlined in France (2011): nuchal crest, mastoid process, glabella, and mental eminence. Each trait corresponds to a muscle attachment point on the skull, and overall is expected to be more prominent and robust in males than in females who exhibit soft gracile traits.

### *Long Bone Morphology*

In addition to the morphology of the skull and the pelvis, long bones too reflect the sex of an individual. By focusing on prominent muscle attachments such as the linea aspera, femoral head, deltoid tuberosity, and humeral head, and interosseous crests on the ulna and radius, it is possible to ascertain the difference between males and females. Estimations were observed according to Bass (2005:151-231) and include the following metric analyses:

Vertical diameter of humeral head:

Females - <43mm

Indeterminate – 44-46mm

Males - >47mm

Greatest diameter of femoral head:

Female – <42.5mm

Female? – 42.5-43.5mm

Indeterminate – 43.5-46.6mm

Male? – 46.5-47.5mm

Male - >47.5mm

### Determination of Ancestry

In order to determine the ancestral background of those interred at Moran, the following nondestructive methods were employed: cranial metrics and morphology, and dental morphology and metrics.

### *Cranial Measurements*

The following measurements were taken when possible using digital sliding and spreading calipers following Buikstra and Ubelaker (1994:74-77):

Table 2

*Cranial Measurements Used in the Assessment of Ancestry*


---

Maximum Cranial Length	Maxillo-Alveolar Breadth	Nasal Height	Frontal Chord
Maximum Cranial Breadth	Maxillo-Alveolar Length	Nasal Breadth	Occipital Chord
Bizygomatic Diameter	Biauricular Breadth	Orbital Breadth	Foramen Magnum Length
Basion-Bregma Height	Upper Facial Height	Orbital Height	Foramen Magnum Breadth
Cranial Base Length	Minimum Frontal Breadth	Biorbital Breadth	Mastoid Length
Basion-Prosthion Length	Upper Facial Breadth	Interorbital Breadth	

---

Once obtained, the measurements were evaluated using the following traditional typologies as outlined in Bass (2005:70-76):

Cranial Index= Maximum cranial breadth x 100/ Maximum cranial length  
 Dolichocrany-X-74.99-narrow or long headed  
 Mesocrany-75.00-79.99-average or medium  
 Brachycrany-80.00-84.99-broad or round headed  
 Hyperbrachycrany-85.00-X-very broad headed

Nasal Index= Nasal breadth x 100/ Nasal height  
 Leptorrhiny-X-47.99-narrow nasal aperture  
 Mesorrhiny-48.00-52.99-average or medium  
 Platyrrhiny-53.00-X-broad or wide nasal aperture

Total Facial Index= Total facial height x 100/ Bizygomatic breadth  
 Hypereuryprosopy-X-79.99-very broad face  
 Euryprosopy-80.00-84.99-broad face  
 Mesoprosopy-85.00-89.99-average or medium  
 Leptoprosopy-90.00-94.99-slender or narrow face  
 Hyperleptoprosopy-95.00-very slender or narrow face

Additionally, the craniometric data were entered into Fordisc 3.0. The following populations were selected based on their expected presence within the



colony: White Male, Black Male, AmerInd Male, White Female, Black Female, and AmeriInd Female. After processing the calculations, statistical probabilities were noted and used as a cross reference with results of cranial morphology assessment.

### *Dental Morphology*

The following 11 dental traits were selected from a list established by Scott and Turner (1987), which represents one of the most complete lists of dental traits, including their geographic affiliation, published; these traits represented those that appeared to have the greatest degree of population specificity. Each was scored as present or absent on the corresponding tooth.

Table 3

### *Dental Morphologies Used in Ancestral Analysis*

---

Incisor Shoveling	U1M Carabelli's Cusp	L2M Y-Pattern
Bushman Canine	U1M Hypocone	3 Rooted U2M
Interruption Groove	L1M Hypoconulid	3 Rooted L2M
U2M Hypocone	L2M Hypoconulid	

---

The frequency of these traits were also evaluated using a Mean Measure of Divergence equation (MMD) (Harris and Sjøvold, 2004)

$$\text{MMD} = \sum_{k=1}^k (\Theta_{ik} - \Theta_{jk})^2 / r - (1/n_i) + (1/n_j)$$

The Moran individuals were then compared to data from research done on Sub-Saharan African populations by Irish (1997)

### *Dental Metrics*

Mesial/distal and buccal/lingual measurements were taken with digital sliding calipers, recorded to the nearest 0.01mm, from all teeth that were sufficiently preserved. These measurements were then inserted into a Robust Index formula created by Hillson (1996:72):

$$\text{Robust Index} = \text{Mesial/Distal average} \times \text{Buccal/Lingual average}$$

These results were then entered into a scatter plot (Appendix B) in order to determine whether individuals clustered around the population mean or were outliers.

### *DNA Analysis*

The burials analyzed for mtDNA analysis were selected from the series for several reasons; some individuals exhibited morphologically significant indicators, such as shoveled incisors or brachycranic skull, which would set them apart from typical European values or suggested multiple ancestors. Others lacked a cranium for analysis, making ancestry determination difficult. Still others had unusual mortuary associations, such as the presence of a coffin or burial in the prone position, suggesting that they may have had special status within the group.

Samples from eight individuals at Moran were sent to PaleoDNA Laboratory at Lakehead University in Ontario. The level of preservation at Moran was sufficiently poor so as to prevent DNA recovery from most elements. Therefore, the skeletal element analyzed, whenever possible, consisted of a molar pulled directly from the dental arcade in order to obtain an uncontaminated sample. When teeth were unavailable, long bone samples, usually from the femur, were cut from the thickest part of the bone with a Dremel tool. Again, this was to ensure DNA purity

and sufficient specimen size to run the test. In addition, buccal swabs were taken from Dr. Danforth and the author in order to check for cross contamination since they had handled the skeletal remains most extensively.

### *Stable Isotope Testing*

Carbon and nitrogen tests were utilized in order to evaluate the diet of those interred at Moran. This could be advantageous when considering the two distinct diets of colonists and Native American peoples. A diet high in maize consumption shows a bone collagen  $\delta^{13}\text{C}$  value of around -10‰ to -7‰. A diet with high wheat consumption would show a bone collagen  $\delta^{13}\text{C}$  value of around -20‰ (Schoeninger and DeNiro, 1984).

In addition to carbon, the use of nitrogen may denote the colonists' diets. Nitrogen trophic levels are recorded as plants having the lowest value of nitrogen (maize = 9.6‰) while seafood has a higher value (15‰) (Ubelaker and Owsley, 2003:131). These measurements would be especially helpful if colonial diets changed from marine animals to one that contained more brackish or riverine organisms or whether they relied on more plant material than animals.

Previously isotope analysis conducted at Moran included Burials 5 and 6, previously tested by Carter et al. (2004). Also, as previously described, Page (2005) tested 23 collagen and apatite samples from Burials 1 through 8, as well as surface remains. Fifteen additional long bone samples were taken from burials 16 through 30 and were similarly tested for this research by The Isotope Analysis Laboratory at the University of Georgia. No sample from Burial 31 was taken since it was found

after the other samples had been submitted. Data from both studies were combined for analysis.

In order to determine the ancestry of each individual, all traits that could be assessed were considered. If they all suggested the same affiliation, then a definitive assignment was made. If indicators conflicted with one another, then the strengths and weaknesses of each trait was considered. The frequency of each trait within a population is not uniform and therefore needed to be considered. The first trait that assisted in ancestral identification is mtDNA; each haplogroup was placed into its corresponding geographic region(s) prior to other marker analyses. Second was cranial morphology since this is a direct indicator of environmental adaptation and the groups represent distinct geographic locations. The third trait was dental morphologies. As it was previously explained, all dental morphologies have the potential to present themselves in every population; although some have a higher rate of occurrence than others. The traits chosen for this study however, are ones which are likely to be found in particular ancestral groups far more than others. Following that is cranial metrics were evaluated since they loosely correlate with morphology but can also reflect a population's range of cranial shapes and sizes. The fifth factor was dental metrics. This trait was given less credence than the others simply because there is not a lot of research on this subject. Furthermore, dental measurements are at the mercy of interobserver error as well as methodological inaccuracies. Finally isotope results were included in the ancestral determination because the possibility existed that Native Americans close to the colony were eating wheat and Europeans who ran low on supplies relied on corn from indigenous groups.

In conclusion, each individual is expected to present some conflicting ancestral characteristics and it is not assumed that every burial will be able to be assigned conclusively to one of the three groups; European, African, or Native American. If the remains present too many contradictions or not enough markers then they will be indeterminate until further methods can be applied.

## CHAPTER VI

## RESULTS

This chapter focuses on the results that were obtained from demographic evaluation of the Moran population. Each burial is considered individually, and the criteria used in determination of age and sex are presented. Ancestral determinants and isotope values are also discussed, and more emphasis is given to these traits based on the focus of this study. Finally, a summary and analysis of population level findings are given at the end.

Based on the destructive nature of Hurricane Katrina, Burial 1 through 9 were comingled. Analysis on these individuals consisted of arbitrarily assigning burial numbers that no longer reflect field assigned numbers. However, Burials 3 and 6 could be reconstructed in accordance with notes from the 2003 analysis. In addition, 117 unassigned teeth were analyzed but unable to be assigned with any burial.

*(Lab Assigned) Burial 1*

Age: Adult  
Sex: Male  
Ancestry: Indeterminate  
Cranial Morphology: N/A  
Cranial Metrics: N/A  
Dental Morphology: N/A  
Dental Metrics (Robust Index): N/A  
DNA Haplogroup: N/A  
FORDISC: N/A  
Carbon Isotope: N/A

Age was based on complete epiphyseal fusion of long bones. Sex was based on prominent cranial features including nuchal and mastoids. In addition, this individual also presented a femoral head of 45.68mm and a narrow sciatic notch.

*(Lab Assigned) Burial 2*

Age: 20-35 years  
 Sex: Male  
 Ancestry: Indeterminate  
 Cranial Morphology: N/A  
 Cranial Metrics: N/A  
 Dental Morphology: N/A  
 Dental Metrics (Robust Index): N/A  
 DNA Haplogroup: N/A  
 FORDISC: 75.8% African female  
 Carbon Isotope: N/A

Burial 2 presented male characteristics of the cranium as well as a femoral head measurement of 46.3mm. Suture closure was minimal, indicating a young adult.

*(Field Assigned) Burial 3*

Age: 42-50  
 Sex: Male  
 Ancestry: European  
 Cranial Morphology: Narrow nasal aperture and interorbital breadth, long narrow face, oval shaped orbits  
 Cranial Metrics: Dolichocranic, Leptorrhinic  
 Dental Morphology: N/A  
 Dental Metrics (Robust Index): N/A  
 DNA Haplogroup: N/A  
 FORDISC: 64% European male  
 Carbon Isotope: -19.62/9.40 (C3)

Burial 3 was the most complete of the comingled remains, with the majority of elements represented. Therefore, sex was based on a combination of pelvic, femoral, and cranial indicators. Age was assessed using the auricular surface and resorption of the dental arcade.

Cranial morphology is indicative of an individual of European ancestry. In particular, the narrow nasal aperture, and interorbital breadth is what would be expected to be seen in colder climate populations, rather than the wide and low nasal

aperture of equatorial groups (Steggmann, 1972) (Figure 16). Supporting the cranial morphology are metric data. These data also suggest an individual of possible Caucasoid ancestry by falling within the dolichocranic, or long and narrow, head shape and long and slender nasal aperture.



*Figure 16.* Burial 3 Facial Morphology.

Carbon isotope data indicates a person consuming C3 plants, which would have been expected of a European colonist, especially one of this age who probably spent more time in Europe than the colony.

Based on a number of characteristics, Burial 3 appears to be European.

*(Lab Assigned) Burial 4*

Age: Adult  
Sex: Indeterminate  
Ancestry: Indeterminate  
Cranial Morphology: N/A  
Cranial Metrics: Dolichocranic  
Dental Morphology: N/A



Dental Metrics (Robust Index): N/A  
 DNA Haplogroup: N/A  
 FORDISC: N/A  
 Carbon Isotope: N/A

Age was assessed as adult according to general size of elements present and degree of epiphyseal closure. However, none of the elements present permitted sex or ancestral estimation.

*(Lab Assigned) Burial 5A*

Age: 35-50 years  
 Sex: Probable Male  
 Ancestry: Indeterminate  
 Cranial Morphology: N/A  
 Cranial Metrics: N/A  
 Dental Morphology: N/A  
 Dental Metrics (Robust Index): N/A  
 DNA Haplogroup: N/A  
 FORDISC: N/A  
 Carbon Isotope: N/A

Burial 5 consisted of fragmented long bones and pelvis. Based on a femoral head measurement of 46.14mm, this individual is believed to be a probable male.

*(Lab Assigned) Burial 5B*

Age: Juvenile  
 Sex: Undetermined  
 Ancestry: Undetermined

This individual is represented by a left petrous portion. It could potentially represent a child around 2.5 years based on the size and morphology (Scheuer and Black, 2004).

*(Lab Assigned) Burial 5C*

Age: Juvenile  
 Sex: Undetermined  
 Ancestry: Undetermined

This burial is represented by a left petrous portion. Based on size it was determined this belonged to a juvenile individual; however, the length was .5cm larger than 5B and therefore was probably older than 2.5 years at death.

*(Field Assigned) Burial 6*

Age: 25-40 years  
 Sex: Female  
 Ancestry: Indeterminate  
 Cranial Morphology: N/A  
 Cranial Metrics: N/A  
 Dental Morphology: N/A  
 Dental Metrics (Robust Index): N/A  
 DNA Haplogroup: N/A  
 FORDISC: 19% African Male  
 Carbon Isotope: N/A

Burial 6 represents one of the original pre-Hurricane Katrina excavated remains and is consistent with field notes from that time. Sex was determined by general size and gracile nature of all elements, in addition to a wide sciatic notch. Age was assessed in 2003; although no notes indicate how age was determined, it is likely based on suture closure since no other elements were present.

*(Field Assigned) Burial 7*

Age: 30-40 years  
 Sex: Male  
 Ancestry: European  
 Cranial Morphology: N/A  
 Cranial Metrics: Leptorrhinic, Dolichocranic,  
 Dental Morphology: N/A  
 Dental Metrics (Robust Index): N/A  
 DNA Haplogroup: N/A  
 FORDISC: 75.8% European female  
 Carbon Isotope: N/A

Burial 7 could not be distinguished from the comingled remains. Therefore, photographs and notes from 2003 (Figure 17) were used to analyze cranial

morphology of this individual. From this, it was possible to note prominent superciliary arches and mastoids, in addition to a squared mental eminence typical of a male.



*Figure 17. Burial 7 Facial morphology.*

Its facial morphology presented a slender nasal aperture and long narrow cranial vault, both indicative of a European. Pictures taken from 2003 also show partially flaring zygomatics and high cheek bones often associated with Native Americans. However, these features are also present in other populations and do not provide enough evidence to contradict cranial metric data. Therefore, this individual is determined to be European.

*(Lab Assigned) Burial 8*

Age: Adult  
Sex: Probable Male  
Ancestry: Indeterminate  
Cranial Morphology: N/A

Cranial Metrics: N/A  
 Dental Morphology: N/A  
 Dental Metrics (Robust Index): N/A  
 DNA Haplogroup: N/A  
 FORDISC: N/A  
 Carbon Isotope: N/A

This burial is represented by the bones that comprise parts of the shoulder girdle, including the humeri and scapulae. Based on general size of these bones, these remains were determined to represent a probable male. Ancestry could not be assessed.

*(Lab Assigned) Burial 8A*

Age: Adult  
 Sex: Indeterminate  
 Ancestry: Indeterminate  
 Cranial Morphology: N/A  
 Cranial Metrics: N/A  
 Dental Morphology: N/A  
 Dental Metrics: N/A  
 DNA Haplogroup: N/A  
 FORDISC: N/A  
 Carbon Isotope: N/A

Burial 8A was only identified through a minimal number of individual (MNI) analysis conducted on the comingled ossuary remains in the laboratory. It was not identified in 2003. The only elements that can be attributed to this individual are a set of adult tali.

*Burials 9-12*

These remains were lost with the construction of a fence to the south of the Moran property (Greenwell, personal communication, 2008).

*Burial 13*

Burial number not used.

### *Unassigned Dentition*

Of the 117 ossuary teeth, none could be assigned to any particular burials. Ancestral traits that could be observed are as follows: three shoveled incisors, one interruption groove, one Carabelli's cusp, two hypoconulids, six three-rooted upper second molars, and two three-rooted upper first molars. Were other ancestral traits present, these teeth would have the potential to support evaluation of geographic origin. However, these traits occur in every population and therefore cannot be considered in isolation.

### *Burial 14*

Age: 18-23 years

Sex: Male

Ancestry: Indeterminate

Cranial Morphology: N/A

Cranial Metrics: N/A

Dental Morphology: Shovel shaped incisors, Y-pattern on second mandibular molars

Dental Metrics (Robust Index):  $M^2$  83.02

DNA Haplogroup: J

FORDISC: 86.5% European male

Carbon Isotope: -18.85/12.12 (C3)

Age was assessed using tooth eruption, as well as degree of long bone and vertebral epiphyseal fusion. Sex was assigned based on a large nuchal crest, large mastoid processes, narrow sciatic notch and robust long bone metrics. All metric data was also inserted into FORDISC, which determined Burial 14 to be male.

Unfortunately, few cranial measurements were obtainable.

Dental morphology suggests that this individual was more likely Native American or African based on the two distinct traits: shoveling and a second

mandibular molar Y-pattern (Figure 18). The latter feature is most commonly associated with the San population.



*Figure 18.* Burial 14.Y-Pattern 2<sup>nd</sup> Mandibular Molar.

Dental metrics show that the robust index exceeds one standard deviation of the mean for the Moran population. In fact, based on Kieser's (1990) recorded data set on various geographic dental metrics, Burial 14's robust index (83.2) is small, coming closest to the San Bushmen population (97.97). However, this ancestral origin is unlikely.

Page's (2007) carbon isotope analysis placed Burial 14 within the range of a C3 plant eater, so it appears that the individual is unlikely to be Native American despite the presence of shoveled incisors.

DNA results indicate a J haplogroup which could represent either an individual of European or African origin.

Based on these mixed data, Burial 14 is considered to be of indeterminate ancestry.

### *Burial 15*

Age: Infant

Age was based on the dental development of the three deciduous teeth present. Consequently, no ancestral or sex scoring was conducted on this individual.

*Burial 16*

Age: 15-18 years  
 Sex: Male  
 Ancestry: European  
 Cranial Morphology: Slight nasal guttering  
 Cranial Metrics: Brachycranial, Leptorrhinic, Leptoprosopic  
 Dental Morphology: 2nd molar hypoconulid, 3 rooted upper 2nd molar  
 Dental Metrics (Robust Index): Average of all maxillary molars=122.12  
 DNA Haplogroup: N/A  
 FORDISC: 44% African Male  
 Carbon Isotope: -19.5/8.6 (C3)

Age was assessed based on palatine suture closure, partial third molar eruption and distal tibia epiphyseal fusion. Sex determination was based on a narrow sciatic notch, robust supraorbital ridge, and large head of femur (46mm). FORDISC analysis also indicated a male.

Cranial morphology (Figure 19) presented slight guttering of the nasal aperture. Although typical in Africans, this feature was not sufficiently prominent to establish ancestry.

Cranial metrics presented a relatively broad skull, narrow nasal aperture, and slender, narrow face. When compared to Europeans at other French colonial sites, namely Fort Michilimackinac and St. Croix Island, both nasal index and upper face index fall within the average range. On the other hand, the cephalic index is among the larger population outliers, being far more brachycephalic.

One dental trait, the retention of the lower 2nd molar hypoconulid, has the potential to suggest non-European ancestry.



*Figure 19.* Burial 16 Cranial Morphology.

Based on the average robust index, Burial 16 represents an outlier, being larger than other Moran individuals. However, when compared to Kieser's data, an index of 122.12 is on par with North American groups (120.72) and high compared to Europeans (116.58) and Africans (109.9).

The carbon isotope results indicate an individual who has consumed C3 plants (e.g., wheat) for up to the past 20 years. Considering Burial 16 is 15 to 18 years old, it is likely that he had been born in Europe and immigrated to the colony. Even though it was not uncommon for colonists to consume wheat while in the New World, it would be atypical that an indigenous person would be eating European foods, given that colonists adopted maize into their diet.

Based on observations and measurements taken, it can be expected that this individual is of European ancestry, regardless of a larger, rounder skull. The observation of a broad skull can easily be explained by secular change, which suggests that cephalic index is impacted by microevolutionary changes (Garn, 1982).



According to these modifications it is not uncommon to see some discrepancy between cranial shape and other metric indices.

*Burial 17*

Age: 15-21 years  
 Sex: Male  
 Ancestry: European  
 Cranial Morphology: n/a  
 Cranial Metrics: Platyrrhine  
 Dental Morphology: Loss of lower 1st and 2nd molar hypoconulid, three-rooted upper 2nd molar  
 Dental Metrics (Robust Index): Average of all maxillary molars 95.45  
 DNA Haplogroup: N/A  
 FORDISC: 97.5% Caucasian female  
 Carbon Isotope: -19.3/12.9 (C3)

Age was assessed using third molar eruption and suture closure. Sex was based on the sciatic notch, which was narrow, and a large femoral head measurement (47mm). Therefore, the female determination of FORDISC was unexpected, but the discrepancy could be because this individual was a young male, who had not obtained fully sexual dimorphic cranial traits yet.

The only cranial measurement that could be obtained indicated a broad nasal aperture. Even though this feature would be expected in non-Europeans, this single measurement is not enough to determine ancestry.

Dental morphological traits, specifically the absence of the hypoconulid of the lower first and second molars, overall are European. On the other hand, a three rooted upper second molar would suggest Sub-Saharan African. However, this trait seems to occur regularly across all groups among Western Eurasians (Ennaffaa et al., 2009). This high rate of occurrence does not provide a dependable ancestral determinant, allowing the other two traits to be relied on more. Burial 17's robust

index is average when compared to the other Moran individuals. However, it is small when compared to other world populations.

Carbon analysis results indicated a C3 diet. Although Burial 17 was an outlier when compared to other isotopic values seen in Moran individuals, this burial was still within the normal range of prehistoric Old World agriculturalists. Therefore, it is likely that he is of European ancestry.

### *Burial 18*

Age: Adult  
Sex: Male  
Ancestry: Indeterminate  
Cranial Morphology: N/A  
Cranial Metrics: N/A  
Dental Morphology: N/A  
Dental Metrics: N/A  
DNA Haplogroup: N/A  
FORDISC: N/A  
Carbon Isotope: -19.2/12.2 (C3)

Age and sex were based on long bone measurements, since Burial 18 was not found with a skull. Due to the absence of stratigraphy in the sandy soil, it is difficult to know whether this individual was disturbed after burial, or was actually buried without his head. Since many of the skeletal elements were very fragmented and still encased in shellac, it could argue for disturbance as the more likely explanation. According to excavation maps from 1969 and 2003, this individual may actually be Burial 8, which would explain the shellac.

The carbon isotope results suggest that Burial 18 is consistent with other Moran individuals and fits within the range of prehistoric European agriculturalists, thereby suggesting that he was eating a C3 diet. Given the lack of additional data concerning ancestry, this determination cannot be made

*Burial 19*

Age: 35-45  
 Sex: Male  
 Ancestry: Indeterminate  
 Cranial Morphology: N/A  
 Cranial Metrics: N/A  
 Dental Morphology: N/A  
 Dental Metrics: N/A  
 DNA Haplogroup: N/A  
 FORDISC: N/A  
 Carbon Isotope: -19.8/12.5 (C3)

Since no dentition was available, age was assessed using Lovejoy's (1985) method for the auricular surface. There was also early stage arthritis on the distal fibula, suggesting this individual was a middle aged adult. Despite a small head of femur (43mm), this burial was determined to be male, based on a robust linea aspera on the femur and an acute sciatic notch.

Carbon isotope results indicate an individual who has consumed C3 plants (e.g., wheat) for the past 20 years. Considering the advanced age of the individual, it is unlikely that he had been born in the colony; even more unlikely is the possibility that he is of Native American descent and started eating wheat as an adult. Given the paucity of data concerning ancestry, no conclusive determination can be made.

*Burial 20*

Age: 17-20  
 Sex: Female  
 Ancestry: Possible African  
 Cranial Morphology: Slight prognathism, wide nasal aperture, rectangular palate  
 Cranial Metrics: Brachycranial, Platyrrhine  
 Dental Morphology: Shoveled incisors, Y-pattern second mandibular molar  
 Dental Metrics (Robust Index): N/A  
 DNA Haplogroup: H  
 FORDISC: 94.3% Black Female  
 Carbon Isotope: -19.3/9.7 (C3)

Age was assessed using dental eruption and epiphyseal fusion. Partial development of third molars indicated an age range of 17 to 20 years old. This was supported by a still unfused medial clavicle epiphysis. Sex determination of female was evidenced in both the cranium and pelvis by a wide sciatic notch, gracile cranial features, and pointed mental eminence.

Cranial morphology (Figure 20) and metrics suggests this individual is likely of African ancestry, based on traditional ancestral markers including a wide nasal aperture and rectangular palate. Some prognathism is present, but it is slight when compared to the standards outlined by France (2011). This individual also presents a brachycranic skull and platyrrhinc nasal aperture, which are typically associated with East Asian and African ancestry respectively (France, 2011). Burial 20 represents one of three brachycranic skulls within the whole population, indicating this was not a prevalent trait for this group.



*Figure 20.* Burial 20 Midfacial Region.

Dental morphology, including the presence of shoveling and a Y-pattern 2nd mandibular molar, also supports the hypothesis that Burial 20 is not of European

ancestry. The combination of these traits would suggest that this individual was of African ancestry.

DNA results indicate an H haplogroup, which is predominantly seen within European populations, but also occurs with relatively high frequencies among West African populations as well (Ennafaa et al., 2009). If the French had received slaves from this part of Africa, then it would not be unexpected that this individual might reflect an H haplogroup.

Carbon isotope data suggests a diet of terrestrial protein and C3 plants. These carbon results could potentially link this individual to either European or African origins and based on the cranial morphology, African ancestry seems the most likely.

*Burial 21*

Age: Adult  
 Sex: Male  
 Ancestry: Indeterminate  
 Cranial Morphology: N/A  
 Cranial Metrics: N/A  
 Dental Morphology: N/A  
 Dental Metrics: N/A  
 DNA Haplogroup: N/A  
 FORDISC: N/A  
 Carbon Isotope: -19.6/11 (C3)

Due to poor preservation, a detailed analysis of this individual was not possible. However, the greater sciatic notch, femoral head (46mm), and nuchal area of the skull were preserved sufficiently to determine this was a male, while complete vertebral fusion and light porosity indicated Burial 21 to be an adult. Only one tooth, a central incisor, was associated with the remains and did not display any morphological trait that is tied to ancestry. Carbon isotope values display typical C3 results, as seen in other Moran individuals.

Based on the paucity of relevant traits, however, ancestry cannot be conclusively assessed.

*Burial 22*

Age: Adult  
Sex: Male  
Ancestry: Indeterminate  
Cranial Morphology: N/A  
Cranial Metrics: N/A  
Dental Morphology: N/A  
Dental Metrics (Robust Index): Average of all maxillary molars 94.69  
DNA Haplogroup: N/A  
FORDISC: N/A  
Carbon Isotope: -19.8/13.2 (C3)

Preservation of Burial 22 was poor, and many elements were severely fragmented.

Sex of Burial 22 was assessed using the cranium and femur, and displayed the robust features typical of a male individual. Age could be assessed as adult based on dental eruption, epiphyseal fusion, and suture closure.

This individual did not present any dental morphology indicative of ancestral background. Dental metrics, on the other hand, show values slightly below that of the average Moran individual and significantly lower than Kieser's regional averages, which do not include any data from French populations.

Carbon and nitrogen values are both outside the average range of Moran individuals (Appendix G). Carbon values are still within the range of a C3 consumer, but nitrogen values are more consistent with someone who is eating marine animals (Ubelaker and Owsley, 2003). However, carbon values and dental metrics are not enough to conclude any ancestral affiliation.

*Burial 22B*

Age: Juvenile

The individual was found with Burial 22 and is represented by vertebral fragments. Based on their size it was concluded that Burial 22B is a juvenile.

*Burial 23*

Age: 30-40

Sex: Male

Ancestry: European

Cranial Morphology: N/A

Cranial Metrics: Dolichocranic

Dental Morphology: Shoveled incisors

Dental Metrics (Robust Index): Average of all maxillary molars 102.48

DNA Haplogroup: H

FORDISC: 50.4% Black female

Carbon Isotope: -18.7/9.9 (C3)

Burial 23 presented a challenge in terms of aging and sexing due the fusion of the atlas to the occipital condyles and the axis to the third cervical vertebrae, a condition otherwise known as Klippe-Feil Syndrome (Hensinger, 1974) (Figure 21). Since the neck has limited mobility in this syndrome, it has the potential to accelerate suture closure, creating a situation in which the individual appears older than he or she is (Kroman, 2009). Unfortunately, poor preservation prevented other areas from being aged so suture closure had to be relied on to obtain a general age range of 30 to 40 years. Sex markers on the cranium were also altered due to Klippe-Feil, but when paired with an acute sciatic notch and large femoral head (45.09mm), this individual was clearly a male.



*Figure 21.* Burial 23. Klippe-Feil Syndrome. Fusion of axis and third cervical vertebrae.

Even though cranial morphology could not be assessed, cranial metrics fell within the typical range for the French. One study shows that the average index of French males is 82.8 with the highest being 89.00 (Bean, 1934:253). Burial 23 clearly falls within this range at 83.04. However, the same study assigns North American Indian groups a median cephalic index of 82.5. Clearly, these two group medians are too close in Bean's study to securely appoint Burial 23 to either one. On the other hand, Burial 23 resembles other European individuals when compared to contemporary French burials found at Fort Michilimackinac and St. Croix Island using cranial measurements. Analysis using FORDISC concluded that Burial 23 was an African female. However, it should be taken into consideration that it was only a 50% certain classification.

Dental morphology suggests Asian ancestry based on the presence of shoveled incisors. Robust index, on the other hand, is closer to the median European index (116) than that of North Americans, which appears to be more robust (130) (Keiser, 1990).

Carbon isotope values also represent a C3 diet typical of other Moran individuals. This would suggest a lifelong diet of wheat rather than any C4 plant.



Taking this into consideration, along with age and small tooth size, it would be unlikely that this individual is an indigenous North American. Most likely he is European.

*Burial 24*

Age: Older Adult (50+)  
 Sex: Male  
 Ancestry: European  
 Cranial Morphology: No prognathism, narrow nasal aperture  
 Cranial Metrics: Brachycranial  
 Dental Morphology: N/A  
 Dental Metrics (Robust Index): Average of maxillary molars 87.77  
 DNA Haplogroup: N/A  
 FORDISC: 94.8% White Female  
 Carbon Isotope: -19.9/11.7 (C3)

Burial 24 overall showed good preservation of the upper body. However, age could not be narrowed down beyond older adult, because the pelvis was essentially destroyed. Instead, age was assessed using suture closure and dental wear. Complete obliteration of the sagittal suture and significant closure of the coronal, coupled with advanced wear and bone resorption on the dental arcade, suggests an older adult. Sex was obtained through cranial markers and femoral head measurement (49.5mm) which suggested a male individual. These results conflict with FORDISC which concludes that this individual is a white female with 94.8% likelihood since all but femoral head measurements were small.

Cranial morphology was also indicative of a European and shows no suggestion of other traits usually associated with non-European ancestries. However, cranial metrics are atypical when compared to populations at other French sites, including Fort Michilimackinac and St. Croix Island. Burial 24 represents a

brachycranic skull with a cephalic index slightly above (8%) the means of the two previously mentioned French samples.

Robust index is below average when compared to other Moran individuals as well as world populations reported by Keiser (1990). One possible explanation of this is based on healed porotic hyperostosis and cribra orbitalia, which could indicate general metabolic stress contributing to an arrested dental growth during development years, resulting in smaller robust index. Garn et al. (1968) suggest that positive secular change occurs when diet improves, including greater levels of fluoride (Cooper and Ludwig 1965) and Vitamin A (Paynter and Grainger, 1956), and changes in maternal diet (Holloway et al., 1961). However, Kieser (1990) suggests these data are speculative, and dental size could just as easily be a random or chance process.

According to carbon isotope results, Burial 24 is likely to have consumed wheat rather than maize. Results are also consistent with values seen in other Moran individuals as well as prehistoric European agriculturists. Based on this and cranial morphology it can be concluded that Burial 24 is European.

*Burial 25*

Age: 25-35

Sex: Indeterminate

Ancestry: European

Cranial Morphology: N/A

Cranial Metrics: N/A

Dental Morphology: N/A

Dental Metrics (Robust Index): Average of maxillary molars 106.68

DNA Haplogroup: H

FORDISC: 75% Black Female

Carbon Isotope: -20.5/13.1 (C3)

Burial 25 represents a unique individual. This was the only set of remains from Moran that was buried face down. Originally identified as a female in the field, this burial presented conflicting sex markers with laboratory analysis. Cranial morphology suggested gracile feminine features in addition to a femoral head measurement of 40.5mm. These initial findings are consistent with FORDISC's female estimate. However, sciatic notch morphology is indicative of a male. Therefore, the sex estimation is inconclusive. The age range was determined by vertebral fusion, which was scored as a late Stage 3 (Albert and Maples, 1995), and presence of moderate dental wear.

Mean robust index for maxillary third molars was above average for Moran individuals and just below the African average (Keiser, 1990). Unfortunately, cranial damage was too extensive to allow for any metric or morphological analysis.

DNA results indicate an H haplogroup typical of European and northwest African populations. Consistent with the likely for European DNA, carbon and nitrogen isotopes suggests this individual was consuming wheat and marine animals. Given this individual's age, diet, and DNA, it would be improbable for him to be of African ancestry and more likely would have been European.

#### *Burial 26*

Age: 50+  
Sex: Male  
Ancestry: European  
Cranial Morphology: N/A  
Cranial Metrics: Dolichocranic, Mesorrhinic  
Dental Morphology: N/A  
Dental Metrics: N/A  
DNA Haplogroup: H  
FORDISC: 69.7% Native American  
Carbon Isotope: -19.5/10.6 (C3)

One of the oldest and most robust individuals found, Burial 26 was surrounded by an outline of nails, indicative of a coffin. He also displayed arthritis, an unfused metopic suture, and significant dental loss. Overall the remains exhibited large muscular markers on the clavicles, aninion hook, and potential healed trauma in the right acetabulum.

Cranial measurements indicate traits typically seen in Europeans. These measurements are well within the range of values found for the populations at Fort Michilimackinac and St Croix Island, as well as indices established by Bean (1934). Diet is established as C3 plants, most likely wheat, and is within the range of other Moran burials.

DNA results indicate an H haplogroup, which has been previously established as either European mtDNA or northwestern Africa. Based on cranial morphology, including aninion hook, and diet based indicated by isotope values, it would be assumed that this person represents a European.

*Burial 27A*

Age: Adult  
 Sex: Male  
 Ancestry: European  
 Cranial Morphology: N/A  
 Cranial Metrics: N/A  
 Dental Morphology:  
 Dental Metrics: N/A  
 DNA Haplogroup: J2  
 FORDISC: N/A  
 Carbon Isotope: -19.5/11.5 (C3)

Buried directly beneath Burial 26 and containing two individuals, Burial 27 had potentially been disturbed when the casket was interred above them. This is

directly evidenced by 27A's missing skull and lumbar vertebrae (Figure 22). This individual is represented primarily by major thoracic elements and both ilia. Without the cranium, sex was based on acute sciatic notch and femoral head measurements (46.5mm). No age determination was possible beyond adult based on epiphyseal closure.



*Figure 22.* Burial 27.

Burial 27 is the only individual tested who exhibited a J2 haplogroup, which is most commonly seen in Spain. Based on the specificity of this haplogroup, it is possible that Burial 27 represents one of the non-French individuals who migrated into the colony, or perhaps was a visiting Spaniard whose own colony was close by.

*Burial 27B*

Age: Adult  
 Sex: Male  
 Ancestry: Indeterminate

Burial 27B was discovered with subsequent laboratory analysis, and was determined to be the more complete of the two sets of remains. Elements present include the majority of major long bones and axial skeleton. Sex was determined based on a femoral head measurement of 47.2mm. There was nothing that could age this individual more specifically than adult, nor were there any indicators of ancestry that could be evaluated.

*Burial 28*

Age: 35-45  
 Sex: Male  
 Ancestry: Possible African  
 Cranial Morphology: N/A  
 Cranial Metrics: Brachycranic  
 Dental Morphology: N/A  
 Dental Metrics (Robust Index): Average of maxillary molars 102.58  
 DNA Haplogroup: U  
 FORDISC: N/A  
 Carbon Isotope: -19.4/10.2 (C3)

Burial 28 represents one of the older adults present on site based on auricular surface, vertebral fusion, the presence of arthritis on lumbar vertebrae, and obliteration of cranial sutures. There was also extensive dental loss and resorption of alveolar portion of the mandible, also indicative of an older individual (Figure 23). Sex was determined by robust cranial markers, a femoral head measurement of 51.5mm, and a distinctly male pelvis.

Cranial metrics indicates an individual who exhibits a brachycranic skull. Although similar to the cranial indices of two other individuals in the cemetery, when

compared to contemporary French burials at St. Croix, only one individual, Burial 7, has a comparable index as Burial 28. According to Bean (1934), a cephalic index of 89 is the extreme end of the European range, which interestingly was seen in a French skull in his study.



*Figure 23.* Burial 28. Loss of dentition and resorption of mandible.

U haplogroup DNA results could potentially support an African origin (as discussed in Chapter IV). Unfortunately, it is unknown what subgroup this individual belongs to, and therefore actual origin remains uncertain.

Carbon isotopes are average when compared to other Moran individuals, suggesting a C3 diet. Nitrogen results are lower than average, suggesting more of a terrestrial diet, rather than one based on marine life. It is expected that African individuals would more than likely have C4 carbon results, indicative of hot arid conditions however; parts of western Africa including Ghana, a major slave producer during the colonial period, are found to be predominantly C3 plants, with only a

presence of C4 grasses (Talbot, 1993). Coupled with DNA and a larger than average cranial index, it is possible that Burial 28 was from Africa.

*Burial 29A*

Age: Older Adult  
 Sex: Male  
 Ancestry: Probable European  
 Cranial Morphology: N/A  
 Cranial Metrics: N/A  
 Dental Morphology: N/A  
 Dental Metrics (Robust Index): Average of maxillary molars 82.81  
 DNA Haplogroup: N/A  
 FORDISC: N/A  
 Carbon Isotope: -21/11.8 (C3)

Two individuals were discovered when inventory was being conducted post excavation. Preservation of Burial 29A made aging difficult. However, the presence of arthritis on the vertebral column and fusion of the auricular surface to the sacrum of Burial 29A suggests older adult. Sex was determined based on cranial markers, pelvic indicators, and a femoral head measurement of 45mm.

Dental metrics were small when compared to other Moran individuals and world populations. Although high, carbon isotope values still fall within the C3 range and would indicate a wheat diet consistent with other Europeans. Based on those traits present, this individual is considered to be a possible European.

*Burial 29B*

Age:  $\approx$  15 years  
 Sex: Indeterminate  
 Ancestry: Indeterminate  
 Cranial Morphology: N/A  
 Cranial Metrics: N/A  
 Dental Morphology: N/A  
 Dental Metrics (Robust Index): N/A  
 DNA Haplogroup: N/A  
 FORDISC: N/A



Carbon Isotope: N/A

Burial 29B remains consist of pelvis and sacral fragments which are inconsistent with the age of 29A. Instead, these remains are approximately 15 to 16 years old, evidenced by unfused sacral vertebrae and a billowing iliac crest.

Unfortunately no sex or ancestry analysis was possible.

*Burial 30*

Age: 50+  
 Sex: Male  
 Ancestry: European  
 Cranial Morphology: N/A  
 Cranial Metrics: Platyrrhinc  
 Dental Morphology: Lingual groove  
 Dental Metrics: N/A  
 DNA Haplogroup: D/H  
 FORDISC: N/A  
 Carbon Isotope: -19.1/12.3 (C3)

Burial 30 could possibly represent the oldest individual found to date at the Moran Cemetery. Analysis of the auricular surface and obliteration of most sutures suggest an older adult. Dental wear is extensive with antemortem loss of second and third molars, with complete mandibular remodeling.

Nasal measurements were the only metric analysis possible for the skull (Figure 24). They indicate an individual with a wide flat nose. This morphology is commonly seen in individuals of African heritage; however, this one observation is not enough to assign ancestry.

Analysis of dental morphology shows a lingual groove or interruption groove is present, which is often associated with Native Americans; however, there is no evidence of shoveled incisors.



*Figure 24. Burial 30.*

DNA could assist in determining ancestry, since this individual has a 16223T polymorphism. This polymorphism is seen in 7% of Europeans (Richards et al. 1998), 65% of Mongolians (Kolman et al., 1996), and 91% of Africans (Watson et al., 1997). As previously explained, haplogroup H could be either European or Northwest African. D on the other hand has been attributed to populations found in North and South America, and coupled with the high rate of 16223T occurrence among these individuals.

When considering DNA information, and comparing it to age of the individual and carbon results, it would be improbable this person was Native American, unless he was consuming European food twenty years prior to death. Furthermore, cranial morphology makes Burial 30 even less likely to be either Native American or African. Therefore, it is concluded that he must be European.

*Burial 31*

Age: 27-31  
 Sex: Male  
 Ancestry: Indeterminate

Cranial Morphology: N/A  
Cranial Metrics: N/A  
Dental Morphology: N/A  
Dental Metrics: N/A  
DNA Haplogroup: N/A  
FORDISC: N/A  
Carbon Isotope: N/A

Sex was determined by robust cranial features, pelvic indicators, and a femoral head measurement of 49mm. Age was based on auricular surface and suture closure. Burial 31 was the only set of remains discovered during the 2009 field season. Due to this late find, this burial did not undergo any isotope testing. Furthermore, no ancestral markers could be assessed because the face was missing right below the superciliary arches and the dentition that was present did not display any population specific characteristics. Therefore this individual is indeterminate until chemical or genetic testing can be conducted.

#### *Summary of Findings*

Overall, demographic analysis showed the individuals buried in the Moran cemetery ranged in age from infant to older adult (Appendix A). The majority (60%) of those interred were young to middle aged adults (between 20 and 50 years old), followed by 16% young adults (15 to 20 years old), 10% older adults (older than 50 years) and then 10% infants or children. Due to preservation, infants and juveniles were typically represented by one or two elements per child with the possibility that different elements represented the same individual. Sex distribution showed a greater representation of males (N=22) compared to females (N=2).

Demographically, the Moran cemetery appears to generally correspond with expectations for a colonial cemetery, both in terms of age and sex distribution (See

Table 4). For instance, Cybulski (1988:66) reports the remains of Quebec cemetery consist of 90% male, 8% female, and 2% indeterminate, all of which were European adults over the age of 14 years. St. Peter's (Owsley and Orser, 1984:188), on the other hand, presents almost a 50:50 split between males and females with 10% of those recovered are juveniles whereas, the St. Croix Island Cemetery is composed completely of males. Finally, Fort Michillimackinac consists of 61% males, 30% females and 13% subadults. The greater presence of males to females and adults to juveniles of these comparative sites is consistent with the Moran population.

Table 4

*Age and Sex Distribution of French Colonial Cemeteries*

Site	Males	Females	Indeterminate	Adult	Juveniles
Moran	78% (n=22)	8% (n=2)	14% (n=4)	90% (n=28)	10% (n=3)
St. Croix	100% (n=25)			100% (n=25)	
Fort Michilimackinac	53% (n=8)	26% (n=4)	6% (n=1)	86% (n=13)	13% (n=2)
St. Peter's	53% (n=14)	46% (n=12)		90% (n=23)	10% (n=6)
Quebec City	90% (n=45)	8% (n=4)		98% (n=49)	2% (n=1)

Ancestral results indicated that 35% of the population was European, with the presence of a few individuals of possible African ancestry (9%), but the majority (54%) is indeterminate. When compared to other sites (See Table 5), ancestral

composition of is not as consistent as age and sex data. For instance, St. Peter's Cemetery (Owsley and Orser, 1984:185) contains two Europeans, 13 Africans, and two people of mixed ancestry, whereas Cybulski (1988:66) reports present a population of all probable Europeans based on the presence of long narrow heads and narrow nasal apertures. Additionally, St. Croix Island (Crist, n.d.) has all Europeans, with the exception of one individual who presents Native American features such as wormian bones and shoveled incisors. Similarly, Fort Michillimackinac (Shunn, 2005:18) also consists of all Europeans with one indeterminate individual whose craniometric data indicated he/she was Native American. Compared to these French colonies, Moran fits within the expected norm, including the possible presence of diverse ancestral markers and the possibility that non-Europeans are represented.

Table 5

*Ancestral Distribution of French Colonial Cemeteries*

Site	European	African	Native American	Indeterminate	Mixed Ancestry
Moran	39% (n=11)	9% (n=2)		54% (n=15)	
St. Croix	96% (n=24)			4% (n=1)	
Fort Michilimackinac	94% (n=14)			6% (n=1)	
St. Peter's	6% (n=2)	44% (n=13)		38% (n=11)	33% (n=3)
Quebec City	100% (n=50)				

In terms of specific markers, when compared to Kieser's dental measurements of different ancestral populations, those found at Moran generally had a small robust index (Appendix B) and fell considerably outside the range of any of the comparative groups. This could be the result of poor health, which was frequent among the types of colonists that were chosen by the French to emigrate to New Biloxi as compared to the people Kieser chose for his study. Mean Measure of Divergence for the Moran population, when compared to Irish's (1997) findings for Sub-Sahara Africans (Appendix C), showed those with shoveling, interruption groove, Y-pattern, and three rooted upper second molars, were the least divergent from Sub-Sahara and individuals exhibiting these traits would more likely be from that geographic region. This would suggest that individuals with these traits would be more likely to be of African descent rather than European.

When results were compared to FORDISC there was only a 25% agreement between the program's assignment and assignment based on the other markers. If only relying on FORDISC for results, the marked discrepancy has the potential to provide an incorrect answer 75% of the time, which might be due to limited population sampling or insufficient data input. Additionally, FORDISC does not take into account secular change, or the natural variation that occurs in human bodies over generations. Therefore, the populations that are being compared to Moran will in fact present deviation because they are from a different century. Finally, other problems which might occur are a result of inaccurate field measurements. The accuracy of *in situ* osteometrics becomes compromised when points are hard to reach or impossible

to take. These inconsistencies again parallel those seen in other studies using the program (Sanders, 2002).

In conclusion, Moran represents an integrated group with males and females; juveniles and adults; and Europeans and Africans being interred in the same space. Possible interpretations of such a demographic distribution are explored in the next chapter.

## CHAPTER VII

### DISCUSSION

In this chapter, results concerning the demographic analysis of the Moran Cemetery will be discussed. Findings will be compared to those of contemporary skeletal populations and cemeteries in order to ascertain whether Moran represents a French Colonial population that adhered to the ridged social rules of the *ancien régime* purposed by Law or was a new pattern all together tailored to the colonial frontier.

#### Age and Sex Composition of the Moran Population

The demographic composition of the Moran Cemetery represents a stable colony after initial French exploration but prior to the mass influx of the Mississippi Bubble. Ages range from infant to middle adult, and most individuals are under 40 years old. Even though both sexes are present, men outnumber women 10:1. This discrepancy in age and sex, with the population consisting mostly of young adult males, fits the expectations of an early colony whose initial population members were convicts and soldiers. When compared to other early French colonies, Moran closely resembles the demography of Quebec City which dated to the mid-18th century and housed Protestant prisoners (Cybulski, 1988). However, the ratio of males to females in this case might reflect the nature of war rather than the citizens living within the city. Therefore, the next comparable population is Fort Michilimackinac which was a fortified living area for soldiers, traders and their families (Shunn, 2005). The demographics of this site are only slightly off when compared to Moran who has 18% less women than Fort Michilimackinac. However,



number of indeterminate remains at Moran is twice the amount seen at Fort Michilimackinac and could potentially represent the missing females. Even if this was not the case, it would still be a better match than St. Peter's, an established colony, has more than five times the amount of females and individuals who are of mixed ancestry. Moreover, the fact that St. Croix consists only of males and more than likely, only Europeans, also contrasts with the Moran population. Therefore, this close comparison with Fort Michilimackinac leads to the conclusion that Moran was most likely an outpost or staging area rather than a short stopover like 17th century St. Croix appears to have been or an established colony like St. Peter's in New Orleans.

#### Law and the *Ancien Régime*

Prior to John Law's exhaustive efforts to colonize, the majority of inhabitants in the region would have been military and their families due to competing European exploration by several nations, including France, Spain and England. "The settlement of Louisiana presented a continual scene of military display and hostile preparations" (de La Harpe, 1851:21), most of which took place in Mobile. The majority of these early residents would have continued to see to the progress and development of the colony, and therefore would have still been there, barring death, when large scale immigration began in 1717. His proposal mainly impacted French citizens, but was also presented to nations in central Europe, including parts of Germany. In fact, it was written that "People of all nations were allow'd to subscribe to [the Mississippi] Company" (Anonymous, 1720:3). Seemingly virtually anyone was allowed to purchase stock and invest in the Mississippi Company. As seen in

historic documents, the arriving masses would have been immigrants from a mixture of European backgrounds intended to fill the Louisiana Colony according to Law's plan. These ideals for the French Colony consisted of segregated spaces that kept different ranks separate from one another. For example, New Orleans consisted of a grid in which different segments of society were isolated from one another, including slaves who were supposed to be housed outside of the fortification around New Orleans (Dawdy, 2008).

Had colonists adhered to the *ancien régime*, then strict segregation would have been followed and the demographic composition of the Moran cemetery would consist of only one ancestral population with other groups being buried elsewhere. For instance, if those interred at Moran were European then it would explain predominantly occurring European haplogroups, generally long narrow cranial vaults, and Christian burial practices. Based on findings, it can be concluded that among sixteen individuals for whom ancestry could be determined, 11 appear to be Europeans. However, several individuals display dental morphologies, such as shoveled incisors, that are less likely to be seen in Europeans. Cybulski (1988:68) does report that 45.7% of the prisoner skeletons from mid-18th century Quebec, all whom he determined to be European, as having some trace amount of shoveling, noting that this trait is inadequate at determining ancestry. This trait had also been seen at St. Croix Island, but that individual was considered to have indeterminate ancestry.

Another trait not traditionally characteristic of Europeans but seen in several individuals at Moran is brachycephalic crania. One might argue that this could be

explained through malnutrition (Angel, 1982) in which the weight of the brain puts pressure on the occipital making the skull wider and flatter, similar to rickets in long bones. Of the sites in which cranial metrics was available, only St. Croix reported an individual with a brachycranial head in addition to shovelings, but this person was of an indeterminate ancestry. Thus, these characteristics could indicate someone who is non-European or Europeans with nontraditional markers.

The possibility of non-European traits on Europeans is also supported by Shunn (2005), who found that out of 13 individuals at Fort Michilimackinac, six were identified as Native American through craniometric and morphology analysis. However, when mtDNA analysis was conducted, 12 were determined to be European and one was indeterminate.

#### Evidence of Integration

Although it may be argued that the Moran bioarchaeological population could provide support for community adherence to the *ancien régime* favored by Law, there are at least two individuals, Burials 14 and 20, and possibly another, Burial 28, who do not appear to be Europeans. These three individuals stand out from those who have been determined to be Europeans based on cranial and dental morphology. Burials 14 and 20 exhibit shoveled incisors and Y-pattern molars. In addition, Burial 20 and 28 also display brachycranial skulls, while Burial 20 also had prognathism and a wide nasal aperture. Although Burial 20's H haplogroup is typically associated with Europeans, it is also found in high frequencies in Northwest African populations (Ennaffaa et al., 2009). Based on the presence of shared distinctive dental morphologies and other skeletal characteristics, it might even be speculated that

Burial 14 and 20 were relatives. Even though DNA haplogroups do not match between the two individuals, it does not preclude these two from being related; rather, they just did not share mothers. Since mtDNA reveals information only concerning maternal ancestry; it would not be impossible for a European male to have had children with two non-European women, this assuming that that non-European ancestry would more often than not be represented through the mother (Shunn, 2005; Spear, 2009). In fact, some Native American women were kept for sexual purposes and concubinage to the extent that moneylenders threatened to enter the debtors' house and take his concubine (DuVal, 2008).

If these individuals are indeed non-European, it would instead suggest an integrated society. One explanation for their presence could be the “relaxation of spatial restraints in colonial situations” and/or a significant change of religions and institutions in all colonial settings (Weglian, 2006:1). Intermarriage of the French with other groups occurred frequently in the New World. For example, historic records from Fort Michilimackinac indicated “10 French families, three of which had mixed ancestry” lived within the stockade (Shunn, 2006:6). In addition, “of the 62 marriages recorded in the Mackinac Register between 1698 and 1765, 48% of them were unions between Canadian men and Native American or *Metis* women, and 32% were between Canadian men and Canadian women” (Shunn, 2005:7).

The fact that a marriage of non-Europeans was being recorded by the French would indicate that Christianity was being introduced into such groups. One unknown author (1720:75) writes that “the Illinois, the Apalages, and the Chactaux, have all embrac'd the Christian Religion. The Illinois are in some Measure civiliz'd,

by the Care of the Jesuits, and the Assistance of some French Travelers. There are a great many French settled amongst them, who have built a Fort there.” If these Native Americans were Christian, then they would have been buried in a Catholic cemetery. It also might be argued that those who were African Christians might have been afforded the same treatment, especially if the African Habitation Area noted on period maps never was constructed, as some have suggested.

Early reports also note African slaves to be a large segment of colonial society. According to French (1851), it was England’s intentions to have a monopoly on slave importation to both Spanish and French colonies. The specific number of Africans in Biloxi is unknown; however, it has been determined that in 1721 a significant amount of slaves arrived in Biloxi from Africa’s west coast (Hall, 1992). Furthermore, at one point a frigate arrived in the colony with 180 Africans while another carried 340 (de la Harpe, 1718: 86). A 1732 census record from New Orleans also accounts for 247 Negro slaves, and 2 free Negroes of the 957 total population (Conrad, 1970 as cited in Owsley et al., 1987:187).

It can be speculated that a prominent African presence is what prompted de M. Bienville to compose the *Code Noir*. Among its articles, the *Code Noir* expressed strict cultural and behavioral regulations for both slave and master, a number of which conveyed religious beliefs. Articles 2-5 specifically prohibit any religion other than Roman Catholicism from being practiced by slave or master (French, 1851). These articles could explain why the cemetery at Moran contains individuals of different ancestries. As long as everyone was seen as a Roman Catholic, there would not have been any reason for colonists and slaves to be buried separately from one

another. This could also explain why Burial 14, a possible African male, was buried with a rosary. Another reason why this individual had a rosary could be related to how much money or how devoted his master was to his faith.

African Catholicism is also evident at St. Peter's Cemetery in New Orleans. It had been reported by Owsley (1987) that a number of Africans were intermingled with Europeans. Of these African individuals, Burial 11 was found with a Catholic medallion depicting Mary and St. Christopher. There is also some degree of admixture in the St. Peter burials. Of the 32 excavated, two are reported as being of White-Negro and one White-Indian. However, it is unknown how Owsley determined admixture, and based on the complexity of ancestral determination, the ancestral assignments should be approached cautiously.

Thus, examples of census records and contemporary burials show that the typical French colony was integrated. Africans and indigenous groups were a part of the colony and rather than being ostracized and excluded, were actually buried with Europeans as a group. Based on these historical data combined with osteological findings, it appears that New Biloxi was an integrated colony that had a mixed cemetery. It is unknown the reason why they were buried together, but their internment within a singular burial location might suggest either a swift death indicative of mass disease and quick burials, or a cohesive living space occupied by a religious and social hierarchy that placed Christians on equal status to one another in death, while still upholding a socioeconomic structure in life.

When compared to current research, early scientific investigations to estimate ancestry have a considerable amount of ethnocentric assumptions that makes

methods and results questionable citations. Often times an agenda was being carried out by anthropologists with the potential to skew results, a phenomenon Gould (1981:100) terms “subjectivity directed toward prior prejudice.”

These previous prejudices no longer affect research designs. A large portion of current studies in this field still use either small sample sizes or a limited amount of ancestral markers to make determinations. On the other hand, studies are also utilizing more complex and in depth methods of analysis such as isotopes and DNA as part of a more comprehensive research design strategy. Application of DNA research in particular has tremendous potential in determination of ancestry, but few bioarchaeologists have used DNA to support their ancestral determinations, partly because of the relatively costly expense and partly because of limited permission to apply destructive research methods. Therefore, cranial and dental traits often must be relied upon. More studies need to be conducted that merge the two methodologies in order to obtain an assessment on how the different approaches compare, especially considering the results of Shunn (2006) at Fort Michilimackinac in which there seemed to be some conflict.. Isotope analysis for strontium or oxygen would also prove useful in many investigations. Unfortunately it could not be used at Moran given the poor preservation of the bone as well as the multiple regions of Europe and Canada from which the immigrants might have come.

In conclusion, assessment of ancestry within the French Colonial cemetery at Moran provides an intriguing look at the social structure and religious structure of a community whose story is often unheard. The archaeological and bioarchaeological data from this site suggest a complex culture in which groups interacted with one

another on personal and multifaceted integrated levels. These results appear to conflict with the sterile segregated society John Law had planned, depicted, and hoped for as the Louisiana Colony was settled in the early 18th century.



## APPENDIX A

## AGE AND SEX DISTRIBUTION OF MORAN BURIALS

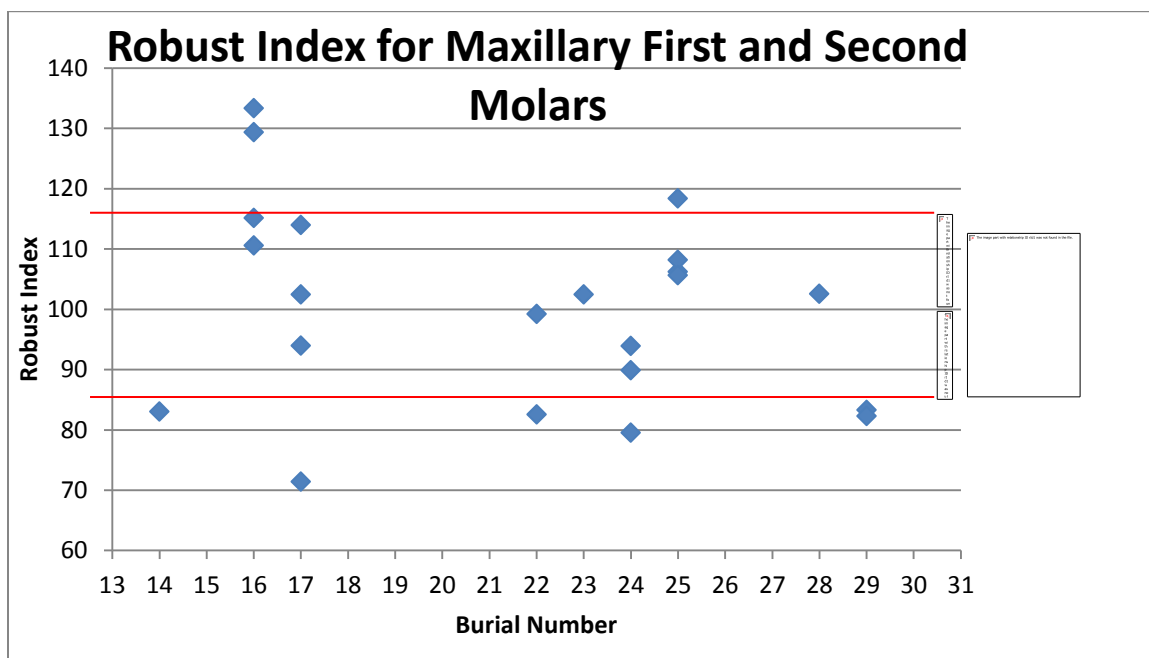
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Burial	Age	Sex
1	30-40	Male
2	20-30	Male
3	Adult	Male
4	25-35	Male
5	35-50	Male
6	25-40	Female
7	30-40	Male
8	18-23	Female
14	18-23	Male
16	15-18	Male
17	15-21	Male
18	Adult	Male
19	39-42	Male
20	17-20	Female
21	Adult	Male
22	Adult	Male
23	30-40	Male
24	Older Adult	Male
25	25-35	Male
26	>50	Male
27	Adult	Male
28	39-42	Male
29	Older Adult	Male
30	54-63	Male
31	27-31	Male

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## APPENDIX B

## ROBUST INDICES OF MORAN INDIVIDUALS



APPENDIX C  
COMPARISON OF MEAN MEASURE OF DIVERGENCE FOR MORAN  
AND SUBSAHARAN INDIVIDUALS

Trait	%	N	MMD
Shoveling U1I	23	3	-0.0656
Bushman Canine	0.08	1	0.008220205
Interruption Groove U2I	0.08	1	-0.05446979
Hypocone U2M	0.40	3	3.074151434
Carabelli's U1M	0	0	2.441918546
Hypocone U1M	0.40	4	-0.07917077
Hypoconulid L1M	0.37	3	
Hypoconulid L2M	0.77	7	1.173163291
Y-Pattern L2M	0.33	2	-0.01730655
3ROOTED U2M	0.80	8	-0.09275111
3ROOTED L2M	0.13	1	3.557785207

## APPENDIX D

## MTDNA HAPLOGROUPS SEEN AT THE MORAN SITE

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Burial	mtDNA Haplogroup
14	J
20	H
23	H
25	H
26	H
27A	J2
28	U
30	D/H

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APPENDIX E  
DATE AND MNI OF COMPARATIVE SITES

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Site	Date	MNI
St Peter's Cemetery	1725-1788	29
Fort Michilimackinac	1715-1781	15
Quebec City	1746-1747	47
St. Croix	1604-1605	25

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## APPENDIX F

## ROBUSTICITY INDEX

Group	Tooth	Position	M/D	B/L	Robust Index
TN Woodland	2M	MAX	9.95	11.2	111.44
Pecos Pueblo	2M	MAX	9.94	11.24	111.7256
TN MS	2M	MAX	9.87	11.36	112.1232
Eskimo Aleut	2M	MAX	10	11.28	112.8
TN Archaic	2M	MAX	9.61	11.8	113.398
Mexico, Saltillo	1M	MAX	10.16	11.21	113.8936
Eskimo Aleut	1M	MAX	10.37	11.21	116.2477
Mexico, Tlaxcala	1M	MAX	10.41	11.24	117.0084
TN MS	1M	MAX	10.35	11.34	117.369
Mexico, San Pablo	1M	MAX	10.34	11.4	117.876
Ohio Valley Adena	2M	MAX	9.93	11.88	117.9684
Indian Knoll	2M	MAX	10.02	11.89	119.1378
TN Archaic	1M	MAX	10.1	11.9	120.19
Ohio Valley Glacial Kame	2M	MAX	9.89	12.18	120.4602
Mexico, Cuauaian	1M	MAX	10.56	11.42	120.5952
TN Woodland	1M	MAX	10.55	11.5	121.325
Eskimo Hall Beach	2M	MAX	10.26	11.9	122.094
Ohio Valley Hopewell	2M	MAX	10.31	11.89	122.5859
Eskimo Igloodik	2M	MAX	10.4	11.8	122.72
Pecos Pueblo	1M	MAX	10.74	11.54	123.9396
Ohio Valley Adena	1M	MAX	10.57	11.93	126.1001
Eskimo Igloodik	1M	MAX	11.1	11.8	130.98
Ohio Valley Hopewell	1M	MAX	10.9	12.03	131.127
Ohio Valley Glacial Kame	1M	MAX	10.74	12.21	131.1354
Indian Knoll	1M	MAX	11.11	11.88	131.9868
Eskimo Hall Beach	1M	MAX	11.05	12	132.6
Norwegian	2M	MAX	9.34	10.96	102.3664
Anglo Saxon	1M	MAX	9.5	11	104.5
British Modern	1M	MAX	9.7	11.7	113.49
Norwegian	1M	MAX	10.23	11.24	114.9852
Lapps	2M	MAX	9.87	11.66	115.0842
Anglo Saxon	2M	MAX	9.9	11.7	115.83
Iceland	2M	MAX	10.08	11.77	118.6416
Lapps	1M	MAX	10.53	11.73	123.5169
British Modern	2M	MAX	10.2	12.4	126.48

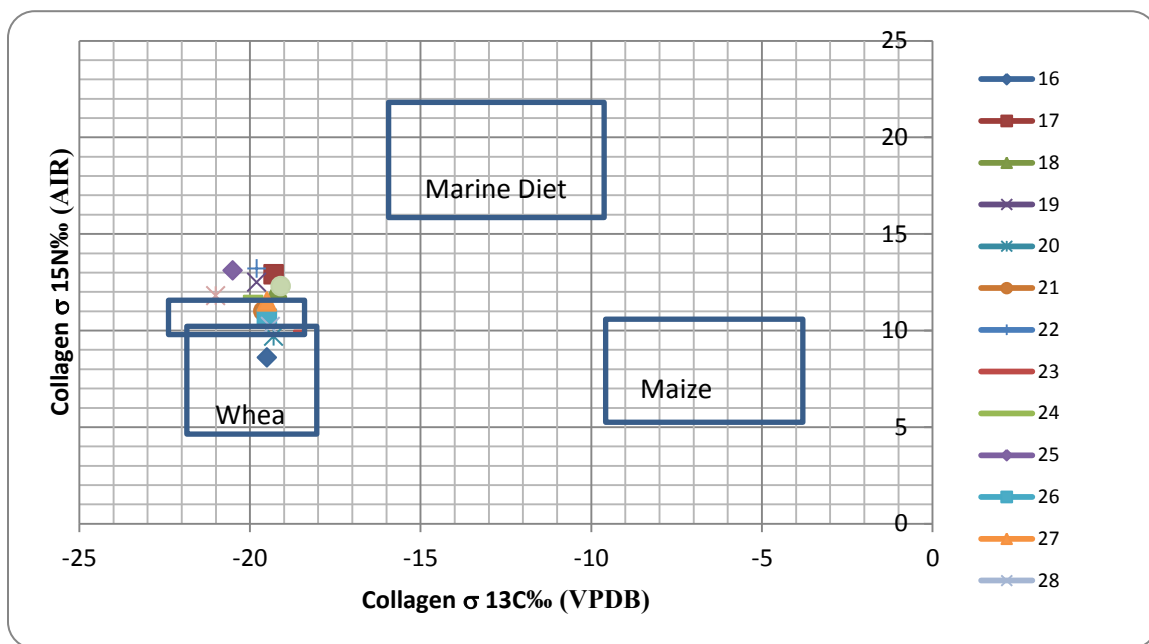
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Iceland		1M	MAX	10.98	11.92	130.8816
Moran	Bu 14	2M	MAX			83.0159
Moran	Bu 16	2M	MAX			110.5708
Moran	Bu 16	2M	MAX			115.16505
Moran	Bu 16	1M	MAX			129.3655
Moran	Bu 16	1M	MAX			133.3664
Moran	Bu 17	2M	MAX			71.4058
Moran	Bu 17	1M	MAX			93.94125
Moran	Bu 17	1M	MAX			102.4512
Moran	Bu 17	2M	MAX			113.94525
Moran	Bu 22	2M	MAX			82.555
Moran	Bu 22	1M	MAX			99.2325
Moran	Bu 23	2M	MAX			102.48
Moran	Bu 24	2M	MAX			79.5123
Moran	Bu 24	1M	MAX			89.8934
Moran	Bu 24	1M	MAX			93.916
Moran	Bu 25	2M	MAX			105.621
Moran	Bu 25	1M	MAX			106.21985
Moran	Bu 25	1M	MAX			108.21085
Moran	Bu 25	2M	MAX			118.3744
Moran	Bu 28	2M	MAX			102.579
Moran	Bu 29	2M	MAX			82.30995
Moran	Bu 29	2M	MAX			83.3199
San Bushmen		2M	MAX	9.7	10.1	97.97
San Bushmen		1M	MAX	9.9	10.2	100.98
Negro W.African		2M	MAX	9.78	10.37	101.4186
Nubian Intensive Agricult		2M	MAX	9.73	10.44	101.5812
San Bushmen		2M	MAX	9.9	10.3	101.97
Nubian Agricult		2M	MAX	9.79	10.64	104.1656
San Kalahari Nomadic		2M	MAX	10.22	10.43	106.5946
Negro S. African		2M	MAX	10.32	10.59	109.2888
Nubian Intensive Agricult		1M	MAX	10.42	10.68	111.2856
San Bushmen		1M	MAX	10.7	10.5	112.35
San Kalahari Settlers		1M	MAX	10.95	10.27	112.4565
Negro W.African		1M	MAX	10.63	10.58	112.4654
San Kalahari Settlers		2M	MAX	10.51	10.77	113.1927
San Kalahari Nomadic		1M	MAX	10.78	10.52	113.4056
Nubian Agricult		1M	MAX	10.49	10.82	113.5018
Negro S. African		1M	MAX	10.64	10.74	114.2736
Nubian Mesolithic		2M	MAX	10.59	11.43	121.0437
Nubian Mesolithic		1M	MAX	11.08	11.75	130.19

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## APPENDIX G

CARBON AND NITROGEN VALUES FOR THE MORAN POPULATION.





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