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Head shaping of the ancient Maya at Wild Cane Cay and Moho Cay, Belize

Kellye Alyse French
Louisiana State University and Agricultural and Mechanical College, kfrench@crt.state.la.us

HEAD SHAPING OF THE ANCIENT MAYA AT WILD CANE CAY AND MOHO CAY, BELIZE

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Abstract

As a sign of beauty or status, the ancient Maya shaped the skulls of their infants, resulting in what modern researchers see as several forms of cranial modification. My project consists of the study of cranial modification of the coastal Maya from two trading ports, including an Early Classic (A.D. 300-600) sample Moho Cay, Belize, and a Postclassic (A.D. 900-1300) sample from Wild Cane Cay, Belize. Using the classification set forth by Dembo and Imbelloni, I calculate the type of cranial modification found at each site. I then create gender, temporal, and spatial distributions and compare the results to other established cranial modification distributions for the Maya area.

Chapter 1: Introduction

The skeletal remains of an individual tell a story. By doing an osteological analysis of the remains, not only can the sex and age at death be estimated, but also the health of the individuals while they were living. Disease and physical labor leave marks on the bone. Scientific testing, such as DNA and isotope analysis, can tell us the genetic make-up of the individuals and what types of foods they most often ate. Long bones are measured to estimate the height of the individual. Large samples of skeletal material from similar provenience can provide population estimates and life expectancy of a population. Health status of the population as a whole can be used to answer questions about the collapse of a society. In some cases, cultural practices are evident in the skeletal remains. In the case of the Maya, there are two distinct cultural practices that physically altered the human body and are evident in the osteological record: dental decoration/modification and head shaping. This thesis will focus on the cultural practice of cranial modification and the different types of cranial modification found at two coastal sites in Belize.

The ancient Maya are often associated with the practice of cranial modification (Agrinier 1964, 1978; Coe 1959; Dingwall 1931; Feindel 1988; Fry 1956; Gann 1918; Kennedy 1983; Massey 1989; Ricketson 1937; Saul 1972, 1975; Stewart 1953, 1975; Tiesler 1999). According to Saul (1972:3), many early Maya archaeologists only noted that skulls were modified or which portion of the skull showed signs of modification. Often, the skulls that did show signs of modification were discarded as being useless. Eventually, Maya archaeologists realized that cranial modification was a culturally controlled trait with information about Maya peoples such as cultural diffusion and population movement (Saul 1972; Stewart 1953). There have been several attempts made to develop a classification system for the types of Maya cranial modification (Hrdliçka 1912; Nemann 1942; Stewart 1951). The classification system of Dembo and Imbelloni (1938) is the most frequently used by Maya archaeologists (Kennedy 1983; Romero 1970).

For my thesis research, I will examine the crania from the sites of Wild Cane Cay and Moho Cay, Belize and classify the type of modification present, if any, according to the method set forth by Dembo and Imbelloni (1938). I then create gender, temporal, and spatial distributions using my data and that from eight other sites in the Maya region. These distributions will be compared to other established cranial modification distributions for the Maya area. The two primary sites in my study and the eight other sites used in my distributions can be seen in Figure 1.

Figure 1: Map of the Maya area showing sites for spatial and temporal comparison, created by Rachel Watson and Kellye French

Chapter 2: Literature Review

Body Modification

The body is central to anthropology in that the body is the vehicle through which we present ourselves to others (Albin 2006; Ferraro 2001; Lock 1993). To this end, cultures around the world have, and still do, practice many forms of body modifications in order to transmit ideas, such as status, gender and group identity, and attractiveness (Albin 2006; Montserrat 1998). Some examples of the types of body modification practices, both ancient and modern, include foot binding, cranial modification tattooing, scarification, neck stretching, piercing, breast augmentation, rhinoplasty, and liposuction. Of these listed types of body modification, evidence of cranial modification is preserved among the ancient Maya.

Head Shaping

The ancient Maya were not the only culture to practice intentional cranial modification. Cranial modification has been seen in ancient populations across Europe, Asia, South Pacific, Caribbean, North America, Central America and South America (Blackwood and Danby 1955; Dingwall 1931; Kennedy 1983; Hoshower et al. 1995; Neumann 1942; Torres-Rouff and Yablonsky 2005). The theory behind this practice of cranial modification ranges from aesthetics to group identity to ability to carry burdens (Blackwood and Danby 1955; Dingwall 1931; Kennedy 1983; Miller 2009; Torres-Rouff and Yablonsky 2005). Evidence of cranial modification has even been found in the skulls of early humans from the Shanidar Cave in Iraq (Trinkaus 1982).

How the Maya achieved cranial modification is known from Bishop Diego de Landa. In his sixteenth century account of contact with the people of the New World, de Landa wrote that very shortly after birth the infants were “stretched out upon a sort of little bed made of reeds or strips of other material, and then the head was placed between a couple of boards, one at the back and one at the

front. These were then pressed together and fastened" (Dingwall 1931:153). However, archaeological evidence in non-Maya areas shows that the process of shaping the head took longer than reported by de Landa. Shaping apparatus have been found at some South American sites in increasing sizes suggesting "a continual refitting, as head size increased with age (White 1996: 401).

The reasons the ancient Maya practiced cranial modification have been researched by Maya archaeologists. Saul and Saul (1989:293) suggest that the practice of cranial modification began by accident with the use of cradle boarding infants by their mothers. The lambdoid area of the infant skull was flattened by being strapped to the cradleboard and perhaps the mother thought it an attractive trait, and began to intentionally modify the skulls of their children. Based on the carvings found at many ancient Maya sites, the artificially modified crania was part of the Maya idea of beauty (Thompson 1954). Another theory behind the Maya practice of head shaping is that it was done to resemble the Maize god (Houston et al. 2006). Other Maya researchers suggest that the practice of cranial modification was associated with the elite class, such as priests or nobility, while others suggest that modification was related to the individual's role in the society, but not necessarily to their social status (Chase and Chase 1992; Dingwall 1931; Gerszten and Gerszten 1995; Hammond 1999).

The type of modification practiced does seem to be status related, at least during the Classic period, with the tabular erect type appearing most often in the elite class (Tiesler 1999a, b). The Early Classic ruler from Copan, Yax K'uk Mo, was shown in iconography to have a modified skull, yet when his remains were excavated, they showed very little signs of cranial modification. Yax K'uk Mo was possibly born outside of the Maya area where cranial modification was not an important trait in the elite class, but to portray him as a true ruler, he was shown in iconography to have the shaped head of someone of his ranking. Oviedo, a Spanish chronicler, reported that he was told by a native that "our ancestors were told by the gods that if our heads were thus formed we should appear noble and handsome and better able to bear burdens" (Dingwall 1931: 155).

Site Background

Moho Cay, Belize

Moho Cay was a Classic Maya island trading port located in the mouth of the Belize River with a record of settlement extending from the Late Preclassic (400 B.C. to A.D. 250) through the Postclassic (A.D. 1200-1521) (Healy et al. 1984; McKillop 1980, 1984, 1985, 2004, 2007). This site was visited by numerous explorers and reseachers prior to excavations by McKillop in 1979 (1980, 2004) for her M.A. research at Trent University. The burials were in residential areas of the site – likely under the house floors – and were dated to the Early Classic period (McKillop 2004). The burials consisted of a minimum of twenty-two individuals with twelve adults, six subadults, and four of unknown age (Morris and McKillop 2007). This comprehensive study developed from an earlier study by Lund (2003). The data from the comprehensive study by Morris and McKillop (2007) were made available to me for my study on cranial modification.

Wild Cane Cay, Belize

Wild Cane Cay was a Classic to Postclassic Maya trading port in the mouth of the Deep River in southern Belize (McKillop 1987, 1989, 1996, 2002, 2005, 2007). Maya occupation of the site spans the Late Classic (A.D. 600 – 800) to Postclassic periods (A.D. 1200 – 1521). The skeletal material used in this thesis research is from McKillop's excavations in Postclassic coral architecture as part of her 1981 – 1992 research at the site (McKillop 1987, 2002, 2005; Morris and McKillop 2007). The burials consisted of a minimum of twenty-four individuals with nineteen adults and five subadults (Morris and McKillop 2007). The age, sex, and health status data were made available to me for my thesis research. In addition, a study of the teeth from the Wild Cane Cay burials was carried out (Seidemann and McKillop 2007).

Dembo and Imbelloni's Classification System

Dembo and Imbelloni (1938) spent much time studying cranial modification in both Mesoamerican and South American cultures. They realized that there was an abundance of classification systems available to "craniologists" (Dembo and Imbelloni 1938:251) with many of the systems relying on visual inspection that made them subjective. There were systems also suggesting classification based upon the use of a shaping device (Saul and Saul 1989); however, because the device itself rarely survived in the archaeological record, this method, too, was imperfect. The system created by Dembo and Imbelloni (1938) combined visual inspection and measurement. Dembo and Imbelloni (1938) developed a comprehensive classification of artificially modified skulls to date. In their classification system, skulls are grouped into tabular or orbicular form and then broken down into erect or oblique varieties.

Tabular Erect

Tabular implies the skull is subject to fronto-occipital compression. For the skull to then be classified as erect, the pressure must have been applied to the upper-squamous region of the occipital. Tabular erect modifications display an angle of less than 120 degrees formed by the oblique, or general, cranial axis and the Frankfort plane. The flattening produced is in such a posterior plane that the angle formed with the basion-bregma line is so acute that the two planes are almost parallel. The pressure in the tabular erect modification involves all three of the bones in the lamdoid area: the parietals and the occipital, and is applied in a "cradle position" (Comas 1960:391); (See Figure 2). Dembo and Imbelloni (1938) further describe seven variations within the tabular erect type of modification, but as they are not used in my study, they will not be discussed here.

Tabular Oblique

The oblique designation within the tabular category is used when the pressure to the crania was placed on the entire occipital area. The cranial axis forms an angle with the Frankfort plane of about

120 degrees. The flattening is tangential to the occipital protuberance. The pressure involves only the occipital bone (See Figure 3). Five variations are discussed within the tabular oblique type of modification, but as they are not used in my study, they will not be presented here.

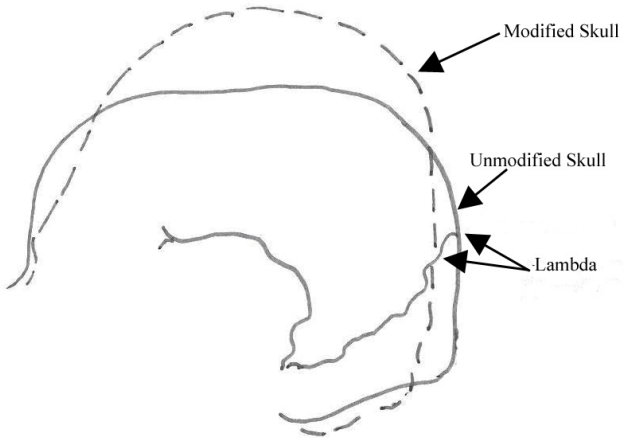

Figure 2: Sketch of lateral view of crania showing an unmodified cranium Compared to a cranium modified in the tabular erect style – Adapted from Dembo and Imbelloni (1938: 250)

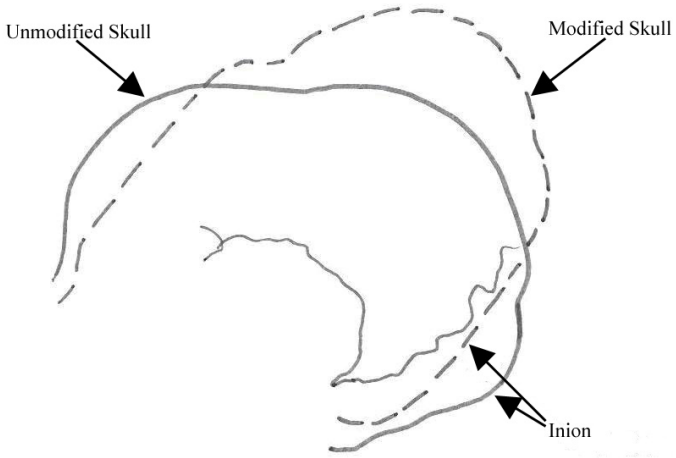

Figure 3: Sketch of lateral view of crania showing an unmodified cranium compared to a cranium modified in the tabular oblique style – Adapted from Dembo and Imbelloni (1938:250).

Orbicular

In the orbicular head shape, the cranium appears to have been shaped by elastic bands or bandages that compress the entire circumference of the crania. The normal cross-section of a skull in the orbicular category along the cranial axis is almost circular, whereas in a tabular, this same section is flattened in an antero-posterior direction. The angle formed by the Frankfort plane and the foramen magnum is almost always negative. In the tabular form, this angle may be positive or negative. In the tabular oblique form, the angle is usually positive. Skulls of the erect variety with hypsicephaly, or a high head (Bass 1995), or the obliques with platycephaly, or a broad head (Dorland's Medical Dictionary 2009) may be classified as orbicular. Therefore, four overall categories exist within Dembo and Imbelloni's (1938) classification of cranial modification: tabular erect; tabular oblique; orbicular erect; and orbicular oblique (Comas 1960). In the orbicular classification, there are only two variations of both the erect and oblique variety. One variety is the conical, in which the anterior-posterior diameter is greater than the transverse diameter and the skull takes on the shape of a cone. The second variety is cylindrical, described as the curves perpendicular to the shape's general axis are significantly circular and skull takes on a cylindrical shape.

With the exception of a recent study by Tiesler (1999 a,b), the variations within the four main types as described by Dembo and Imbelloni are not utilized in other Maya cranial modification publications and they will not be used in the classification of the skulls from Moho Cay and Wild Cane Cay for this study.

Previous Studies Involving Ancient Maya Head Shaping

As previously mentioned, modified skulls were often considered as useless, or else a notation was simply made in the inventory that the skull was deformed (Saul 1972). I have gathered the skeletal studies that thoroughly examine the modification present in the cranial remains. Not all of the skulls

were classified using any of the available methods, but the modifications present in the crania were described in depth, usually with the location of the modifying pressure being noted.

E. A. Hooten (1940) examined the remains of 42 individuals recovered from the Cenote of Sacrifice at Chichen Itza, in the central Yucatan. At the time of his publication, the remains had not been dated nor was he certain they were Maya. However, Hooten did provided a detailed account of the artificial modification present in the cranial remains. Of the 42 individuals recovered at Chichen Itza, 39 skulls were examined – 10 males, eight females, and 21 juveniles. All but four crania showed some type of modification. In his publication, Hooten (1940) found five of the juveniles showing only occipital flattening. Seven skulls show frontal flattening combined with antero-posterior flattening of the occipital region. Nine skulls show postero-vertical flattening, resulting in the post-auricular region appearing "squashed down" (Hooten 1940:273). Six skulls exhibit postero-vertical modification plus frontal flattening. Two have frontal flattening plus annular constriction in the post-coronal region. Hooten does not describe a sexually dimorphic pattern to the cranial modification, except to say that all the adult males exhibit frontal flattening, but that this frontal flattening deformation appears in only half of the females and older children.

Stewart (1951) published his findings on 19 of the 54 burials he examined from Nebaj, in western Guatemala. Stewart describes the cranial deformation present in the sample, and classified the modification in a system of his own creation. Of these 19 burials, only eight were able to be evaluated for type of modification. In the Early Classic skulls, Stewart found four incidences of pseudocircular modification, all from males. In the one Postclassic skull able to be evaluated, Stewart describes a male with fronto-vertico-occipital deformation.

Stewart (1953) examined the skeletal remains recovered from Zaculeu, in western Guatemala. Due to the poor preservation of the remains, and previous disturbances at the site, Stewart was unable to obtain a definite minimum number of individuals, but he estimates that there are at least 250

individuals in the sample. Stewart's examination concludes that the sample is 45% male, 15% female and 40% unknown. As for the ages, 75% are adult, 20% are juvenile and 5% unknown. Stewart observed that most of the skulls are modified, with pseudocircular appearing more commonly in the earlier phases of the site (Early and Late Classic) and the fronto-vertico-occipital making its first appearance in the Postclassic phase of Zaculeu.

Fry (1956) compiled a detailed description of the skeletal remain from Mayapan, Mexico. Although no attempt was made to determine the minimum number of individuals or even the sex of the individuals, Fry did describe the modified skulls from the sample. Ten skulls from Mayapan exhibit modification. Fry did not classify the modification, but listed the location of the flattening. Five skulls show occipital flattening, one skull shows right occipital flattening, one skull shows left occipital flattening, one skull exhibits lambdoid flattening and two skulls present with fronto-occipital flattening.

As part of his analysis of the remains from Altar de Sacrificios site in Guatamala, Saul (1972) looked at the cranial remains to determine the type of modification present, if any. The sample was made up of 90 individuals, including 63 adults (31 male, 21 female, and 11 of unknown sex) and 27 juveniles of unknown sex, ranging from the Preclassic through to the Postclassic period. Of the 90 individuals in the sample, only 27 skulls could be evaluated for the presence of intentional modification. Of the 27 skulls, 14 showed definite signs of modification. The Late Classic skulls in the sample include one male and five females with the tabular oblique modification and one female with tabular modification of uncertain variety. As for the Postclassic crania in the Altar de Sacrificios sample, three females exhibit the tabular oblique type of modification and two males and one female exhibit the tabular erect type.

The Late Classic remains from Lubaantun were thirty-two, only one of which was a juvenile (Saul 1975). The remains consisted of 12 males, seven females, and 13 individuals of unknown sex.

Only two individuals, both of which were male, had sufficient cranial remains to determine modification type. Saul determined that both of these remains presented the tabular erect type of modification.

In 1975, Stewart published his notes on the skeletal remains from Dzibilchaltun, located in the northwestern region of the Yucatan, Mexico. Stewart (1975) found 10 individuals with sufficient cranial material to be examined for head shaping. Stewart's front-vertico-occipital modification appears in two females and one individual of unknown sex from the Late Classic period and one male from the Terminal Classic. One male dated to the Late Classic presents with pseudocircular modification. Simple lambdoid flattening shows up in a male of the Postclassic and a male from the Terminal Classic. Two individuals in this sample have no modification present. An infant skull could not be typed for modification.

Saul and Saul (1991, 1997) examined 166 burials from the Cuello site. This sample consists of 36 juveniles and 130 adults, 85 of which were male, 26 female and 19 individuals of unknown sex. Of these remains, only 14 were able to be examined for the presence of cranial modification. The Tabular Oblique type was found in three males and one female. Tabular Erect type of modification was found in three males. Two males and one female in the sample presented with the Tabular type but uncertain variety. Unmodified skulls were present in two males and one female. For one male it could not be determined if cranial modification was present.

The cranial remains from the site of Seibal have been examined for the presence of cranial modification (Saul 1991). The Preclassic remains of Seibal exhibit a tabular erect type and a tabular oblique type, and one individual with Tabular modification of uncertain variety. Remains dated to the Classic and Postclassic at Seibal show 12 tabular oblique skulls, five tabular erect skulls and one tabular of unknown variety (Saul 1991).

Virginia Massey (1989) analyzed the remains uncovered in a skull pit from Colha, Belize. In this pit, the crania of 30 individuals, 10 juveniles and 20 adults, were excavated and dated to the Terminal Classic period. Of the adult remains, eight were determined to be male, 10 female and two of unknown sex. Of the 30 individuals, eight showed definite signs of intentional cranial modification. The tabular erect type of modification was present in three males, one female, and one juvenile, aged three to four years. One female from the site exhibited the tabular oblique modification. The type of modification could not be determined in two of the male individuals. Of the remaining 22 skulls, 10 had normal crania, 11 of the crania were of an undetermined type, and one individual had no associated crania.

In her doctoral thesis, Vera Tiesler (1999b) examined over 1500 skulls from the Maya area for evidence of cranial modification and/or dental decoration/modification. Of these 1500 skulls, 740 were investigated for cranial modification. Cranial modification was present in 594 of the skulls. In 63 of the skulls, modification was undetermined. Some 83 skulls showed no cranial modification. Of the modified skulls, 241 were male and 198 were female. The males included 167 examples of the tabular erect modification, 32 examples of the tabular oblique, and 42 tabular mimetica. The females included 121 tabular erect modifications, 29 tabular oblique and 48 tabular mimetica modifications of the crania.

Tiesler also looked at the types of modification over time. Of the 37 Preclassic skulls examined, 29 had cranial modification present, including eight tabular erects, eight tabular obliques, eight tabular mimetica, and five of unknown type. The Classic period skulls showed 110 examples of tabular erect modification, 58 tabular oblique, 55 tabular mimetica, 23 of unknown type, and 43 unmodified skulls. The 151 skulls from the Postclassic included 146 modified skulls composed of 134 tabular erect types, four tabular oblique types, four tabular mimetica types, and four skulls of unknown type.

Chapter 3: Methodology

My study of Maya head shaping is part of a collaborative project directed by my advisor, Dr. Heather McKillop. I had access to the demographic and other data for the Moho Cay and Wild Cane Cay skeletal data as well as the skeletal material (Morris and McKillop 2007). For this study on head shaping, the cranial material, including the mandible, was separated from the total collection. All juvenile remains were excluded from this study. Further reconstruction of the crania material was carried out for my study in order to take measurements. The reconstruction process employed Duco cement and a sandbox to support the mended cranial fragments.

Using the Microsoft Excel program, I created a spreadsheet to record the 34 standard cranial measurements (Buikstra and Ubelaker 1994) and the four osteometric points used for determination of cranial modification (Dembo and Imbelloni 1938) (see Appendix 1). Once the inventory was complete and the measurements were taken, this spreadsheet was used to determine which skulls were sufficient to determine type of cranial modification. Cranial measurements were taken using calibrated sliding and spreading calipers. An osteometric board and a protractor wee used for some measurements of the mandible. The measurements were recorded on a measurement form from Buikstra and Ubelaker (1994).

As only adult crania were used in this study, determining age on each individual was not necessary. As stated previously, this research is part of an ongoing project, and an age and sex assessment had already been carried out by other researchers (Morris and McKillop 2007) and I was given access to their data. However, I performed my own estimation of sex on the individuals. In all cases, my estimation agreed with that of Morris and McKillop (2007). Sex was estimated by analyzing landmarks on the skull and pelvis, when available. The landmarks of the skull are the supra-orbital ridge, mastoid process, nuchal crest, mental eminence, and supra-orbital margin. The landmarks used

on the pelvis were the greater sciatic notch, preauricular sulcus, and three areas of the pubis – presence or absence of a ventral arc, presence or absence of a subpubic concavity and the breadth of the ischiopubic ramus. In general, the sex determination followed the procedures laid out in Bass (1995) and Buikstra and Ubelaker (1994). My sex estimations also agreed with those of Morris and McKillop (2007).

Based on the inventory of cranial measurements, the skulls were narrowed down to those with the four points crucial to determining modification type in Dembo and Imbelloni's (1938) method. The skulls were placed in the Frankfurt plane in the left lateral position. A marker was placed on bregma and lambda when possible for measuring purposes. Photographs were taken of the crania showing modification, but that were too fragmentary to determine type. Photos were taken using a Polaroid i532 and then uploaded to Adobe Photoshop and printed.

As stated above, Dembo and Imbelloni's (1938) method relies on the degree of the angle formed by the oblique cranial axis and the Frankfurt plane, which throughout the remainder of this paper will be referred to as the oblique cranial angle. The oblique cranial axis was not explained by Dembo and Imbelloni (1938), nor was I able to locate the term in any anatomical text or dictionary. However, based on line drawings in Dembo and Imbelloni's work, I surmised that the oblique cranial axis was the line connecting the craniometric points lambda and opisthion. Due to the incompleteness of the reconstructions, the foramen magnum was not present on any of the four skulls that were sufficient to be typed for modification. Therefore, estimation of the location of the opisthion was necessary to determine the oblique cranial axis. This estimation of the opisthion presented a problem because the act of cranial modification not only changes the shape of the cranial vault as intended, but also may change the basilar aspect of the skull (White 1996). In order to estimate the location of opisthion, I looked at the occipital bone in the left lateral positioned photos. By using anatomical drawings of the base view of the skull I was able to estimate the location of opisthion.

Lines were drawn on the printed photos to show the location of Frankfurt plane and oblique cranial axis. A protractor was used to measure the degree of the oblique cranial angle on the photo. After recording the measurement of the angle, I performed a visual inspection of the modified skulls, with an unmodified skull for reference. I made note of the location(s) of the flattening pressure and other effects to the skull due to the modification. By combining the measurement of the oblique cranial angle and the results of my visual inspection, I made a determination of the type of modification present based on Dembo and Imbelloni's (1938) classification system.

Chapter 4: Results

There were cranial remains from 17 individuals from the Moho Cay and Wild Cane Cay burials. A complete reconstruction was not possible on any of the skulls. However, there were six skulls that were complete enough to take 34 cranial measurements, not including those of the mandible. Including the measurements from the mandible, all but two of the 17 individuals were able to be measured. A table showing the average of each measurement can be seen in Appendix 2. Many early Maya archaeologists were interested in comparing the cranial measurements from modified skulls to those of unmodified skulls to determine the effect cranial modification had on the face and cranial vault (Hooten 1940; White 1996). I was not able to take a complete set of measurements from any of the Wild Cane Cay or Moho Cay burials, and therefore, I chose not to take my research in this direction.

The remains from Moho Cay consisted of five males, two females and two adults of undetermined sex. Three of the individuals had no skulls associated with the remains. Of the six remaining individuals, two had cranial remains too fragmentary to determine if cranial modification was present. Four individuals had modification present, with two crania sufficient to be typed using Dembo and Imbelloni's (1938) method. The remainder of the adult crania from the site were excluded from this research because they could not be associated with a single individual or they were isolated remains.

The Wild Cane Cay remains are from four male, six female and five adults of undetermined sex. Seven of the crania were too fragmentary to determine if modification was present. One skull from this site was unmodified. Two individuals had no skull associated with their remains. Four individuals had modified crania, two of unknown type and two that were able to be classified using Dembo and

Imbelloni's (1938) method. There were four adults excluded from this study because they could not be associated with a single individual or they were isolated remains.

Type of Cranial Modification

Four of the skulls were found to be sufficient for classification of modification type to be determined, including two from the Moho Cay burials and two from the Wild Cane Cay burials.

Moho Cay Burial 2

I estimated Moho Cay Burial 2 (MC2) to be female. When viewed in the left lateral position, the location of the flattening pressure is difficult to determine for MC2 (see Figure 4). The right lateral view of MC 2 shows a flattening of the occipital bone in the upper-squamous area (see Figure 5). Frontal compression is present in this individual. In the posterior view, the parietals are not flared and there is a slight depression located just superior to bregma (see Figure 6). This depression is likely due to the ligatures or bands used to attach the shaping device. The oblique cranial angle of MC 2 has a measurement of 105 degrees. This angle falls within the tabular erect category with an angle less than 120 degrees. Based on the measurement of the oblique cranial angle and the visual inspection, I have classified MC2 as tabular erect.

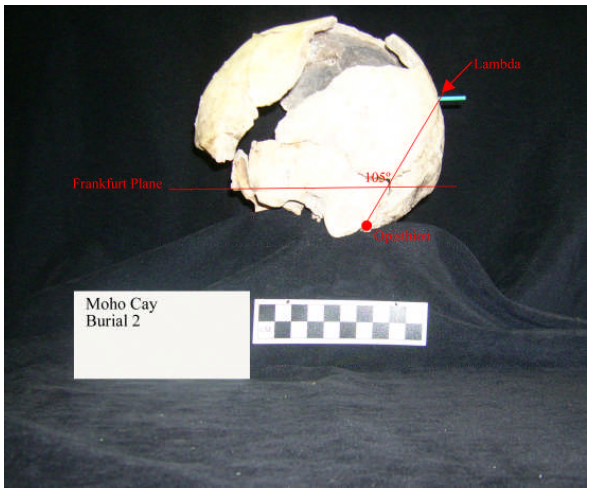

Figure 4: Moho Cay Burial 2 – Left Lateral View, with lines drawn to measure oblique cranial angle, Photo by Kellye French.

Figure 5: Moho Cay Burial 2 – Right Lateral View, Photo by Kellye French.

Figure 6: Moho Cay Burial 2 – Posterior View, Photo by Kellye French.

Moho Cay Burial 4, Individual 2

Moho Cay Burial 4, Individual 2 was estimated to be male. The visual inspection of MC4 #2, viewed in the left lateral position, shows a slight flattening in the inion area of the occipital bone (see Figure 7). When viewed in the right lateral position, the skull of MC4 #2 has a slight conical appearance, such as that associated with the orbicular form (see Figure 8). In the posterior view of MC4 #2, most of the lower occipital bone is missing, making it difficult to determine if, in fact, there is flattening of the inion (see Figure 9). The posterior view also shows no sign of flattening in the upper-squamous region of the occipital. A flattening pressure does appear to have been applied to the frontal bone. The parietal of MC4 #2 are not flared. The oblique cranial angle of MC 4 #2 presents with an angle of 119 degrees. This angle is in line with the tabular oblique designation with the degree of the angle being "about" 120 degrees. The measurement of the oblique cranial angle and the visual inspection leads me to classify this skull as tabular oblique.

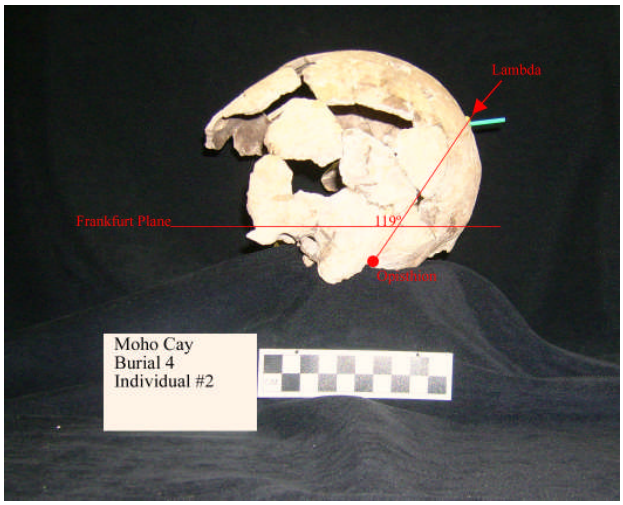

Figure 7: Moho Cay Burial 4 #2 – Left Lateral View, With Lines Drawn to Measure Oblique Cranial Angle, Photo by Kellye French.

Figure 8: Moho Cay Burial 4 #2 – Right Lateral View, Photo by Kellye French.

Figure 9: Moho Cay Burial 4 #2 – Posterior View, Photo by Kellye French.

Wild Cane Cay Burial 3

The oblique cranial angle in Wild Cane Cay burial 3 (WCC3), a male, measures 107 degrees, falling within Dembo and Imbelloni's (1938) tabular erect category of an angle measuring less than 120 degrees. However, the visual inspection of WCC3 appears to have the characteristics of the tabular oblique type of modification. The flattening pressure appears to have been placed in the inion area of the occipital bone (see Figure 10 and Figure 11). There is a depression at lambda, which could have been caused by the bands securing the shaping device, or a second location of flattening pressure. The

parietals of WCC3 are flared (See Figure 12). The presence of frontal compression is unclear in this specimen. Though there is some discrepancy between the visual inspection and the measure of the oblique cranial angle, I have classified this skull at tabular erect, due to the fact that the measure of the oblique cranial angle is a quantifiable measure and more reliable than visual cues.

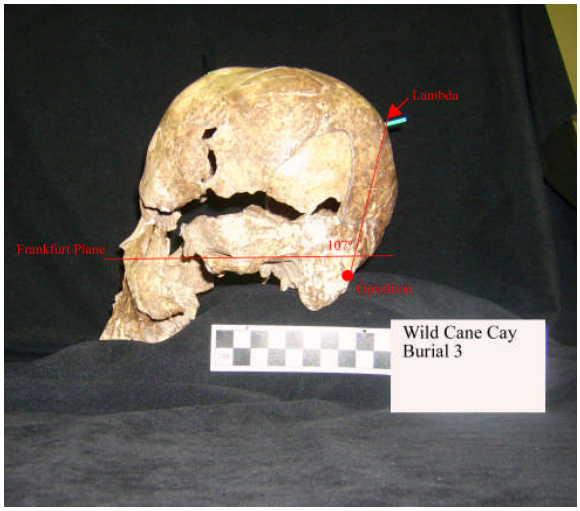

Figure 10: Wild Cane Cay Burial 3 – Left Lateral View, with lines drawn to measure oblique cranial angle, Photo by Kellye French.

Figure 11: Wild Cane Cay Burial 3 – Right Lateral View, Photo by Kellye French.

Figure 12: Wild Cane Cay Burial 3 – Posterior View, Photo by Kellye French.

Wild Cane Cay Burial 4

I estimated the sex of Wild Cane Cay Burial 4 (WCC 4) to be male. The skull of WCC4 had flattening pressure applied in the upper-squamous region of the occipital. The skull exhibits no frontal flattening (see Figure 13 and Figure 14). Viewed from the posterior, the parietals are flared slightly and a sulcus can be seen between the parietal bones (see Figure 15). This sulcus is likely due the bands attaching the shaping apparatus. The oblique cranial angle in WCC4 measures 106 degrees. Due to the angle measurement and the visual inspection, I have classified WCC4 as being tabular erect.

Figure 13: Wild Cane Cay Burial 4 – Left Lateral View, with lines drawn to measure oblique cranial angle, Photo by Kellye French.

Figure 14: Wild Cane Cay Burial 4 – Right Lateral View, Photo by Kellye French.

Figure 15: Wild Cane Cay Burial 4 – Posterior View, photo by Kellye French.

To summarize, I was able to classify four crania according to Dembo and Imbelloni's method. From the Classic site of Moho Cay, one female presented with Tabular Erect modification and one male presented with Tabular Oblique. The Postclassic Wild Cane Cay burials also had two individuals with crania sufficient for classification, both male and both presenting with the Tabular Erect type.

Chapter 5: Discussion

Temporal Distribution

Head shaping in the Maya has been noted since the Preclassic (Agrinier 1964, 1978; Coe 1959; Dingwall 1931; Feindel 1988; Fry 1956; Gann 1918; Kennedy 1983; Massey 1989; Ricketson 1937; Saul 1972, 1975; Stewart 1953, 1975; Tiesler 1999). Part of my research is to determine if the pattern of cranial modification found at Moho Cay and Wild Cane Cay are consistent with the temporal distribution of cranial modification types as noted by other Maya archaeologists.

Classic

The site of Nebaj had four skulls classified as pseudocircular, all of which were male (Stewart 1951). The pseudocircular classification is part of the system created by Stewart (1953) to type the modified skulls he recorded in the Maya area, and also includes the fronto-vertico-occipital type. The pseudocircular type and the fronto-vertico-occipital type coincide with Dembo and Imbelloni's (1938) tabular oblique and tabular erect, respectively (Saul 1972). At Zaculeu, while exact numbers are not known, Stewart reports that the pseudocircular (tabular erect) type appears most commonly in the Classic phases of this site (Stewart 1953). At Altar de Sacrificios, Saul recorded six instances of tabular oblique modification, one male and five females, and three instances of the tabular erect type, all of which were male (Saul 1972). Of the two individuals able to be typed at Lubaantun, two males were determined to present with tabular erect modification (Saul 1997). Dzibilchaltun had four skulls presenting with fronto-vertico-occipital (tabular erect), two females, one male, and one individual of unknown sex (Stewart 1975). The skull pit from Colha produced five skulls that could be accurately typed: one female presenting with tabular oblique and one female and three males with tabular erect (Massey 1989). The Moho Cay sample produced one female with the tabular erect type and one male with the tabular oblique type of modification.

Table 1 summarizes the modified crania found at the Classic period sites discussed above. In the Classic period, I show six males and six females exhibiting the tabular oblique type of modification. The tabular erect type is found in nine males, four females and one individual of unknown sex.

Table 1: Classic Period Cranial Modification Type.

	Tabular Oblique			Tabular Erect		
	Male	**Female**	**Unknown**	**Male**	**Female**	**Unknown**
Nebaj[1]	4					
Altar de Sacrificios[2]	1	5		3		
Lubaantun[3]				2		
Dzibilchaltun[4]				1	2	1
Colha[5]		1		3	1	
Moho Cay[6]	1				1	
Total	**6**	**6**		**9**	**4**	**1**

In Table 2, I compared the type of cranial modification from the above sites by gender to determine if there was a preference. I found that six male exhibit with tabular oblique and nine males exhibit with tabular erect. The females show six instances of the tabular oblique and four of the tabular erect type of modification.

Table 2: Comparison of Cranial Modification by Sex for Classic Period Crania.

	Tabular Oblique	Tabular Erect	Total
Male	6	9	15
Female	6	4	10
Total	**12**	**13**	**25**

[1] Stewart, 1951
[2] Saul, 1972
[3] Saul, 1975
[4] Stewart, 1975
[5] Massey, 1989
[6] This study

Postclassic

Nebaj had one male with the fronto-vertico-occipital modification (tabular erect) (Stewart 1951). Tabular erect modification was found in two males and one female at Altar de Sacrificios. Also at Altar, three females presented with tabular oblique modification (Saul 1972). Wild Cane Cay had two males exhibiting the tabular erect modification.

Table 3 summarizes the modified crania found at the Postclassic period sites discussed above. I show no males and three females exhibiting the tabular oblique type while five males and one female show the tabular erect type of modification.

Table 3: Postclassic Cranial Modification Types.

	Tabular Oblique			Tabular Erect		
	Male	**Female**	**Unknown**	**Male**	**Female**	**Unknown**
Nebaj[7]				1		
Altar de Sacrificios[8]		3		2	1	
Wild Cane Cay[9]				2		
Total	**0**	**3**		**5**	**1**	

In Table 4, I compared the type of cranial modification from the above sites by sex to determine if there was a gender preference. The males of the Postclassic exhibit no instances of the tabular oblique modification and five instances of the tabular erect modification. The females show three examples of the tabular oblique modification and only one example of the tabular oblique.

Table 4: Comparison of Cranial Modification by Sex for Postclassic Period Crania.

	Tabular Oblique	Tabular Erect	Total
Male	0	5	5
Female	3	1	4
Total	**3**	**6**	**9**

[7] Stewart, 1951
[8] Saul, 1972
[9] This study

T.D. Stewart (1975) gave an overview of modification found in the Maya region, in which he acknowledged that there was a spatial and temporal pattern to the distribution of types of cranial modification found. The tabular oblique type, according to Stewart, was found predominantly in the Late Classic and Postclassic periods. Stewart (1953) also noted that the pseudocircular type of modification (tabular oblique) appears most often in the Early and Late Classic phases of the site and the fronto-vertico-occipital type (tabular erect) does not appear until the Postclassic phase at Zaculeu. Saul (1975) found that the tabular oblique variety was dominant in the Late Classic and that tabular erect was dominant in the Postclassic. Saul (1972) also discusses the appearance of tabular oblique type in both males and females in the Late Classic, but by the Postclassic, tabular oblique is found only in females, with tabular erect showing up only in the male population. The modified skulls from Moho Cay and Wild Cane Cay both fall within this previously established pattern.

My findings indicate that both tabular erect and tabular oblique types of modification were equally practiced by the Maya in the Classic period. However, in the Postclassic, the tabular erect type appears at a rate of two to one compared with the tabular oblique type. I found 12 examples of the tabular oblique and 14 examples of the tabular erect type of modification in the Classic period. In the Postclassic period, I found three examples of tabular oblique and six examples of tabular erect modification. A summary of the temporal comparison of cranial modification type can be seen in Table 5.

Specifically, at the Classic period Moho Cay, the two crania that were able to be typed for modification exhibited one tabular erect and one tabular oblique. The Postclassic Wild Cane Cay sample, also with two skulls able to be typed, displayed the tabular erect type of modification in both skulls. The tabular oblique type of modification is present only in the female sample from the Postclassic period (see Table 4), consistent with the pattern noted by Saul (1972).

Table 5: Temporal Comparison of Cranial Modification Type.

	Tabular Oblique	Tabular Erect	Total
Classic	12	14	26
Postclassic	3	6	9
Total	**15**	**18**	**35**

Spatial Distribution

After looking at the temporal distribution of head shaping in the Maya area, I began to question whether there was a pattern in the spatial distribution of cranial modification. Little research has been done in this area. In fact, I was able to locate one other study that looked at the spatial distribution of Maya cranial modification (Tiesler 1999). Stewart (1975) gave an overview of cranial modification types in the Maya area and included a brief paragraph of the differences of modification types found in the southern and northern Maya Lowlands. I chose to look at the distribution of cranial modification in the inland and coastal areas rather than the traditional northern and southern Maya Lowlands and the southern Maya Highlands.

Coastal

Dzibilchaltun had one recorded case of tabular oblique but four cases of tabular erect modification (Stewart 1975). Lubaantun shows two examples of tabular erect and none in the tabular oblique category (Saul 1975). Colha presents with one tabular oblique variety and four of the tabular erect type (Massey 1989). Table 6 summarizes the modified crania found at the coastal sites discussed above. I found the tabular oblique type of modification in 3 individuals and the tabular erect type of modification in 13 individuals.

Table 6: Cranial Modification Types by Region (Coastal).

	Tabular Oblique	Tabular Erect	Totals
Dzibilchaltun[10]	1	4	5
Lubaantun[11]	0	2	2
Colha[12]	1	4	5
Moho Cay[13]	1	1	2
Wild Cane Cay[14]		2	2
Totals	**3**	**13**	**16**

Inland

At the site of Nebaj, Stewart recorded four examples of the tabular oblique and one tabular erect modification (1975). Altar de Sacrificios shows nine examples of tabular oblique modification and six skulls shaped in the tabular erect fashion (Saul 1972). The Cuello remains show four examples of tabular oblique modification and three examples of the tabular erect type (Massey 1989). Finally, Seibal presents with thirteen examples of the tabular oblique and six examples of the tabular erect type of modification (Saul 1991). Table 6 summarizes the modified crania found at the inland sites discussed above. I found that the inland sites exhibited 30 examples of the tabular oblique type of modification while only showing 16 examples of the tabular erect type.

Table 7: Cranial Modification Types by Region (Inland).

	Tabular Oblique	Tabular Erect	Totals
Nebaj[15]	**4**	**1**	**5**
Altar de Sacrificios[16]	**9**	**6**	**15**
Cuello[17]	**4**	**3**	**7**
Seibal[18]	**13**	**6**	**19**
Totals	**30**	**16**	**46**

[10] Stewart, 1975
[11] Saul, 1975
[12] Massey, 1989
[13] This study
[14] This study
[15] Stewart, 1951
[16] Saul, 1972
[17] Saul and Saul, 1991
[18] Saul and Saul, 1991

Based on the breakdown of modification types between coastal and inland areas, my study indicates that the inland areas show a preference for the tabular oblique type of modification and the coastal Maya preferred the tabular erect type of modification. The findings at the coastal sites of Wild Cane Cay and Moho Cay agree with this as three of the four skulls able to be typed for modification presented with the tabular erect type. The coastal sites exhibit 13 samples of the tabular erect type of modification and three samples of the tabular oblique type. The inland sites show 16 examples of the tabular erect type, but 30 examples of the tabular oblique type of modification. Table 8 shows the spatial comparison of modification types.

Table 8: Spatial Comparison of Cranial Modification Type.

	Tabular Oblique	Tabular Erect	Totals
Coastal Sites	3	13	16
Inland Sites	30	16	46
Totals	**33**	**19**	**62**

Few studies have been done on the spatial distribution of cranial modification type. Stewart (1975) considered the traditional Maya areas of the Northern lowlands, Southern Lowlands and then the areas to the west and south of the Lowlands, when looking for spatial patterns in cranial modification types. Therefore his findings cannot be directly compared to those of my study. Stewart did note that the tabular oblique type of modification was concentrated in the western side of the Lowlands, but not the eastern side. This is consistent with my findings that the tabular oblique type of modification dominated in the inland region, which corresponds with Stewart's western Lowlands.

In her 1999 Ph.D. dissertation, in a project similar in scope, but larger in scale than the current study, Vera Tiesler examined over 1500 skulls for evidence of both cranial and dental modification. Because her study includes many of the sites I have used for comparative purposes, I found comparing Tiesler's results to my own to be difficult. Tiesler recorded 110 examples of the tabular erect type and

58 examples of the tabular oblique type of modification in the Classic Period. In the Postclassic period, the sample shows 134 examples of tabular erect modification and only four of the tabular oblique type, showing a marked decline in the latter type. This fits with my findings, especially in the Wild Cane Cay population, where no examples of the tabular oblique type were found. The Moho Cay and Wild Cane Cay support this trend also.

Tiesler also compared the types of cranial modification found in the Maya area by region; however, she compared them by present day Mexican states and included Guatemala and Honduras (Tiesler 1999a and 1999b). Because I chose to only separate the Maya regions into coastal and inland, comparison of Tiesler's findings can only be made to the Classic and Postclassic period and associated cranial modification. Tiesler did note that there were regional differences in the type of cranial modification practiced by the Maya. She found that the tabular oblique variety was preferred in the Lower Usumacinta area, whereas the tabular erect type of modification seemed to dominate in the Highlands. However, the Lower Usumacinta is in an area that could be considered to be inland, therefore, my finding of tabular oblique modification being preferred in the inland areas is consistent with Tiesler's (1999b) statement that tabular oblique was preferred in the lower Usumacinta River area. The Maya Highlands, however, include areas that I considered to be both coastal and inland, so my results cannot be compared with Tiesler's.

The results of my comparisons show that patterns are present for both temporal and spatial distributions in the ancient Maya populations. The patterns established in my study are consistent with the patterns in head shaping established by other Maya archaeologists.

I compared the percentages of head shaping at sites in order to estimate the incidence of this practice (see Table 9). The sites used by Tiesler (1999) include all of the sites used in my study for comparative purposes. Because of this duplication of data, I felt that any direct comparisons between Tiesler's study and my own would create inaccurate data. I did, however, include the percentages of

the presence/absence of cranial modification from Tiesler's (1999b) study as a separate entry in Table 9. This table shows that anywhere from 49% to 80% of the crania recovered from Maya sites are artificially modified.

Table 9: Summary of Presence/Absence of Cranial Modification.

	Modified	No Modification	Unknown	Total
Chichen Itza[19]	35	4	0	39
Nebaj[20]	5	3	0	8
Zaculeu[21]	0	0	0	0
Mayapan[22]	10	0	0	10
Altar de Sacrificios[23]	14	13	0	27
Lubaantun[24]	2	0	30	32
Dzibilchaltun[25]	5	4	1	10
Cuello[26]	10	3	1	14
Seibal[27]	17	8	22	47
Colha[28]	8	10	11	29
Moho Cay[29]	4	0	2	6
Wild Cane Cay[30]	4	1	7	12
Total	**114**	**46**	**74**	**234**
Percentage	**49%**	**20%**	**31%**	
Tiesler's Study[31]	**594**	**83**	**63**	**740**
Percentage	**80%**	**11%**	**9%**	

[19] Hooten, 1940
[20] Stewart, 1951
[21] Stewart, 1953
[22] Fry, 1956
[23] Saul, 1972
[24] Saul, 1975
[25] Stewart, 1975
[26] Saul and Saul, 1991
[27] Saul and Saul, 1991
[28] Massey, 1989
[29] This study
[30] This study
[31] Tiesler, 1999b

Chapter 6: Conclusion

The Maya have been practicing cranial modification since the Preclassic period and the results of this study show that the Maya from Moho Cay and Wild Cane Cay are no different. The incidence of head shaping varies from 49% in my study to 80% in Tiesler's (1999b) study. Clearly cranial modification in the Maya is an area of Maya osteology that could benefit from further study.

While Dembo and Imbelloni's (1938) method is still currently used today by Maya archaeologists, the system is not without its problems. The poor preservation of skeletal material in the Maya region is the biggest hindrance (Saul 1972). Because most of the cranial remains are fragmentary and must be reconstructed, usually not completely, the measurement of the angle formed by the Frankfurt plane and the oblique cranial axis will more often than not be inaccurate. The visual inspection of the cranial modification is, of course, subjective, and two researchers may come to differing conclusions on the same specimen. Basically, as Tiesler noted, "there are big inter-observer errors involved in this type of research" (personal communication, September 10, 2009). I found this to be the case when my visual inspection would have led me to classify the modification one way, but the measurement of the oblique cranial angle caused me to classify the modification differently.

Another possible area of future research is why the preference for type of cranial modification changed over time. Stewart posits that the change in type of deformation towards the end of the Classic Period in Mesoamerica is suggestive of a major disturbance in both culture and population (1975). Stewart also points out that outside of the Maya area, site specific cranial modification type generally does not vary. The fact that modification varies so greatly within each site suggests several things: 1) population movement within the Maya themselves, or 2) extended contact with outside cultures (Stewart 1975). One study suggests that the Maya used cranial modification as an identity marker, especially in the sites situated near the border with a non-Maya people, explaining the

preference for one type of cranial modification over another (Hyde and Shifrer 2007). There is to date, no definitive explanation of why the distribution of cranial modification changes over time. Further research could help shed light on this cultural marker and direct future research.

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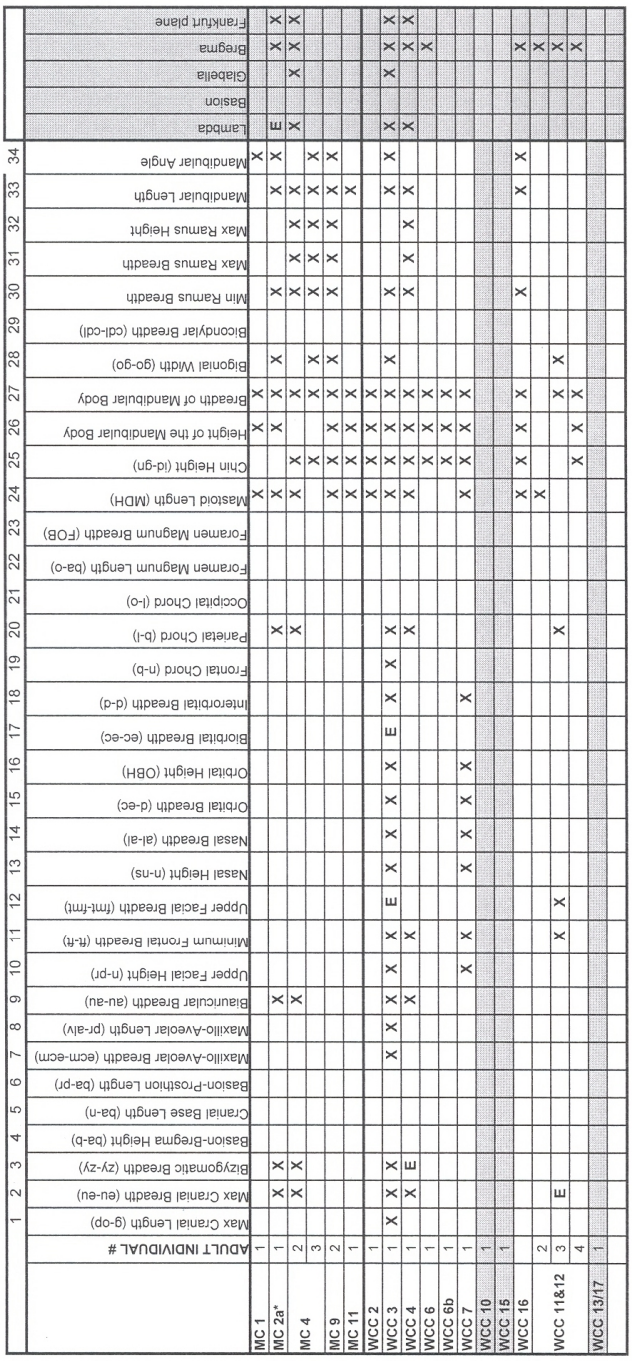
Appendix I
Inventory of Cranial Measurements Taken.



	ADULT INDIVIDUAL #	Max Cranial Length (g-op)	Max Cranial Breadth (eu-eu)	Bizygomatic Breadth (zy-zy)	Basion-Bregma Height (ba-b)	Cranial Base Length (ba-n)	Basion-Prosthion Length (ba-pr)	Maxillo-Alveolar Breadth (ecm-ecm)	Maxillo-Alveolar Length (pr-alv)	Biauricular Breadth (au-au)	Upper Facial Height (n-pr)	Minimum Frontal Breadth (ft-ft)	Upper Facial Breadth (fmt-fmt)	Nasal Height (n-ns)	Nasal Breadth (al-al)	Orbital Breadth (d-ec)	Orbital Height (OBH)	Biorbital Breadth (ec-ec)	Interorbital Breadth (d-d)	Frontal Chord (n-b)	Parietal Chord (b-l)	Occipital Chord (l-o)	Foramen Magnum Length (ba-o)	Foramen Magnum Breadth (FOB)	Mastoid Length (MDH)	Chin Height (id-gn)	Height of the Mandibular Body	Breadth of Mandibular Body	Bigonial Width (go-go)	Bicondylar Breadth (cdl-cdl)	Min Ramus Breadth	Max Ramus Breadth	Max Ramus Height	Mandibular Length	Mandibular Angle	Lambda	Basion	Glabella	Bregma	Frankfurt plane
MC 1	1																								X	X	X	X	X						X				
MC 2a*	1		X	X						X											X				X	X	X	X	X	X	X	X	X	X	E	X	X	X	
MC 4	2		X	X						X											X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	3																																						
MC 9	2																								X	X	X	X	X	X	X	X	X	X	X	X	X	X	
MC 11	1																								X	X	X	X	X	X	X	X	X	X					
WCC 2	1		X	X	X				X	X	X		E	X	X	X	X	E	X	X	X				X	X	X	X	X	X				X	X	X	X	X	
WCC 3	1	X	X	X				X		X	X	X	E	X	X	X	X								X	X	X	X	X	X				X	X	X	X	X	
WCC 4	1		X	E						X		X									X				X	X	X	X	X	X				X	X	X	X	X	
WCC 6	1																								X	X	X	X	X	X									
WCC 6b	1										X						X								X	X	X	X	X	X									
WCC 7	1											X		X	X	X	X		X	X					X	X	X	X	X	X									
WCC 10	1										X	X		X	X	X	X																						
WCC 15	1																																						
WCC 16																									X	X	X	X	X	X				X	X	X	X	X	
WCC 11&12	2											X	X									X			X														
	3			E																																		
	4																																						
WCC 13/17	1																									X	X	X	X	X									

* Skull distorted - measurements may not be accurate
E = Due to missing fragments, measurements may be estimated

Appendix II
Average of Cranial Measurements.

Cranial Measurements	Averages
Max Cranial Length (g-op)	165
Max Cranial Breadth (eu-eu)	155
Bizygomatic Breadth (zy-zy)	131.9
Basion-Bregma Height (ba-b)	
Cranial Base Length (ba-n)	
Basion-Prosthion Length (ba-pr)	
Maxillo-Aveolar Breadth (ecm-ecm)	67
Maxillo-Aveolar Length (pr-alv)	55
Biauricular Breadth (au-au)	103
Upper Facial Height (n-pr)	71
Minimum Frontal Breadth (ft-ft)	98
Upper Facial Breadth (fmt-fmt)	103
Nasal Height (n-ns)	52
Nasal Breadth (al-al)	25.5
Orbital Breadth (d-ec)	38.5
Orbital Height (OBH)	35
Biorbital Breadth (ec-ec)	91
Interorbital Breadth (d-d)	26
Frontal Chord (n-b)	96
Parietal Chord (b-l)	107
Occipital Chord (l-o)	
Foramen Magnum Length (ba-o)	
Foramen Magnum Breadth (FOB)	
Mastoid Length (MDH)	26
Chin Height (id-gn)	30.72
Height of the Mandibular Body	30.79
Breadth of Mandibular Body	13.1
Bigonial Width (go-go)	99
Bicondylar Breadth (cdl-cdl)	124
Min Ramus Breadth	33.13
Max Ramus Breadth	42
Max Ramus Height	62.5
Mandibular Length	84
Mandibular Angle (Degreees)	121

Vita

Kellye French began her studies in the field of accounting at the University of Louisiana at Monroe. After a brief break of her college studies, she decided to explore the field of anthropology. She ended up at Louisiana State University earning a bachelor's degree in anthropology. She felt such a connection with the field that she decided to take her studies further and began her pursuit of a Master of Arts in anthropology. Kellye presented a poster on her thesis research at the Annual Conference of the American Anthropological Association in Washington, D.C. in 2007. She is currently employed by the State of Louisiana in the Division of Archaeology and hopes to have a long career in the field of cultural resources.