Kristina Killgrove. DEFINING RELATIONSHIPS BETWEEN NATIVE AMERICAN GROUPS: A BIODISTANCE STUDY OF THE NORTH CAROLINA COASTAL PLAIN. (Under the direction of Dr. Dale L. Hutchinson) Department of Anthropology, March 2002.

Analysis of morphological variation in human crania and dentition is the most commonly used tool for assessing biological relationships among groups of people based on skeletal remains. These relationships are often termed "biological distance" or "biodistance." The biodistance between two populations can be significant based on clearly distinct cranial and dental traits, indicating that the two populations did not have a high degree of interbreeding or cultural interaction or that their genetic ancestries were markedly different. An insignificant biodistance factor, on the other hand, can indicate that two populations had similar genetic make-up in regard to their skeletal remains and thus were likely closely related.

Around the time of European contact with the New World, ethnohistoric accounts state that Native Americans living along the North Carolina coastal plain were split into three groups based on differing languages. Archaeologists have used this information, as well as typology of ossuary sites and material culture, to classify these cultural groups. Skeletal data from 12 sites in North Carolina and two sites in Virginia comprise the archaeological component of this analysis. Comparative archaeological populations from Georgia and Tennessee, as well as a modern Caucasian sample, are examined as well.

Statistical analysis of cranial nonmetric variants from the Algonkian, Iroquoian, and Siouan language groups shows no clear differences among the groups examined. However, most sample populations examined suffer from small sample size and lack of continuity of the skeletal data. Although the data do not unequivocally support divergence among populations on the North Carolina coastal plain during the Late Woodland, they do aid in interpretation of the Hollowell (31CO5) site as culturally affiliated with the Iroquoian group.

DEFINING RELATIONSHIPS BETWEEN NATIVE AMERICAN GROUPS: A BIODISTANCE STUDY OF THE NORTH CAROLINA COASTAL PLAIN

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For my father,
who encouraged me
despite the distance.

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List of Abbreviations

31BR5	Sans Souci
31BR7	Jordan's Landing
31BW67	McFayden
31CK9	Baum
31CK22	West
31CO5	Hollowell
31CR14	Piggot
31CR86	Garbacon Creek
31CR218	Broad Reach
31MG3	Town Creek
31NH28	Cold Morning/New Hanover
31ON305	Flynt
31ON309	Camp Lejeune/Jarretts Point
44HA65	Abbyville
44SN22	Hand
MMD	Mean Measure of Divergence (C.A.B. Smith, 1972)
MNI	Minimum Number of Individuals
NMNH	National Museum of Natural History (Washington, D.C.)
SCdG-SM	Santa Catalina de Guale de Santa Maria (Griffin, 1993)
TC	Terry Collection

Chapter I - Introduction

Population Studies

The bioarchaeological approach in physical anthropology tends to focus on populations of people, rather than specifically on the individual, which is more an aspect of forensic anthropology. Population studies were not always the norm, however. Previous and even more recent analyses of human remains tended to be descriptive and focused on anomalies or case studies, especially in regard to palaeopathology (Larsen, 1997). Also, many large skeletal series have only been excavated in the past few decades, which precluded prior analysis of skeletal material.

Examining populations allows the bioarchaeologist to answer questions regarding patterns of behavior, lifestyle, and disease, as series of skeletons can inform on both intra- and inter-population variability in a way that single individuals cannot (Larsen, 1997). Populational thinking is important to biological anthropology in that it recognizes all levels of biological difference and incorporates ranges of variation (Ubelaker, 1989). No individual is likely to exhibit the full range of traits present in a population. Thus, a study of 100 individuals from a cemetery will provide more accurate documentation of intra-population variation in the living community, from which further studies of inter-population variation can be performed.

The most important aspect of population studies in bioarchaeology for the purposes of this paper is biological distance. Biodistance is the measure of relatedness or divergence between two populations (inter-population) or subgroups within populations (intra-population) on the basis of statistical analysis of genetically-linked trait manifestation. This theory assumes *a priori* that populations that share more traits are closer in ancestry than those that share fewer traits. Complete background theory on biodistance is presented in Chapter II.

Larsen (1997:304) outlines three major areas of inquiry on which biodistance can inform: 1) issues related to evolutionary history; 2) archaeological and biohistorical issues; and 3) skeletal and dental variability. The first area includes such aspects as gene flow and the influence of geography on population trait expression. The second area includes questions that arise from the differences perceived between cultural and biological changes in the past and can also help identify population boundaries, residence patterns, kin groupings, and miscegenation in a population (Larsen, 1997; Ubelaker, 1989). Finally, the third area can inform on access to nutrition, adoption of subsistence strategies, and social stratification. The major goal of this research is under the second area of the biodistance rubric outlined above: resolving archaeological and ethnohistoric issues in North Carolina through use of biological distance data.

The primary problem with current population history based on archaeological remains in North Carolina is that studies of population variation have been subsumed to studies that further the cultural-history model of prehistoric North Carolina. The current model of the coastal plain, based primarily on David Phelps' (1983) research in this area of the state, was informed through ethnohistory and material culture. As an important goal of archaeology in general is to construct cultural chronologies, archaeologists cannot be faulted for attempting classification of sites. However, as will be shown in this study, using skeletal remains from archaeological sites to lend credence to the model without first performing bioarchaeological analysis of those remains is naïve at best. Lack of population studies in this area of the state has led archaeologists to view material culture as intimately linked to ethnohistoric records of specific Native American groups, and further linked to skeletal populations themselves. There are obviously problems with treating historic information and prehistoric populations as directly correlated, especially when examining skeletal remains and material culture that are up to 800 years older than the earliest historical documents. Considerable changes occur in populations in such a span of time, including intermarriage, trade, and warfare, all of which can affect the ability to neatly categorize cultures based on material and skeletal remains. There are further problems in attempting to correlate visual appearances of skeletal remains and material culture, as the size and shape of one individual's cranium does not dictate his placement in a cultural framework, only in a morphological one.

This study will address problems with relying solely on archaeological and ethnohistoric information in identifying and classifying prehistoric populations in North Carolina. The overall goal of this work is to provide a synthesis of populations on the North Carolina coastal plain during the Late Woodland period based on all available osteological evidence, thereby aiding archaeologists and ethnohistorians in assessing population relationships immediately prior to European contact.

The North Carolina Coastal Plain

The North Carolina coastal plain occupies the eastern third of the state. A brief synopsis of the terrain is given by Christian Feest in *North Carolina Algonquians* (1978:271):

> The North Carolina coastal plain has an almost flat surface with many lakes, extensive swamps, and sand dunes. The coastline is deeply indented by sounds (Currituck, Albemarle, Pamlico) and tidal rivers. A chain of narrow islands and sand bars closes the sounds against the Atlantic Ocean. Predominately sandy soils are covered by coarse grasses, marsh vegetation, and evergreen forests. Climate is of the humid subtropical variety, with an annual growing season of about 250 days. Both freshwater and saltwater fish, oysters, and clams are abundant in the coastal region, which is also much frequented by local and migrant water birds and by game birds. Mammals include deer, fox, squirrel, opossum, rabbit, and in former days also bear and puma.

It is against this backdrop that the people of prehistoric North Carolina lived and died.

The People of Prehistoric North Carolina

The main cultural groups in the North Carolina northern coastal plain were the Carolina Algonkians in the Tidewater zone and the Tuscarora on the inner coastal plain; they belonged to the Algonkian and Iroquoian language families, respectively (Phelps, 1983:36; Boyce, 1978). The southern coastal plain was inhabited by the Waccamaw, who were part of the Siouan language group. Boundaries for these groups were originally based on ethnohistoric information; recent archaeological investigations into material culture have partially confirmed these delineations (Phelps, 1983:16, 36). After AD 800, many of the archaeological assemblages of the Late Woodland period in the northern coastal region can be related to ethnohistoric (primarily linguistic) information; however, the southern coastal region is less well-known (Phelps, 1983:36,47).

Two phases were established to describe the northern coastal plain. The Late Woodland phase of the Carolina Algonkians is called Colington, and the phase of the Tuscarora, Meherrin, and Nottoway in the interior is called Cashie (Phelps, 1983:36). The territory of the Colington phase and thus the Carolina Algonkians extended from southeastern Virginia to the northern Tidewater zone of North Carolina (Figure 1). The Carolina Algonkians were the southernmost of the Algonkian-speaking tribes along the East Coast (Feest, 1978). Boundaries drawn from ethnohistoric sources are relatively coordinated with the archaeologically discovered ones (Phelps, 1983:36-43). Colington phase social structure involved small, organized chiefdoms and a relatively dispersed settlement pattern (Ward and Davis, 1999:211; Feest, 1978). Algonkian ossuaries are usually situated near the edge of a village, include a large number of individuals, and involve a paucity of grave artifacts (Loftfield, 1990:116; Ward and Davis, 1999:216).

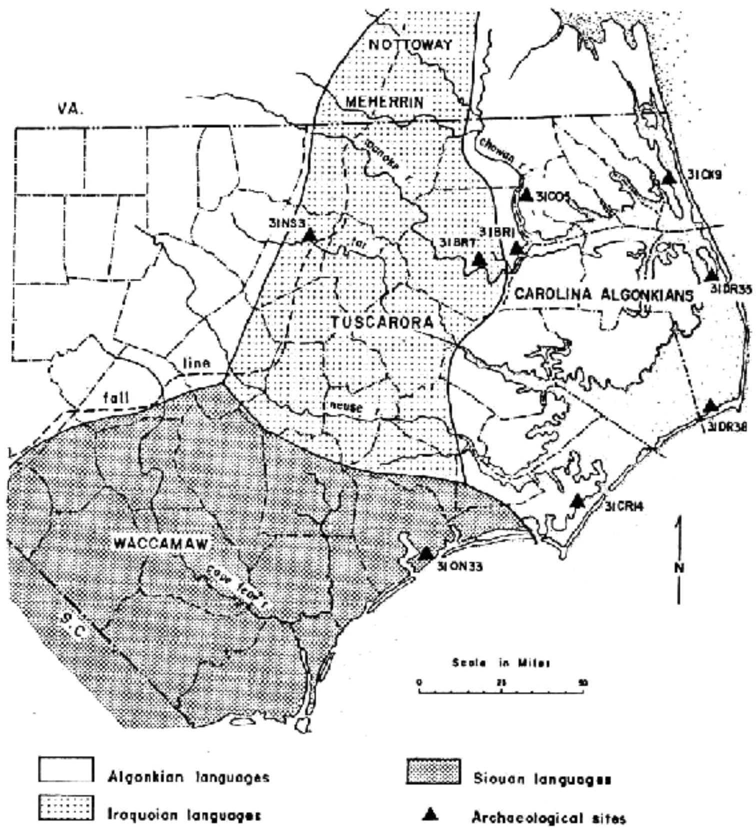

Figure 1: Map of North Carolina Coastal Plain (Phelps, 1983:Figure 1.8.)

The Iroquoian-speaking Tuscarora, Meherrin, and Nottoway lay to the west of the Algonkians and to the north of the Siouan speakers (Ward and Davis, 1999:224). Phelps suggests that the Algonkian and Iroquoian groups are closely related in culture and possibly originated from the same protoculture (1983:47); there is evidence of borrowing of words between the languages (Goddard, 1978), and pebble-tempered ware indicative of the Iroquoian culture has been found in Algonkian associations (Phelps, 1983:37). The territory of the Tuscarora extended from slightly south of the Neuse River to the Roanoke River in North Carolina; the Meherrin and Nottoway occupied area from the Roanoke River north to Virginia (Figure 1). Iroquoian groups were organized into small villages within a larger tribal society and included a dispersed settlement pattern and seasonal villages (Boyce, 1978). Cashie burials involve deposition of two to five individuals in secondary burial; that is, flesh was removed from the bodies before the bones were bundled and deposited; they are often located within village boundaries; and marginella shells are typically found as grave goods (Loftfield, 1990:116; Phelps, 1983:43-7; Ward and Davis, 1999:225).

While the Colington and Cashie phases are presumed to be from the same proto-culture, the southern coastal plain is thought to have been Siouan territory at least since the beginning of the Woodland period and has been called the White Oak phase (Phelps, 1983:47-9). This phase extended from the Neuse River south to Cape Fear and is best known for shell-tempered ceramics and a marine-based diet (Ward and Davis, 1999:217). Burials in this phase are also ossuary in nature. They consist of low sand burial mounds or ridges located far from the village, the bones show some evidence of burning, and there is a lack of contextual artifacts (Loftfield, 1990:118; Phelps, 1983:35; Ward and Davis, 1999:217). In some areas, the White Oak and Colington phases overlap; thus, it is unclear how far south the Algonkian language group extended or how far north the Siouan speakers flourished (Ward and Davis, 1999:222).

Linguistic Groups

Algonkian

The southernmost Algonkian-speaking Native Americans along the East Coast of North America are the North Carolina Algonkian tribes (Feest, 1978:271). The western boundary of these groups was ever-moving, often inhabited by the Iroquoian-speaking natives throughout the years; as such, the Algonkians and Iroquoians (specifically the Tuscarora) were often at war (Feest, 1978:271,273). Even individual tribal boundaries are difficult to determine, as allied groups were often counted as one tribe by Europeans, and some groups are classified as Algonkian based on characteristics other than language, such as association with known Algonkian groups (Feest, 1978:271,272).

North Carolina Algonkians have the dubious distinction of being the first to have prolonged contact with early European settlers (Feest, 1978:281). Many aspects of Algonkian culture were recorded in detail by such Europeans as Thomas Hariot, in his book *A Briefe and True Report of the New Found Land of Virginia* (1590).

An early estimate of the native population in this area is 7,000 or more by 1585 (Feest, 1978:272). Although the Algonkians were often at war with the Iroquoians, they did trade for stones and copper (Feest, 1978:273). Other food-procurement activities the Algonkians were engaged in include fishing, corn cultivation, hunting with bow and arrow, and gathering of nuts, berries, and roots (Feest, 1978:273). Material culture included fabric-impressed or simple-stamped globular pots, shell

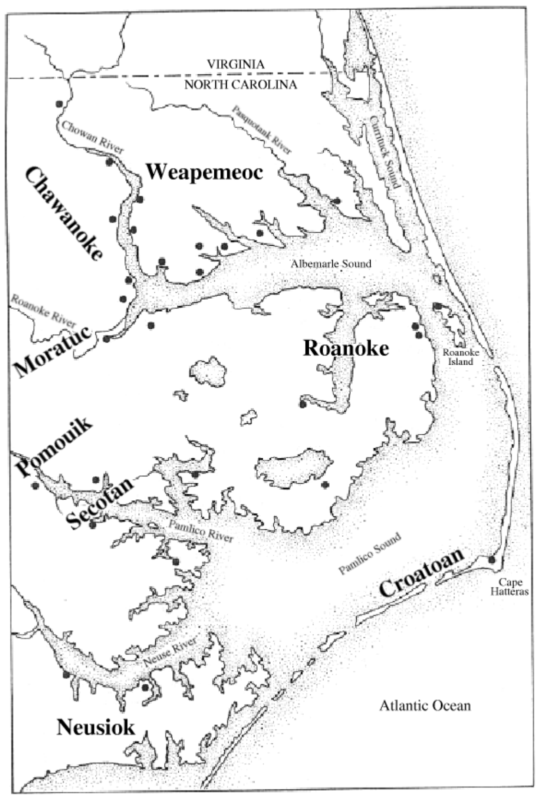

Figure 2: Map of Algonkian-Speaking Tribes in the 16th Century (Feest, 1978:Figure 1a.)

scrapers and knives, curved bows and arrowheads, dugout canoes, clay tobacco pipes, as well as deerskin skirts and moccasins for clothing (Feest, 1978:275-7). Ten to thirty houses (with an average household size of ten individuals) grouped around a central plaza often made up the Algonkian village; sometimes the village was scattered among corn fields, and some villages were surrounded by wooden fences (Feest, 1978:276-

7). Anywhere from one to almost twenty villages could make up one tribe (Feest, 1978:277). Construction of longhouses is key in defining Algonkian culture during the Late Woodland time period (Ward and Davis, 1999).

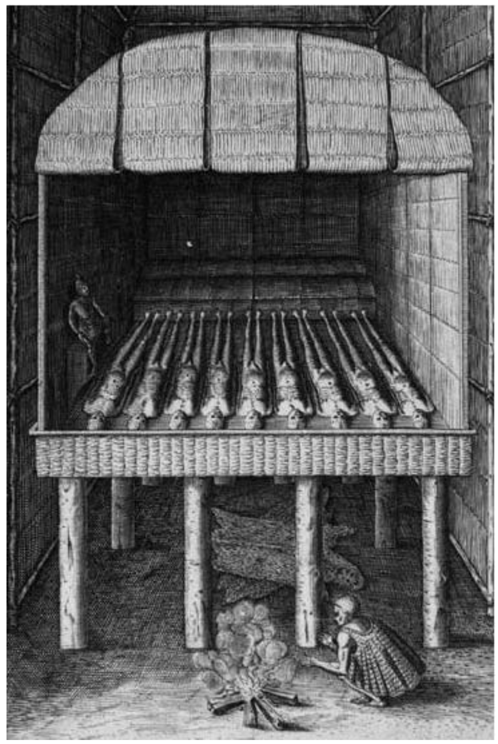

Figure 3: *The Tombe of their Werowans or Cheiff Lordes* (Engraving by Theodore de Bry from a drawing by John White of a Coastal Algonkian Charnel House - 1585; from the University of Virginia Special Collections Archive)

Social stratification among the Algonkians was most pronounced in clothing and in funeral rites. The chief and his family were allowed to wear special ornaments by which other members of the group could distinguish them (Feest, 1978:278). Special status allowed a member to attend political councils and engage in trade monopolies (Feest, 1978:278). Similarly, funeral rites were specialized for those higher on the social ladder. Some temples were reserved as interment sites for dead *werowances* (also called *weroans*), the Algonkian term for someone of high social standing (Feest, 1978:278). Offerings in these ceremonies included tobacco, which was thrown into the fire while a special prayer was uttered (Feest, 1978:278). Even the bodies of *werowances* were treated differently: they were skinned, cleaned, and stuffed to resemble a corpse, then placed on a wooden scaffold within the temple (Figure 3) (Feest, 1978:279). For the lower-ranking people, a simple funeral consisting of interment in graves about three feet deep was the norm (Feest, 1978:279). Algonkians also buried corpses in ossuaries, a practice which reached its peak during the Late Woodland period (Ward and Davis, 1999).

Iroquoian

Iroquoian-speaking groups in the pre-contact United States extended from the northeast coast south to North Carolina. Archaeological evidence places the Iroquoian groups on the coastal plain by AD 800 (Phelps, 1983). By AD 1600, Iroquoian groups had fully established themselves in central North Carolina and along the coastal plain, and Lawson (1967) first creates an Iroquoian word list in 1709. In southern Virginia, the tribes present were the Nottoway and the Meherrin, and in North Carolina lived the Tuscarora. The Tuscarora were the largest and most well-established of the Iroquoian-speaking groups in North Carolina, based on ethnolinguistic accounts (Boyce, 1978). The Nottoway language was recorded in the 1800s, but little other evidence of Nottoway culture exists. Meherrin association with the Iroquoian-speaking tribes is partially substantiated by political alliances they forged with the Nottoway and Tuscarora (Boyce, 1978). Two other groups, the Coree and the Neusiok, are sometimes purported to be Iroquoian, but there is little evidence to support this classification (Boyce, 1978).

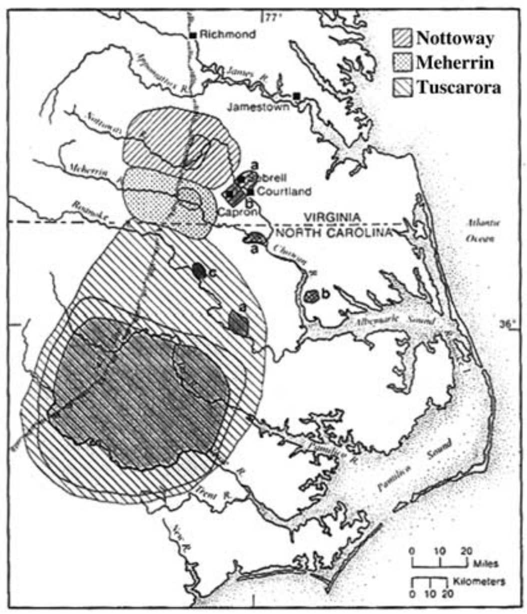

Figure 4: Distribution of Tuscarora in the 17th Century (Boyce, 1978:282)

The territory of the Iroquoians in Virginia and North Carolina included some of the piedmont region and areas of the coastal plain (Figure 4). In Virginia, the Meherrin and Nottoway Rivers flow through this area, and in North Carolina flow the Neuse, Tar, and Roanoke. Land in this area was sandy and well irrigated, as a result of which agriculture was easily sustainable (Boyce, 1978). In the late 17th century, historic accounts of Tuscarora settlements reported them to be plantationlike, with few houses clustered together and approximately a quarter mile between the clusters (Barnwell, 1908). In 1711, a captive of the Tuscarora reported that the village was palisaded, but this is most likely anomalous (Boyce, 1978).

The Meherrin probably belonged to the Iroquoian language group, based on their close political alliance with their Nottoway neighbors (Swanton, 1952). They first appear in historical records as *Maharineck* in 1650. Several decades later, the Meherrin incorporated some Conestoga Indians. The Meherrin lived along the Virginia-North Carolina border near the river that still bears their name until 1802, when they went north with other Tuscarora groups. In 1600, it is estimated that the Meherrin numbered 700 (Mooney, 1928). Nottoway, meaning "adders" in the Algonkian language, were another Iroquoian-speaking people. They lived along an eponymous river in Virginia and kept close ties to the Meherrin, possibly including some Meherrin in their numbers, which in 1600 totalled approximately 1,500 (Mooney, 1928). The name Tuscarora comes from an Iroquoian word meaning "hemp gatherers," as these people made prodigious use of the plant *Apocynum cannabinum* (Swanton, 1952). Many Tuscarora lived along the Roanoke, Tar, Pamlico, and Neuse Rivers in North Carolina. While the nature and time of their split from the Iroquois tribes of New York are not known, the Virginia and North Carolina Tuscarora were historically noted for having large numbers of people and for waging the two Tuscarora Wars in 1711 and 1713 (Swanton, 1952). In 1600, it is estimated that the Tuscarora in this area numbered over 5,000 (Mooney, 1928).

Although the Meherrin, Nottoway, and Tuscarora show similarities in language and material culture, they were not necessarily always allies. Boyce (1975) postulated that each Tuscarora village was governed autonomously based on examination of written historical literature from the early 18th century. Villages did form alliances, causing European colonists to believe these groups were more closely linked than they actually were; however, the alliances only stayed together while there was a common goal (Boyce, 1978). Among the Iroquoian villages in this area were chiefs, called *teethha* by the Tuscarora and *teerheer* by the Nottoway, the political nature of whose roles is unclear (Boyce, 1978).

The Virginia and North Carolina Iroquoians were horticulturists, but also relied on hunting and gathering (Boyce, 1978). Hunting quarters were rectangular shelters located close together, different from the normal housing structures which had an oval floor plan and were typically scattered in fields (Boyce, 1978). Corn was the most important crop, at least by the time Europeans came to North Carolina, and other foodstuffs that were grown included fruits, potatoes, gourds, squash, and beans (Boyce, 1978). For the most part, men concentrated on hunting and growing corn, while women cooked and made clothing and other crafts for the family (Boyce, 1978).

One of the most detailed descriptions of a Tuscarora burial ritual comes from John Lawson, the British Surveyor-General of North Carolina, in the first decade of the 1700s (Lawson, 1967). One day after death, the burial took place, in which the body was wrapped in reeds. A short ritual surrounding this involved food and a speech from a shaman about the finer qualities of the decedent. Mourning was drawn out for hours and even days. Women's burials were not accompanied by as much grandeur as those of men, and village chiefs were often kept in a *quiocosin*, a mortuary house much like that of the coastal Algonkians (q.v. Figure 3).

Around 1720, the Nottoway had begun to live on reservations. By 1824, Virginia had allowed the Nottoway to purchase tracts of reservation land. Many Nottoway intermarried with free Blacks, and this, along with a purported taste for alcohol and disdain for labor, led Whites to hate the Nottoway (Boyce, 1978). Even after incorporating other tribes to boost their numbers, many Nottoway abandoned their land in 1804, when the Tuscarora started moving back north (Binford, 1967; Boyce, 1978). The last Nottoway member was born in 1875 and died in 1963 (Boyce, 1978). As of 1761, the Meherrin were supposedly still residing in Northampton County, North Carolina, near the Roanoke River, but were probably incorporated by the Tuscarora shortly thereafter (Boyce, 1978). When relations between the Tuscarora and White settlers were strained in the 1710s, many Tuscarora fled to Virginia and South Carolina, while those remaining in North Carolina secured establishment of a reservation on the Roanoke River in Bertie County (Boyce, 1978). The Tuscarora were routinely overcharged and cheated by Whites, and internally leadership by a native who loved everything English was causing many Tuscarora to leave the reservation (Boyce, 1978). As stated, by 1804, all the Tuscarora in North Carolina had moved off the reservation, most going north to Virginia and then on to a reservation in New

York (Boyce, 1978).

Siouan

The few Siouan languages that have been documented from North Carolina are part of the Catawba language family, the Pedee branch of which most likely included the Cape Fear Indians, the Pedee, the Waccamaw, and the Winyaw (Speck, 1935). Affiliation of other tribes has been determined based on inference of political relations with the Catawba, but is complicated by probable Algonkian expansion southward into Virginia and North Carolina (Speck, 1935). In sum, information on the North Carolina and South Carolina Siouans on the coastal plain is exceedingly meager (Swanton, 1946). However, a little about housing style and burial customs of Siouan speaking peoples is known through archaeological and ethnographic sources.

Siouan housing style is described by Lawson in the early 1700s as being round wigwams, built of bark with a hole in the roof to let heat from the fire escape (Swanton, 1946; Lawson, 1967). The wigwams are erected using wooden poles, about the thickness of a man's leg. The thick ends of the pole are placed in the ground, while the tops are bent and bound together to form a roof (Swanton, 1946). Each wigwam generally contained one family, but others contained four or five related families (Catesby, 1731). However, in the area of the North Carolina coastal plain, there is an obvious transition between typical Siouan and typical Algonkian house styles (Swanton, 1946).

There is an early 1526 account by Oviedo (in South, 1972) about Siouan burial customs. He tells us that some people were buried in mortuary houses containing numerous bones on coastal islands, but that some were afforded burial in temples by themselves (South, 1972).

In the early 1700s, John Lawson recorded the burial custom of the Santee, a lowland Carolina Siouan tribe, and it reads very much like his account of that of the Tuscarora. The deceased is placed on a scaffold supported by nine stakes over a mound of earth. The body is anointed, and then the family places gourds, bow and arrows, or other possessions around the scaffolding. The body was covered with bark, and subsequently the flesh was removed and the bones cleaned (South, 1972). They then join the bones together and dispose of them in a *quiozogon* or ossuary (Lawson, 1967).

Later burial practices among the Siouan were described by J.A. Holmes (in Sprunt, 1916), who narrates an account of the sand burial mounds of the Cape Fear Indians in 1883:

> They are usually low, rarely rising to more than three feet above the surrounding surface, with circular bases, varying in diameter from 15 to 40 feet; and they contain little more than the bones of human (presumably Indian) skeletons, arranged in no special order. They have been generally built on somewhat elevated, dry, sandy places, out of a soil similar to that by which they are surrounded. No evidence of an excavation below the general surface has yet been observed. In the process of burial, the bones or bodies seem to have been laid on the surface, or above, and covered up with soil taken from the vicinity of the mound. In every case that has come under my own observation charcoal has been found at the bottom of the mound (Sprunt, 1916:19).

On the North Carolina coastal plain, the Siouan groups present were most likely the Cape Fear Indians and the Waccamaw. No tribal name is known for the Cape Fear Indians, who lived along the river bearing the same name, but early references clearly associate them with Siouan tribes and they may have been part of the Waccamaw (Swanton, 1952). In 1600, Mooney (1928) estimates the population of Cape Fear Indians at 1,000. The Waccamaw language has not been preserved, but presumably it is a dialect of the Catawba language. This tribe inhabited the Waccamaw River and the lower Pee Dee. Originally recorded by Francisco of Chicora in the 1500s as *Guacaya*, the Waccamaw likely eventually united with the Catawba or Croatan Indians of North Carolina. In 1600, it is estimated that there were 900 Waccamaw living in North Carolina (Mooney, 1928).

North Carolina Bioarchaeology

Until recently, the coastal plain had been the least examined area of the state of North Carolina (Phelps, 1983). Over the last several decades, the coastal region has received more archaeological attention than any other portion of the state; however, it is still the least understood area (Ward and Davis, 1999:225). Reasons for this lack of information are threefold: first, the coastal area is the most changing environment in the state; second, this region is most threatened by commercial development; and third, most archaeological research has been salvage in nature as sites erode from beaches or are bulldozed for development (Ward and Davis, 1999:226). Nonetheless, in recent years, archaeologists have made great strides toward establishing cultural chronologies, identifying cultural variability, and comprehending subsistence strategies (Ward and Davis, 1999:226).

It is toward the end of determining the extent of cultural variability of the North Carolina coastal plain that this study is being undertaken. In previous research, Late Woodland ossuary populations on the coastal plain had been classified into one of three groups (Algonkian, Iroquoian, Siouan) by archaeologists based on variation of ossuary features, "robusticity" of the bones interred therein, and the aforementioned linguistic divisions (Loftfield, 1990; Phelps, 1980, 1983; Ward and Davis, 1999).

Phelps (1983) created the Colington and Cashie archaeological phases along the North Carolina coastal plain in response to a need for an archaeological model. Based primarily on ceramics and ethnohistoric boundaries, this model has been extended to incorporate physical remains. Ward and Davis (1999:210) sum up the Late Woodland cultural-history model in saying, "Physical, cultural, and linguistic differences emerged that can be traced to the ethnohistorically documented tribes who occupied the coast at the time of European contact." This statement, however, is overly optimistic, especially with regard to the physical remains. Phelps (1983) perceived differences in ceramics along the coastal plain such that he felt division into Colington and Cashie phases was warranted. In looking at historic records, he found evidence of tribal boundaries distinguishing the far eastern coastal plain from the more inland people. He also discovered that, within these geographical limits, different languages were spoken–one Algonkian in nature and one Iroquoian. It is more likely that material culture and language changed very little between the beginning of the Late Woodland and European contact than it is that there were no physical differences in these people. However, Phelps (ibid.) did not perform an analysis of the physical remains themselves before including them in his model.

Thus, in archaeological fashion, in order to validate a model created by analysis of prehistoric ceramic variability and ethnohistoric records, human remains were treated as identical to ceramics in terms of identification of variability. North Carolina archaeology literature is full of statements such as “robust Algonkian” (Loftfield, 1990) and “gracile Siouan” (Coe et al., 1982). Phelps (1984:15) believes that the “physical type” of the Carolina Algonkians can be “accurately reconstruct[ed]” based on the well-preserved skeletal remains from the Baum (31CK9) site. However, these assessments were performed without examining intra-population variation first. For example, in Coe et al. (1982), one skull from Cold Morning (31NH28) is placed next to a cranium from a “known” Algonkian site on the coast. Figure 5 clearly shows that the Algonkian cranium (on the right) is significantly larger in its maximum height than the one from Cold Morning (on the left). However, this difference cannot be interpreted as being physically significant when inter-sex and intra-population variations have not been examined, and when so many variables that affect skeletal morphology, such as health, diet, disease, and climate, are unknown.

The three group culture-history model created by North Carolina archaeologists

Figure 5: Side-by-side Skull Comparison; left to right: Cold Morning male, Town Creek (31MG3) female, Onslow County male (Coe et al., 1982:Plate 15)

is not flawed in that no differences exist among peoples of the coastal plain, it is flawed in its assumption that categorization of physical remains is possible based on morphological variation alone, without regard to underlying biology. Ethnohistoric accounts cannot provide an accurate picture of population dynamics or geography because of the length of time between when archaeological deposition was accomplished and when Europeans were cataloguing Native activities. Because it is all we have to work with in this region, however, it becomes necessary to use both historic documents and archaeological remains to recreate Native American life in the Late Woodland. Particularly, the current model fails when attempting to classify so-called border sites such as Hollowell (31CO5). Other ossuary sites have a mixture of Siouan, Algonkian, and/or Iroquoian traits, with cultural classification being made based on the preponderance of the evidence. These sites are often referred to as having some kind of "acculturation" process developing (e.g., Mathis, 1993; Truesdell, 1995).

As no cross-cultural morphological or craniometric studies have been done to determine what constitutes "robust" or "gracile," it is short-sighted to classify peoples who lived 1,000 years ago based on poorly-defined terms. To answer this problem, two biological distance studies are being performed–the current project and one undertaken by Ann Kakaliouras at the University of North Carolina at Chapel Hill. As outlined at the beginning of this chapter, biological distance studies are useful in examining population relationships using skeletal remains. It is hoped that, in light of these population studies, the current role of ossuary sites in the archaeological model will be reevaluated, leading to further understanding of border sites and of cultural variation on the coastal plain.

Therefore, Hypotheses 1 and 2 of this study deal with associations among cultural groups and archaeological populations. Hypothesis 1 is that cultural groups which have been delineated by archaeologists on the North Carolina coastal plain during the Late Woodland time period–Algonkian, Iroquoian, and Siouan–show little or no difference in terms of nonmetric trait expression, which reveals underlying genetic correlations. Hypothesis 2 is that individual archaeological populations on the North Carolina and Virginia coastal plains during the Late Woodland show little or no difference in terms of nonmetric trait expression. Hypothesis 3 is that affiliation of so-called border sites, sites that have not been typed by archaeologists due to a mixture of typological traits, can be explicated using statistical assessments such as the mean measure of divergence and cluster analysis. This hypothesis is further covered in detail below. Finally, Hypothesis 4 is that marriage and residence patterns can be discovered based on nonmetric trait data using the mean measure of divergence statistic. This hypothesis is also explicated in more detail below.

Other Goals of Research

Border Sites and Questionable Affiliation

Several sites on the North Carolina coastal plain cannot be neatly delineated based on linguistic or material culture, including Hollowell (31CO5), Piggot (31CR14), Jarretts Point (31ON309), Garbacon Creek (31CR86), and Broad Reach (31CR218). Simply put, the above-referenced sites do not fit the prevailing archaeological model. While the latter four sites can be assigned to a cultural group based on the preponderance of archaeological and ethnohistoric evidence, the question of Hollowell's affiliation has been debated for many years. Only Hollowell was specifically examined as a border site in this research, but problems with affiliation of the other four sites are briefly outlined below.

Archaeological background of the Piggot (31CR14) site, as well as analysis of the skeletal remains, was interpreted by Truesdell (1995) as possibly indicating acculturation of the Siouans to northern Algonkian influence. Mark Mathis, a North Carolina archaeologist whose research area includes the central and northern coastal plain, feels that, based on the radiocarbon date and ceramic evidence, Piggot is indicative of a late stage of Algonkian presence in the southern part of the coastal plain (personal communication, 2002). The Jarretts Point (31ON309) ossuary was located away from the village on a sandy knoll, which is usually indicative of Siouan cultures. However, examination of the physical remains led State Archaeologist Steve Claggett (1998) to determine the people were either Algonkian or Iroquoian. Based on burial form and distribution of the burials, though, Mark Mathis (personal communication, 2002) thinks this site was most likely occupied by Algonkians. Garbacon Creek (31CR86) is yet another site with questionable affiliation. A small pot discovered at the site indicates Siouan material culture; however, ethnohistoric accounts and the location of the site place Garbacon Creek in Algonkian territory. Most evidence for this site, though, points to it being Algonkian (Mark Mathis, personal communication, 2002). Finally, there is some question as to the affiliation of the Broad Reach (31CR218) site. Burial practices at this site were so varied that no affiliation could be determined based on ossuary style. Ceramic evidence shows influences of both Algonkian and Siouan peoples, but the longhouses discovered on the site and the time period indicate Broad Reach was most likely Algonkian. However, Mathis (1993) feels there was likely some kind of relationship between the Algonkian and Siouan-speaking peoples at this time in North Carolina history.

Hollowell (31CO5) is the major site on the North Carolina coastal plain for which it is extremely difficult to ascribe a cultural affiliation. Both Colington and Cashie wares were discovered at the site, although Phelps (1983) believes the Cashie artifacts were received in trade with Tuscarora. Although the Hollowell ossuary form was characteristic of a Colington ossuary, the arrangement of the skeletons therein was not (Phelps, 1983). In fact, the Hollowell ossuary, located on the traditional border between Algonkian- and Iroquoian-speaking groups, was very much unlike any other discovered in eastern North Carolina.

Based on analysis of biological affinities between the skeletal remains from the Hollowell site and the Algonkian and Iroquoian groups in general, particular study of the skeletal remains from this site will help determine whether the people were more closely affiliated with either of these groups or if there is significant intermixing of biological groups. For this study, only Hollowell will be singled out as a so-called culturally unaffiliated site. Although questions exist about the affiliation of Piggot, Jarretts Point, Garbacon Creek, and Broad Reach, for the most part the lack of clarity in their cultural affiliation probably represents an increase in trade among the groups–a sharing of material culture but not necessarily the sharing of the same gene pool.

The importance of examining border sites rests with the idea that populations can be placed into the current North Carolina archaeological model at all. Should Hollowell and other sites prove to have no clear affiliation to any cultural group based on genetically-linked skeletal traits, it should be the current model that is reassessed.

Residence Patterns

Osteological data obtained through nonmetric analysis of skeletal traits has been used in determining residence and marriage patterns (e.g. Kennedy, 1981; Lane and Sublett, 1972). Hunter-gatherer groups are ideally suited to this kind of analysis, as marriage patterns reflect kinship ties and thus lead to biological affinities among people (Kennedy, 1981). This method, however, has been applied to Native American groups in order to determine social units (Lane and Sublett, 1972:186). It is assumed in looking at residence patterns from osteological data that the cemetery or ossuary distribution reflected the settlement pattern of the population (Lane and Sublett, 1972). The central thesis behind this kind of study is that, "to the degree that any social organizational feature corresponds to the biological referents of the kinship system, osteological data can be used to elucidate that feature" (Lane and Sublett, 1972:199).

In a landmark study, Lane and Sublett (1972) examined data from Pennsylvania Iroquois groups, discovering that during the late 19th century the Iroquois practiced patrilocal residence. This finding verified the marriage and residence pattern model of the Iroquois based on ethnohistoric data. Other researchers have used this precedential study in examining residence patterns and endogamy, including Kennedy (1981), Konigsberg (1988), and Prowse and Lovell (1996), with great success.

The statistical method of examining residence patterns is much the same as the method for examining cultural affiliation. That is, instead of grouping sites on the basis of supposed cultural affiliation to see how well they fit the archaeological model, male and female individuals from one group, such as the Iroquoian-speaking populations in North Carolina, can be compared against each other using MMD and χ^2 or t-test statistics to evaluate intersex variation (Kennedy, 1981; Lane and Sublett, 1972). Results of statistical analysis of variation between the sexes are presented in Chapter IV, and conclusions about the results are presented in Chapter V.

Significance

Biodistance studies can clarify marriage and migratory patterns among groups in order to elucidate population history (Lane and Sublett, 1972). Studies of this nature can also measure the relationship between culture and biology, showing whether or not biological differences precluded cultural similarities. Specifically, these studies are beneficial to the history of North Carolina because of the gulf in cultural understanding between native populations and the Europeans who first chronicled their existence.

As noted earlier, ossuaries along the North Carolina coastal plain have been used, along with ethnohistoric linguistic divisions and archaeological characteristics such as location of the burials in relation to the living area and accompaniment of grave goods, to generate a culture-history model of North Carolina in the Late Woodland. Investigation of the actual bones has been limited to robusticity assessments, with the Algonkians on the robust end and the Siouans on the gracile end of the continuum. However, classification of people based on non-contemporaneous ethnohistoric accounts of language variation and size of skeletal elements is tenuous at best. This study examines the biological affinities among populations in order to determine whether or not previous cultural classifications are valid.

All anthropology, though, is holistic. Therefore, this research is just a piece of the puzzle of the prehistoric life of the natives of North Carolina. Other pieces will come from archaeologists, ethnohistorians, and cultural anthropologists, and then we can begin to understand the relationships among the indigenous people of this area.

Summary

The Algonkian, Iroquoian, and Siouan-speaking peoples of North Carolina were most likely very different groups before the inception of trade across the state and before European invasion forced many Native American tribes to ally themselves against white influence, oftentimes permanently joining two previously unrelated tribes. By the Late Woodland period of North Carolina archaeological history (AD 800 to European contact), archaeological remains of ceramics, house structure, and burial style clearly show that some trade of artifacts and ideas was present on the coastal plain.

The Algonkian-speaking people lived along the North Carolina outer coastal plain in villages comprised of 10 to 30 houses surrounding a central plaza, sometimes surrounded by corn fields and sometimes surrounded by palisades. Their house style was unique to the Algonkians, that of a long, rectangular house form. Material culture of the Algonkians included fabric-impressed and simple stamped pots, curved scrapers, and a variety of arrowheads. By the Late Woodland, the most common form of burial among the Algonkians was ossuary burial. Algonkian ossuaries were located near the edge of the village and rarely included artifacts. European ethnographers record seeing Algonkian charnel houses in which several corpses were lain until decomposition was completed and secondary burial could be accomplished.

The Iroquoian-speaking people dwelled in the inner coastal plain of North Carolina in small villages that were widely dispersed in the tribal society. Their residential houses were oval in nature and scattered in fields, whereas their temporary hunting structures were rectangular shelters that were placed close together. Material culture included pebble-tempered ceramics. Like the Algonkians, during the Late Woodland, Iroquoians used ossuaries in which to bury their dead. However, the Iroquoian cemetery was located within village boundaries and consisted of two to five individuals in clusters with marginella shell beads as grave goods. European ethnographers note that the Iroquoian burial ritual includes wrapping the corpse in reeds, giving a speech about the deceased, mourning for several hours on end, and, if the deceased was a chief, storage in a charnel house until decomposition of the body was complete.

The Siouan-speaking people occupied the southern coastal plain of North Carolina, but little in the way of villages and social structure is known about these particular Siouan peoples. Their house style was recorded by European ethnographers as being round wigwams made with wooden poles that were tied together at the top. Usually one family lived in the wigwam, but larger dwelling sometimes housed several small, related families. Material culture of the Siouans in this area includes sand-tempered ceramics. As with the Algonkian and Iroquoian peoples, during the Late Woodland, the people of North Carolina also interred their dead in ossuaries. Siouan ossuaries were low sand mounds or ridges located far from the village. There is some evidence of burning of the bones, and rarely are artifacts found in association with burials. European ethnographers described the Siouan burial rituals much the same as the Iroquoian–the body is laid on a mat, a priest or conjurer praises the deceased, and the body is placed in a grave 6 feet deep. After decomposition, the body is cleaned and disposed of in an ossuary.

It has been assumed that the burial ritual for all three of these cultural groups is much like that of the Huron described by Elizabeth Tooker in her ethnography of the tribe in the mid 17th century (1964). The so-called "Feast of the Dead" involves the laying out of the body, praises for the deceased, and mass burial in an ossuary. The Huron organized this activity once every 8 or 10 years, and it is thought that ossuary manufacture among the Native Americans of North Carolina could be very similar to that of the Huron.

Bioarchaeological studies based on genetically-linked traits have previously been done to clarify population dynamics (e.g., Griffin, 1989, 1993; Molto, 1983). North Carolina archaeology can benefit from biodistance studies because of the uncertainty surrounding the role of physical remains in the current archaeological model. Many sites are assessed as having a mixture of cultural traits or as undergoing "acculturation" to explain the difficulty in classifying them. Biodistance studies can clarify population relationships, or lack thereof, in order to gain a better understanding of the underlying genetic associations between populations.

Hypotheses in this study are four-fold; two are stated as null hypotheses, and two are stated as research questions. First, even though archaeologists feel that distinct cultural groups exist, I postulate that, based on nonmetric trait evidence, there will be no significant differences among these groups. Second, based on the above, I also think that no differences will exist among the specific archaeological populations (sites). Third, I surmise that affiliation of so-called border sites will be understood better based on statistical comparisons between skeletal remains from border sites and other groups of "known" affiliation. Finally, I will test the idea that marriage and residence patterns in coastal North Carolina can be discovered based on statistical analysis of nonmetric cranial trait data.

Chapter II - Materials

Twelve archaeological sites from the coastal plain of North Carolina and two sites from the coastal area of Virginia lend skeletal material to this study (see Figure 6). The majority of the material resulted from ossuary burials, as this type of interment is the most common form of burial on the North Carolina coastal plain during the Late Woodland (Mathis, 1993; Phelps, 1983). Most coastal ossuaries consist of roundish pits from 1.5 to 3 meters in diameter, but the total number of individuals interred therein ranges from five to 150 or more (Mathis, 1993; Phelps, 1983). One collection of modern skeletal material, the Terry Collection, was examined as well in order to provide a comparison sample for the Native American material.

Sites in this chapter are presented based on cultural affiliation: Algonkian, Iroquoian, Siouan, Hollowell (31CO5), and the one modern collection. See Table 1 at the end of this chapter for a concise listing of all sites.

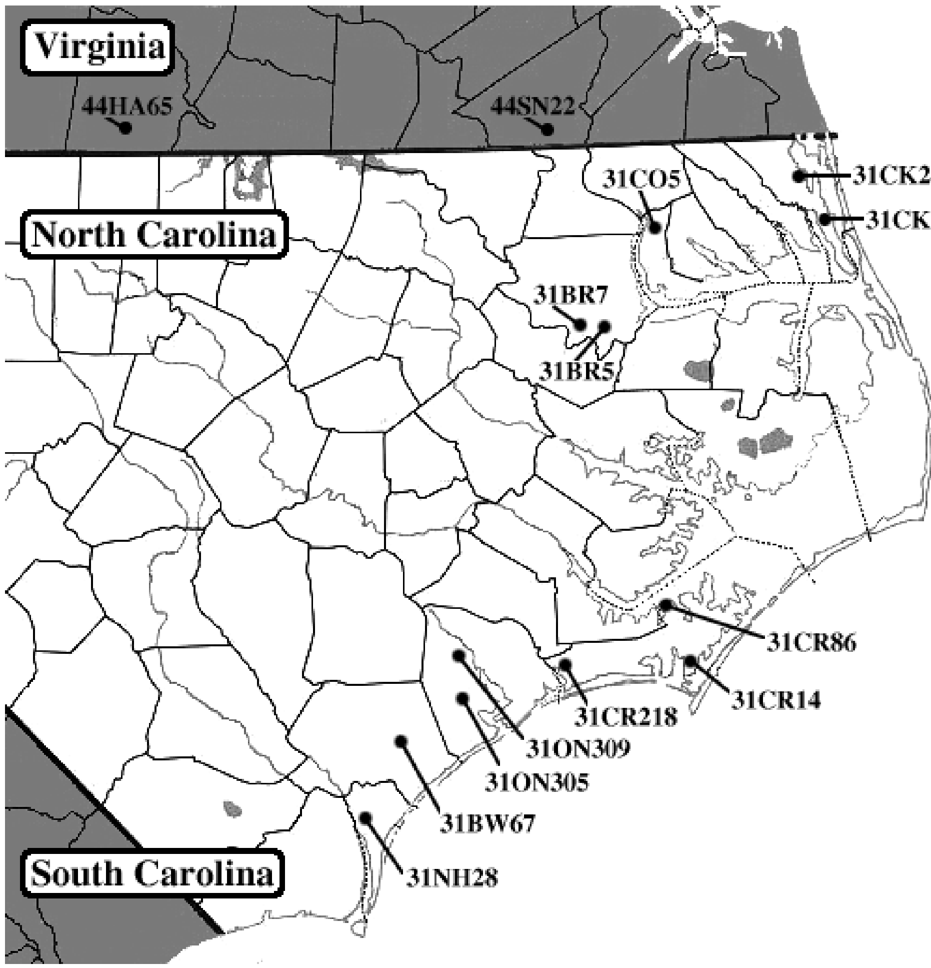

Figure 6: Archaeological Sites Map

Algonkian Affiliated Sites

31CK9 - Baum

The Baum site is a 5-acre tract of land located in Currituck County on the Currituck Sound in North Carolina, just north of the town of Poplar Branch. It was first excavated in 1972 by David S. Phelps of East Carolina University (Hall, 1987; Phelps, 1980). As Baum is located on a sound, some of the site had been eroded prior to excavation, and much of the site has eroded into the water since initial excavations. Phelps' initial excavations have been supplemented by salvage efforts by the North Carolina Office of State Archaeology (Hall, 1987).

Baum as a site was utilized in the Middle and Late Woodland periods of North Carolina prehistory, or from about 300 BC until AD 1650 (Phelps, 1980). During the Late Woodland period, the Baum site reached its maximum size. Numerous artifacts have been recovered, such as ceramics, projectile points, pipes, beads, and bone implements; features such as postmolds have been recovered; and even food remains have been preserved in the archaeological matrix (Phelps, 1980). Perhaps the most indicative remnant of Algonkian culture at the Baum site is the discovery of eight different burial units, including three ossuaries, Burials 1, 5, and 7 (Phelps, 1980).

According to field estimates, Burial 1 contained the remains of over 50 individuals, some in bundle burials and others represented by scattered bones, which also included eight articulated skeletons (Phelps, 1980). Grave goods associated with these burials include a panther mask, bone awls, and bone pins (Phelps, 1980). Burial 5 consisted of more than 30 individuals based on MNI of crania, one of which was a fully articulated skeleton (Phelps, 1980). According to Phelps (1980), the main pit of Burial 1 contained about 30 individuals in a circular pattern with some disarticulated bones propped up against the south wall. In addition, there were three articulated skele-

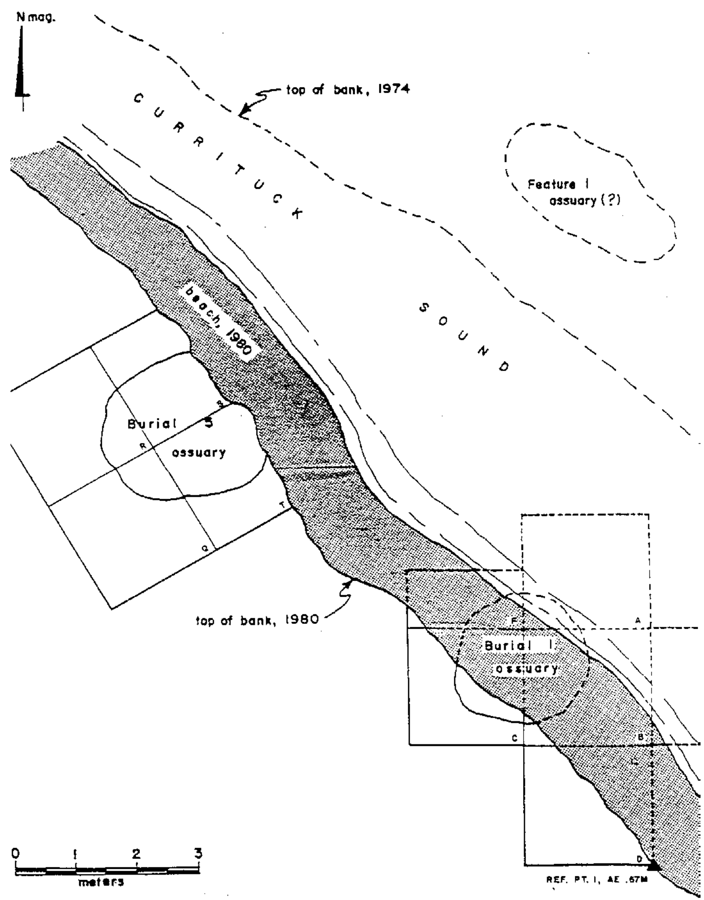

Figure 7: Baum (31CK9) Site Map (Phelps, 1980:10)

tons, several bundles of bones, and additional scattered bone (Phelps, 1980). Burial 5 also presented a circular outline upon excavation and in many ways resembled Burial 1 (Phelps, 1980). However, the only purposeful inclusion with Burial 5 was a small necklace fashioned primarily out of marginella shells and deposited near a group of subadult skeletons (Phelps, 1980). Of note, even though Burial 2 is not an ossuary, one of the cremated individuals had apparently been wrapped in a grass mat (Ward and Davis, 1999). A final MNI for the Late Woodland occupation of Baum was determined to be 204 (Hutchinson, 2002).

Ceramics from the Baum site include fabric impressed, simple stamped, plain, cord marked, and net impressed; lithic materials include biface blades, cores, spalls, and shell beads (Phelps, 1980). Food remains from the Baum burial areas include fish (shark and oyster), mammal (bear and deer), bird, and turtle (Carolina and diamond-back terrapin) bones (Phelps, 1980; Hall, 1987).

Ceramic evidence, ossuary location, and ossuary dates all point to Baum being an Algonkian site (Mathis, personal communication, 2002). Because the Baum ossuary was so large and the remains interred therein so well preserved, Phelps (1984:15) stated that these remains could provide "the opportunity to accurately reconstruct the physical type of the Carolina Algonkian people."

31CK22 - West

The West site is located near Currituck in Currituck County, North Carolina. West was salvaged from erosion into the Currituck Sound in 1994 by Mark Mathis and the North Carolina Office of State Archaeology. A previous ossuary, West Burial #1, was excavated at this site in 1984 and was subsequently analyzed by McCall and Griffin (1985). The site used for this study is West Burial #2, which has an MNI of 134 individuals (Hutchinson, 2002).

While about half of the ossuary was lost prior to commencement of excavations due to erosion, 13 areas of remains were identified. Most of these remains were disarticulated and randomly scattered (Figure 8).

Figure 8: West (31CK22) Site Map (Courtesy Mark Mathis)

Bone pins were found associated with some of the burials, and there were cordage stains on several crania. There are no radiocarbon dates for West, but the artifacts appear to be of the Late Woodland Colington phase, thus making West an Algonkian ossuary (Hutchinson, 2002).

31CR14 - Piggot/Gloucester

Piggot is an ossuary located in Carteret County near Gloucester. It was salvaged in late 1975 by David Phelps, as the site had already been damaged by wave erosion and by activity of the Piggot family since the early 1700s (Truesdell, 1995). Calibrated radiocarbon dating indicates that this site was in use around AD 1420 to AD 1640, the Late Woodland period of North Carolina archaeology (Truesdell, 1995; Phelps, 1983). The ossuary itself measured 1.8 meters by 3.4 meters, with six groups of individuals. Physical remains appeared in bundles, one of which was a partially articulated individual (Truesdell, 1995). As the ossuary was in a shell midden, preservation of the bones was fairly good.

The Piggot ossuary contained the remains of at least 84 individuals, 57 of which were younger than 5 years old at the time of death (Driscoll and Weaver, 2000). Of the adults, only 10 could have sex estimation performed–7 male and 3 female (Truesdell, 1995). Numerous children were present in this ossuary, one of the reasons that sex could not be determined for a larger percentage of the extant population. Analysis of the physical remains revealed that the adults represented in this group were small and short of stature, although so few adult long bones were present that this alone does not qualify Piggot as a Siouan ossuary (Truesdell, 1995:113).

Cranial and long bone measurements from the Piggot skeletal sample, as well as the archaeological background of the site based on ceramic evidence and ossuary type, led Truesdell to conclude that the people in the Piggot population probably represent Siouan acculturation to a northern Algonkian influence (1995:115-116). However, the AD 1465 date and ceramic and burial evidence have led Mark Mathis to conclude that Piggot probably represents a late stage in Algonkian presence south of the Neuse

River (personal communication, 2002).

31CR86 - Garbacon Creek

Garbacon Creek is located in Carteret County, about two miles north of Merrimon, North Carolina, on the south shore of the Neuse River. It was excavated by Keith Egloff of the Research Laboratories of Anthropology at the University of North Carolina at Chapel Hill from November 17 to November 19, 1971 following the onset of Hurricane Ginger (Kakaliouras, 1997).

Erosion from the hurricane, coupled with increased erosion in the year preceding Ginger, had caused much of the ossuary, as well as refuse pits and post holes, to erode from the bank (Egloff, 1971). Egloff described seven different localities, by which the bones were excavated and stored. One feature of burned bone was discovered, but it is assumed that the actual cremation took place elsewhere. Some individuals were still partially articulated, suggesting the Algonkian charnel house method of storing dead bodies until the time of burial (q.v. Figure 3).

The ossuary at Garbacon Creek yielded an MNI of 31. Of these, 20 are adults and 11 are subadults, 9 of which are under the age of 12 (Kakaliouras, 1997). For five out of 20 adults, sex could not be determined, and the majority of the adult individuals for whom sex could be determined were estimated as male (Kakaliouras, 1997).

No radiocarbon dates are available for Garbacon Creek. In addition to the lack of dates, there are questions as to whether the ceramic evidence and the ethnohistoric

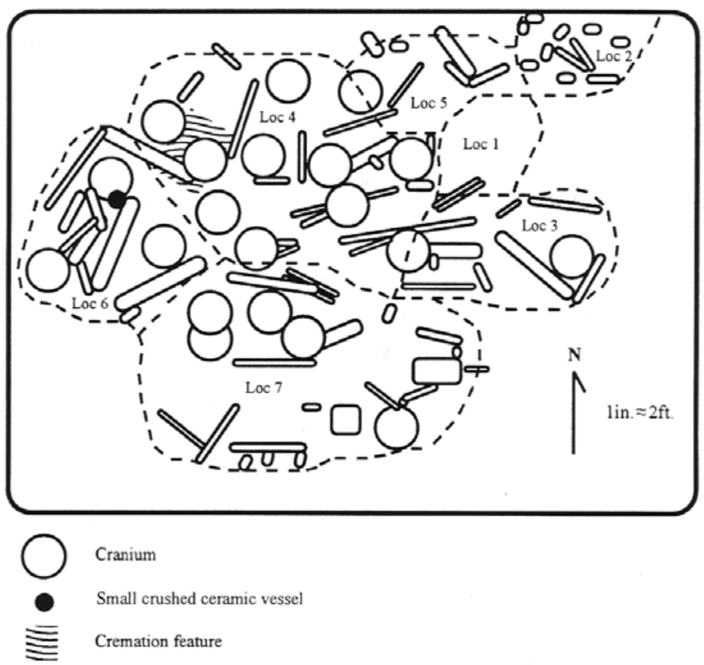

Figure 9: Garbacon Creek (31CR86) Site Map (Kakaliouras, 1997:56)

boundaries indicate Algonkian or Siouan cultural affiliation. One small pot was found in the Garbacon Creek mound. It is shell-tempered and characteristic of the White Oak phase of North Carolina archaeology, usually associated with Siouan peoples. Ethnohistoric accounts, however, and location of Garbacon Creek in the Northern Tidewater Region can be interpreted as placing the site in Algonkian territory. As such, cultural affiliation cannot be definitely determined, although Mark Mathis (personal communication, 2002) feels most evidence and an assumed date of post 1300s indicate Algonkian affiliation.

31CR218 - Broad Reach

One of the most recently excavated sites in the eastern portion of North Carolina is the Broad Reach site, located near Bogue Sound in Carteret County, which was home to Native Americans for several hundred years (Ward and Davis, 1999). Excavation of the three-acre site began in 1987 and continued off-and-on through 1992 (Mathis, 1993).

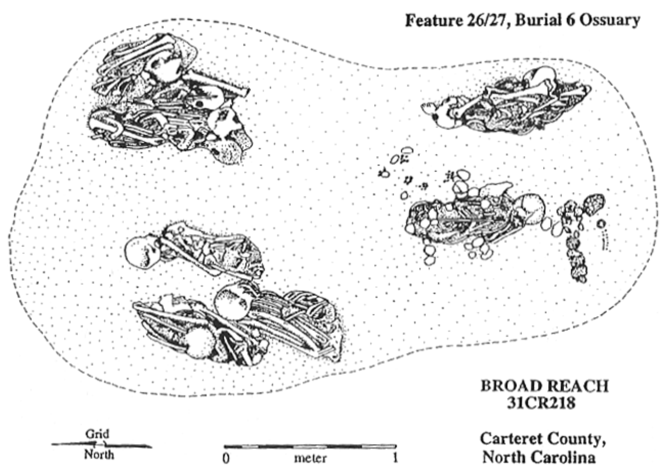

Figure 10: Broad Reach (31CR218) Site Map (Courtesy Mark A. Mathis, NC Office of State Archaeology)

Broad Reach boasts the largest and most varied cemetery site in coastal North Carolina (Mathis, 1993). Because it is so varied, researchers feel that it may provide a reasonable cross-section of Late Woodland burial practices, specifically in terms of status (Mathis, 1993). The different kinds of interments and grave accompaniments discussed below could be related to status of the deceased individual, time or season of death, or availability of relatives to provide proper treatment of the deceased (Mathis, 1993).

In all, 15 pits were excavated at Broad Reach, containing: two ossuaries, one primary burial with two individuals, two primary flexed burials, six secondary bundle burials, and four burials with only bone fragments (Mathis, 1993). These pits occur in three different "clusters." Cluster 1 includes one primary flexed, three bundle, one partially disinterred, and twelve "empty" pits. Cluster 2 includes both ossuaries and two bundle burials with only fragmentary bones remaining. Cluster 3 includes two secondary bundle burials and one burial that had probably been disinterred or disturbed (Mathis, 1993). According to Mathis (1993), Clusters 1 and 2 could actually represent one large complex, but there was neither the time nor the resources to excavated that area of the site fully. The so-called "empty" pits referred to above lacked human remains; however, the size, shape, depth, and lack of fill inclusions led archaeologists to surmise that skeletal remains had been buried in these locations and subsequently disinterred for reburial elsewhere (Mathis, 1993). MNI for this site has been estimated at 36 (Driscoll and Weaver, 2000).

This site contained a primary burial including flexed remains of two individuals with numerous accompanying grave goods: pottery, turtle shell, deer antler and bone, beaver teeth, and a conch shell (Mathis, 1993; Ward and Davis, 1999). Small ossuaries were also present at Broad Reach. One ossuary, which dates to the same time as Flynt (31ON305) and Jarretts Point (31ON309), included nine adults and two or more subadults, whose remains were covered with clam shells (Mathis, 1993; Ward and Davis, 1999). A stain at the bottom of the pit containing these skeletal remains indicates it was possibly lined with organic material such as grasses, wood, or animal skins (Mathis, 1993). Grave goods accompanying these burials included pottery, a stone cup, beads, a small dog, and turtle shell and are highly indicative of high-class burial (Mathis, 1993; Ward and Davis, 1999). Another small burial group consisted of the intermingled remains of four to six individuals and a cremation with associated copper beads (Mathis, 1993; Ward and Davis, 1999). Very few interments were in individual pits–some burials were flexed, some secondary, and some were partially disinterred after burial (Ward and Davis, 1999). Ward and Davis (1999) surmise that the larger ossuaries with more numerous grave goods could reflect a higher social standing than the smaller, more fragmented burials.

According to Mark Mathis, the head archaeologist on the Broad Reach project, the site shares characteristics of both Algonkian and Siouan cultures (Mathis, 1993). The ceramic evidence shows that both Algonkian and Siouan influences are involved, but the discovery of longhouses indicates a classic Algonkian building style. As well, the time (AD 1168), space, and ceramics all point towards Algonkian affiliation (Mathis, 1993; Mathis, personal communication, 2002). Because Broad Reach is so varied in its mortuary complexes, no cultural affiliation can be made based on burial style alone. Based on these observations, Mathis states that there is possibly "some cultural relationship between the Late Woodland societies of the northern and central coastal subarea" (Mathis, 1993:2). However, in including Broad Reach into a cultural group typology, Mathis feels it is Algonkian (personal communication, 2002).

31ON305 - Flynt

Flynt is a four-acre site located in Onslow County, on Chadwick Bay near Sneads Ferry, North Carolina, and the heaviest occupation dates to AD 800 to AD 1200 (Bogdan and Weaver, 1989; Loftfield, 1987). While there is evidence of Early Woodland occupation at Flynt, the heaviest occupation was during the Late Woodland period, determined by radiocarbon dates from seven samples that place the principal occupation between AD 1000 and AD 1100 (Bogdan and Weaver, 1989; Mathis, 1986). Excavations at the Flynt ossuary occurred primarily in 1986, as a project was underway to level the site for construction of a townhouse complex (Mathis, 1986).

The village at Flynt was characterized by large quantities of ceramics, animal and fish bones, and shellfish remains (Mathis, 1986). Over 50 refuse pits and hearths were recorded, as well as at least five deliberate primary dog burials. Before the ossuary was discovered, only one human skeleton had been found at Flynt, that of a secondary interment which was uncovered during construction activities at the site (Burke, 1985).

The ossuary at Flynt was discovered 100 meters from the main area of the site, a prehistoric shell midden and village (Bogdan and Weaver, 1989). Bulldozers had marred the site prior to archaeological intervention, disturbing perhaps 50% of the ossuary. Continued traffic over the ossuary location by bulldozers and cement trucks contributed to additional crushing of the bones (Mathis, 1986). Several construction workers had been collecting unearthed remains that were eventually turned over to the archaeology project manager (Mathis, 1986). Also, it became evident during excavation that the southern half of the ossuary had been dug up, presumably by a backhoe, and redeposited without all of the crania and long bones (Mathis, 1986).

The ossuary itself measured 1.6 meters by 1.5 meters and contained four clusters of human bones along with mixed skeletal material (Bogdan and Weaver, 1989; Mathis, 1986). The pit was defined primarily as the location of the bones, as no clear outline could be determined otherwise (Mathis, 1986). Over 150 individuals, some semi-articulate bundles and some randomly mixed, were discovered in this mound, and one fragment of charred human bone was also found at the site (Bogdan and Weaver, 1989; Ward and Davis, 1999). MNI was determined to be 158 (Bogdan, 1989). Ninety-three of the 158 individuals described were classified as adult, and the remaining were subadults (Bogdan and Weaver, 1989). Sex estimation, however, was more difficult and only 17 individuals could be assessed–6 females and 11 males (Bogdan and Weaver, 1989). There were no apparent grave goods found at the Flynt ossuary mound (Loftfield, 1987).

The interment pattern of the ossuary is Algonkian, according to Loftfield (1987; 1990). The date of this ossuary is AD 1361, and there was shell-tempered pottery found at the site (Mathis, personal communication, 2002). Other ceramic evidence points to both Iroquoian and Algonkian occupation; however, combined with the

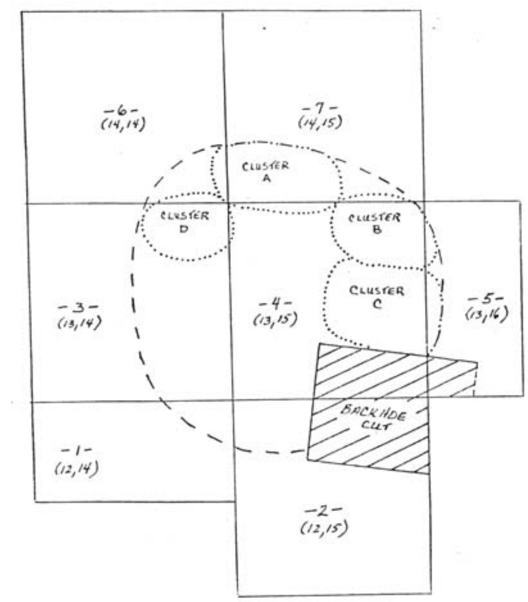

Figure 11: Flynt (31ON305) Excavation Map (Mathis, 1986)

location of the site, it has been determined that it is most likely an Algonkian ossuary (Bogdan and Weaver, 1989; Mathis, personal communication, 2002).

31ON309 - Camp Lejeune/Jarretts Point

The Jarretts Point ossuary is located in Onslow County on the current Marine Corps Base Camp Lejeune. The ossuary itself was on the northern end of Jarrett's Point, a parcel of land that juts into the New River (Bogdan, 1989). Located on a sand dune, the Jarretts Point ossuary was probably 15 feet in diameter (Loftfield and McCall, 1986).

Half of the site had already been destroyed prior to commencement of excavation (Ward and Davis, 1999). Initial excavations were completed by UNC-Chapel Hill in 1982 (31ON304) and later by UNC-Wilmington in 1985 (31ON309). While both 31ON304 and 31ON309 have been compressed into one site, some archaeologists feel that, because the two sites were over 20 meters apart, they are different sites (Mathis, personal communication, 2002). However, for the purpose of this investigation, the two sites are combined. 31ON304 proved to have so few crania that it could not be treated statistically as a separate site.

The ossuary at Camp Lejeune was made up of four bundles on a high sand ridge away from the rest of the site with no associated grave goods (Bogdan, 1989). According to original reports, the MNI of Jarretts Point for the Late Woodland time period is 50, and several Carolina panther phalanges were also recovered; at least three burials from the Historic period were discovered during excavation as well (U.S. Army Corps of Engineers, 1999). The very first MNI estimate for this site was 15; later, it was determined that the MNI was 46 with at least 22 more individuals in slump material (U.S. Army Corps of Engineers, 1999; Ward and Davis, 1999). However, based on anatomical singularity of the specimens, at least 37 individuals are represented; therefore, the researchers who performed the analysis of the skeletal remains (Loftfield and McCall, 1986) estimate the total number of individuals at this site to be between 37 and 68.

Initial osteological analysis of the 1982 material revealed 11 subadults and 24 adults of both sexes; analysis of the 1985 material gave an estimate of six subadults and nine adults, with three females and four males being estimated for the adults

(McCall et al., 1986; U.S. Army Corps of Engineers, 1999). There was also one cremation located at this site (Ward and Davis, 1999).

Jarretts Point has been radiocarbon dated to the 14th century (AD 1297-1408), which places it in the Late Woodland period (Mathis, 1993; U.S. Army Corps of Engineers, 1999; Ward and Davis, 1999). Attribution of the Jarretts Point ossuaries to one of the three cultural groups in coastal North Carolina has proven difficult. Loftfield and McCall (1986) suggested that both ossuaries' location–away from the village on a sandy knoll–could indicate Siouan affiliation. Physical stature and robustness of the remains led Claggett (1998) and Loftfield and McCall (1986) to suspect that these people were either Algonkian or Iroquoian in culture. However, Claggett (1998) concludes, and Mathis (personal communication, 2002) agrees, that based on burial form, distribution of burials, and robusticity of the skeletal material recovered from this site, Jarretts Point was probably occupied by Algonkian populations.

Iroquoian Affiliated Sites

31BR5 - Sans Souci

A number of small ossuaries make up Sans Souci, located in Bertie County, about 10 miles southwest of the Jordan's Landing site. They were excavated by amateur archaeologists as a salvage project and donated to East Carolina University in 1973 (Hutchinson, 2002). There is no published site report on Sans Souci, although several researchers have used the skeletal remains in analysis (Bogdan, 1989; Hutchinson, 2002; Reichs and Calves, 1989). MNI for Sans Souci has been estimated at 33 (Hutchinson, 2002).

According to Mark Mathis (personal communication, 2002), the limited information from Sans Souci, including Cashie phase ceramics and site location, indicates it is a Late Woodland Tuscarora site.

31BR7 - Jordan's Landing

Jordan's Landing, a three-acre site in Bertie County, lies on the north bank of the Roanoke River below Williamston, North Carolina (Byrd, 1997). In the middle of the site is a small creek that drains a swamp (Phelps, 1983). Excavation on this site began in 1971 led by David S. Phelps of East Carolina University, but the site was never fully excavated (Phelps, 1983).

Jordan's Landing is a typical small village, located at the confluence of a small stream and the Roanoke River. A forest of oak and hickory runs along the bank, and behind Jordan's Landing are ridges of sandy loam. The village is roughly oval and has ditches along two sides–possibly the result of natural processes or possibly the remains of a soil palisade (Phelps, 1983). Eventually, however, the ditches became the refuse pits for individuals at the site. While some postmolds have been found, no structures were ever fully excavated (Phelps, 1983). Cooking pots and hearths were found in the north and west of the site.

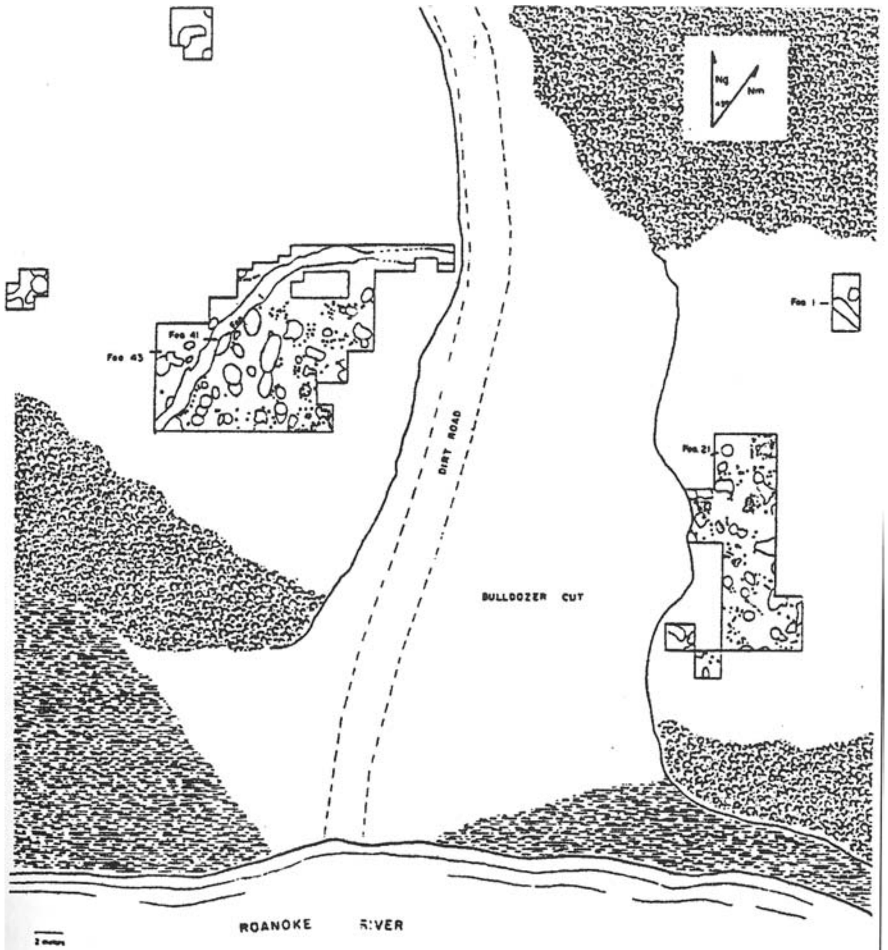

Figure 12: Jordan's Landing (31BR7) Site Map (Byrd 1977:17)

The ossuary itself was located on a sandy loam ridge (Byrd, 1997). Burials are mostly concentrated in the southeastern portion of the site, and included flexed and semi-flexed burials (Phelps, 1983). One of the flexed burials had associated artifacts of seven Roanoke Triangular arrowheads, the only known instance of this type of grave goods (Phelps, 1983; Ward and Davis, 1999). Another burial differed from the rest at Jordan's Landing in that it was an extended burial in a large oval pit with associated grave goods consisting of disc- and barrel-shaped beads. Phelps (1983) feels this may be indicative of a status burial. MNI of Jordan's Landing has been estimated at 43 individuals, including 5 female and 3 male (Hutchinson, 2002; Reichs and Calves, 1989).

Jordan's Landing is an important site in terms of Cashie phase archaeology (Ward and Davis, 1999). This series of ceramics was first discovered at Jordan's Landing. Cashie phase ceramics include fabric-impressed, simple-stamped, incised, and plain with tempering of small pebbles or sand. Whereas in later time periods the Tuscarora frequently participated in hunting parties, leaving their villages for long stretches of time in the winter, evidence from Jordan's Landing indicates that such long-term trips were unnecessary for collecting food and that the site was occupied year-round (Ward and Davis, 1999). A mixed subsistence economy dominated, which included agriculture and fishing in addition to hunting and gathering (Ward and Davis, 1999).

Jordan's Landing is one of a very few archaeological sites that have been determined to be Iroquoian. Location of the ossuary and ceramic evidence of Cashie phase pottery, as well as a date of AD 1425 from a Cashie phase cooking pit on the site, indicate that Jordan's Landing is Iroquoian (Mathis, personal communication, 2002; Phelps, 1983).

44HA65 - Abbyville

Abbyville is located in Halifax County, Virginia. It was excavated and partly salvaged by amateur archaeologists between October of 1966 and January of 1970, primarily under the direction of John Wells, who reported back to professional archaeologist Howard MacCord out of the Library of Virginia. Not all of Abbyville has been excavated, and it has remained underwater since the end of the 1969-1970 excavation season.

Abbyville is the name given to a collection of sites salvaged from Oak Hill Island along the banks of the Dan River in Virginia, and was named for the town that had overlooked the area for over 100 years (Wells, 2001). This collection of sites existed underwater for most of the year as the Kerr Reservoir filled and drained. Thus, only about three months of excavation were allowable each year, and at the end of the excavation season, all of Abbyville was underwater again. The site was accessed primarily by boat because, although the water levels were lower, shallow water and mud made for treacherous paths to the site (Wells, 2001).

Salvage efforts at Abbyville began in 1966 because human bone was seen eroding from the shores of the inland terraces. Most of the human remains were located along the western and southwestern edges of the southern terrace (Wells, 2001). Because of the location of the sites, most of the skeletons were water-logged when found. The results of excavation of many of these burials were fragmented remains. Transportation of recovered burials was difficult in light of the weight of the remains and the length of time it took to transport them back to dry land from the Abbyville sites (Wells, 2001).

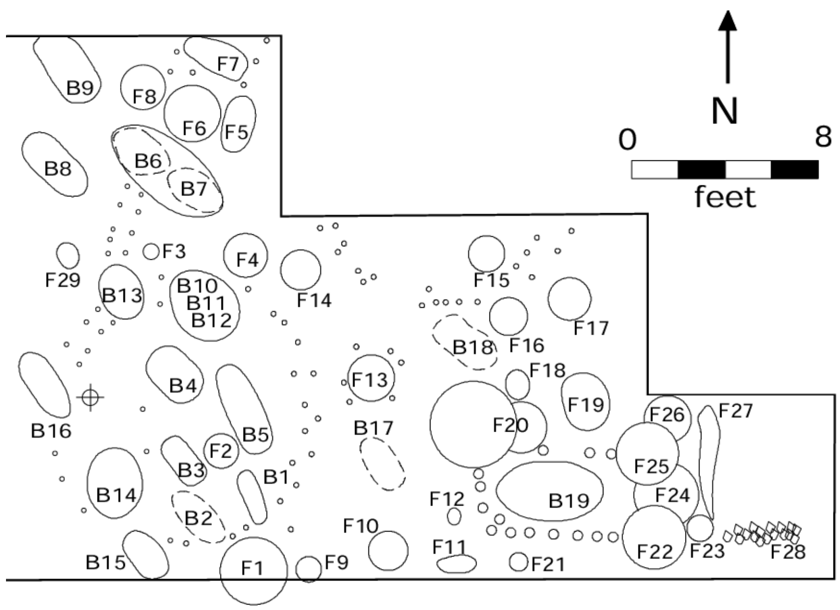

Figure 13: Abbyville (44HA65) Excavation Map - Central Terrace (From Wells, 2001)

Prior to 1966, some burials had been excavated from Abbyville by unknown people. There is also a chance that some deeper burials existed that were not uncovered because of the present water levels from 1966 to 1970. The final count of burials from Abbyville over the four digging seasons is 128 (Wells, 2001). Of these, 65% are semi-flexed burials, 15% are extended, 8% are tightly flexed, and 4% are bundle burials (Wells, 2001). Graves tended to be oval or elliptical in shape. While most of the burials at Abbyville were interments of one individual, there also existed eight or nine graves that contained the remains of two or three individuals (Wells, 2001). As Phelps (1983) has pointed out with regard to Jordan's Landing (31BR7), this method of disposing of the dead appears to be unique to Iroquoian groups.

Only 48 of the 128 burials at Abbyville were removed from the site, and the other 80 burials uncovered were reburied (Wells, 2001). Sixteen of the 48 removed burials were sent in 1969 to National Museum of Natural History's Anthropology Department (Wells, 2001). Twelve of the burials were destroyed in a forest fire while located in an archaeological repository some years after salvage efforts had been completed. Following the fire, the remaining 20 individuals, which had been stored at a different facility, were sent to the NMNH. Thus, the total number of excavated individuals remaining is 36, and they are all currently housed at the NMNH.

Funerary items were present with 37.5% of the burials. These artifacts, as well as other archaeological remains, currently reside at the Halifax Museum of Fine Arts and History in South Boston, Virginia.

One interesting burial at Abbyville deserves mention. Burial 19 was that of a female about 40 years old in the middle of the center terrace of the site. Postholes 18 inches deep were found around three sides of the narrow grave; neither the grave nor the postholes infringed upon the other, suggesting that the grave was dug while the structure stood (Wells, 2001). This report seems to echo John Lawson's description of an Algonkian charnel house. Unfortunately, since Abbyville is underwater, it is highly unlikely that further salvage efforts will ever be made.

44SN22 - Hand

The Hand site is located in Southampton County, Virginia, on the Nottoway River near Franklin, Virginia, close to the North Carolina border, and dates to AD 1580-1650 (Smith, 1984; NMNH, 2002). During this time-span, according to ethnohistoric records, the Nottoway Indians occupied the land (Smith, 1984). The form of the uncovered ossuary also indicates a Tuscarora or more northeastern influence, as opposed to the ossuary forms of eastern (Algonkian) North Carolina (Smith, 1984).

The ossuary area of the Hand site was characterized by overlapping graves and small pits; the diameter of this area is approximately 65 feet (Smith, 1984:18). No physical border was found for this ossuary (Smith, 1984:19). While the central part of the ossuary was dense with bones, the outer margins involved overlap of two or three individuals (Smith, 1984:19).

Burials at the Hand site were grouped into the following seven categories: 1) burials with fire ceremony; 2) flesh burials with grave offerings; 3) bundle burials with grave offerings; 4) cremations with grave offerings; 5) flesh burials without grave offerings; 6) bundle burials without grave offerings; 7) cremations without grave offerings (Smith, 1984:74). Individuals were fully extended, loosely flexed, or tightly flexed, lying on the back or to either site (Smith, 1984:74-75). Specific information on individuals burials is available in Smith (1984:76-85).

Human remains from Hand are curated at the National Museum of Natural History in Washington, D.C. Initial excavations at the Hand site began in 1965, and the

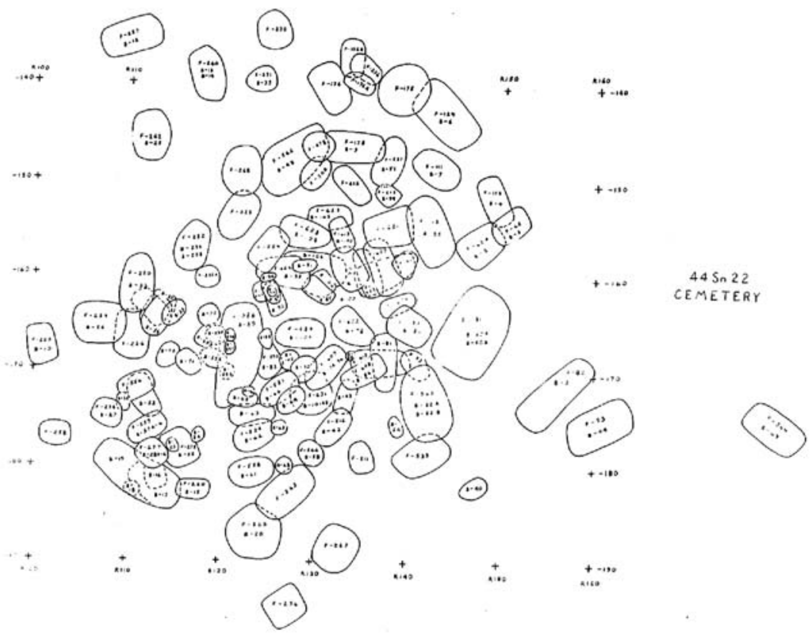

Figure 14: Hand (44SN22) Site Map (From Smith, 1984:138)

collection was accessioned to the NMNH in 1973 (Smith, 1984; NMNH, 2002). In 1993, documentation of the humans remains from the Hand site was created based on a request from the Nansemond Indian tribe (NMNH, 2002). Over 120 individuals are in the collection; 136 individuals were excavated at Hand, but 16 were not included in the collection given to the NMNH (Smith, 1984:19; NMNH, 2002).

Although the Nansemond Indians shared some land with the Iroquoian Nottoway near the mouth of the James River, during the time-period that the ossuary at Hand was in use, only the Nottoway lived in this area. Mortuary practices and house size confirm that this site was of the Nottoway persuasion (Smith, 1984).

Siouan Affiliated Sites

31BW67 - McFayden

The McFayden ossuary, named after the landowner who discovered the mound on his property, was a fairly large burial mound located 15 miles north of Wilmington in Brunswick County, excavated by Stanley South and the Lower Cape Fear Chapter of the Archaeological Society of North Carolina from February 4-5, 1962. Located on a sand ridge, the McFayden site is a large (about 40 feet in diameter) circular mound with multiple burials and cremations (Hogue 1977; South, 1966; Ward and Davis, 1999).

Pot hunters had greatly disturbed this mound, and according to South (1962) barely any portion of the mound was undisturbed. Feature 1 consisted of a mass of broken bones, containing two skulls, two mandibles, and numerous fragments. South thought the bones might have been broken prior to interment. Several disc-shaped shell beads were associated with these burials. Feature 2 consisted of a second concentration of bones, which had been placed on top of a rotten log. These remains were not a typical tightly bundled burial, according to South, and no artifacts were found in this feature. Features 3, 4 and 5 involved concentrations of burned bone fragments, possibly cremations. Features 6 and 7 were concentrations of broken bone, atypical of bundle burials (as the long bones were not parallel).

South (1962) interpreted the burials at the McFayden mound as having occurred

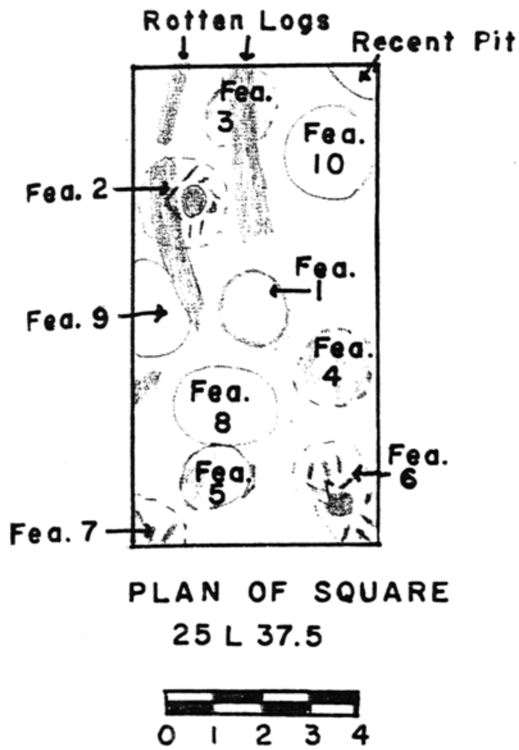

Figure 15: McFayden (31BW67) Excavation Map (South, 1962)

at different times. While some bones were interred in pits, others were placed in piles directly on the ground and covered with sand. Some cremated remains were also added to the mound, but some were interred directly into pits. The majority of the bones, however, are located above the original ground surface.

No complete long bones were found at the McFayden mound, but large fragments of crania were uncovered (South, 1962). As a result of the fragmentary nature, an MNI of only 10 could be determined (Driscoll and Weaver, 2000). While there was ample evidence of secondary burial, there was no evidence of primary burials at McFayden (South, 1962). Very few shards of pottery were found at the site, but those that were discovered have been called Cape Fear Fabric Impressed (South, 1966). Based on location and scanty ceramic evidence, McFayden is regarded as Siouan and is placed at AD 1000-1200 (Mathis, personal communication, 2002).

31NH28 - Cold Morning/New Hanover

The Cold Morning site lies on a sand dune along Barnard's Creek south of Wilmington (Coe et al., 1982). Physical remains were discovered at the site in 1977. However, until they could be excavated by professionals, that area of the site was backfilled with sand (Coe et al., 1982).

Although Cold Morning was used over a long time period, no middens or structural evidence were found, and there were very few features (Coe et al., 1982). The ossuary itself was unique and isolated, and Coe and others (1982:80) postulate that temporally the ossuary was not linked to the site's highest point of use, but rather was a final, singular act (1982:80).

Remains of 11 adults, four subadults, and one fetus were found mingled together with only a few shards of pottery (Coe et al., 1982; Ward and Davis, 1999). The count was based on 10 partial crania, one left parietal, and postcranial evidence of 11 right femorae and 11 left tibiae. Later analysis by Driscoll and Weaver (1999) revealed the MNI of Cold Morning to be 10. The Cold Morning ossuary involved many secondary burials, as there were found to be no individual bundles or evidence of articulated remains, save for the fetal skeleton (Coe et al., 1982:81).

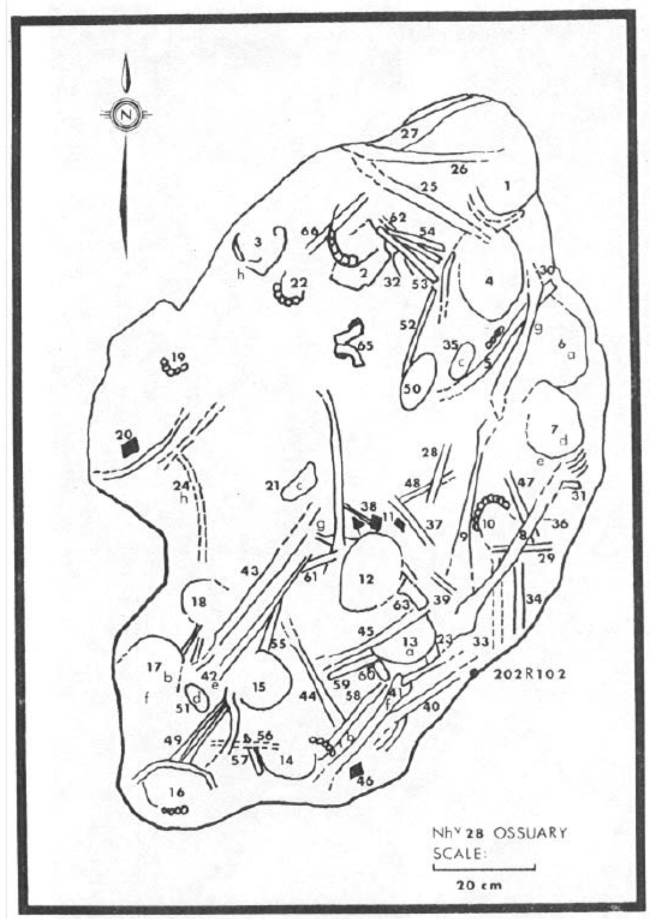

Figure 16: Cold Morning (31NH28) Site Map (Coe et al., 1982)

A previous study of cranial morphology (Coe et al., 1982) has indicated that the skulls from Cold Morning are more similar to the Siouan populations to the south than to the coastal Algonkians. Coe et al. (1982:70) state, "While the Siouan and male crania from the ossuary were small, round-headed, and gracile, the Onslow County skull was large, long, and rugged." In fact, three calvaria from Cold Morning were compared to one female cranium from McFayden and one male skull from Onslow County to determine the gracile nature of the Cold Morning remains (q.v. Figure 5).

Some cranial measurements were done on the Cold Morning crania, but "some of the measurements are estimates" as a result of the condition of the crania (Coe et al., 1982:67).

Both Coe et al. (1982) and Ward and Davis (1999) feel that, by AD 1000, the Siouan-speaking people south of the Cape Fear River were physically very different from those north of the river. There were not very many tribes living near the Cold Morning site, but some researchers surmise they were affiliated with the Waccamaw tribe (Swanton, 1946).

The Cold Morning site has been dated to AD 984. Some sand-tempered ceramic shards have been discovered at this site, leading researchers to conclude that it is most likely a Siouan site (Coe et al., 1982; Mathis, 1993).

Hollowell - 31CO5

The Hollowell site, named after its founder and owner of the land on which it was discovered, is located in Chowan County on a bluff along the Chowan River. It was first uncovered in 1974, but excavations did not being in earnest until 1975 (Phelps, 1982:25). The site had been partially eroded, and a bulkhead was installed. A shell midden was discovered during excavation for a waterline trench, and bone was exposed nearby (Phelps, 1982;25).

Ceramic evidence from Hollowell indicates that typical Colington wares were present (135 shards in the burial pit), as well a number of Cashie wares (5 shards) probably received in trade with Tuscarora to the west (Phelps, 1982:27). Other indications Phelps relied on to determine Hollowell was a Colington ossuary were the midden deposit, the characteristics of the ossuary, and the shape of the small, permanent village (1982:27).

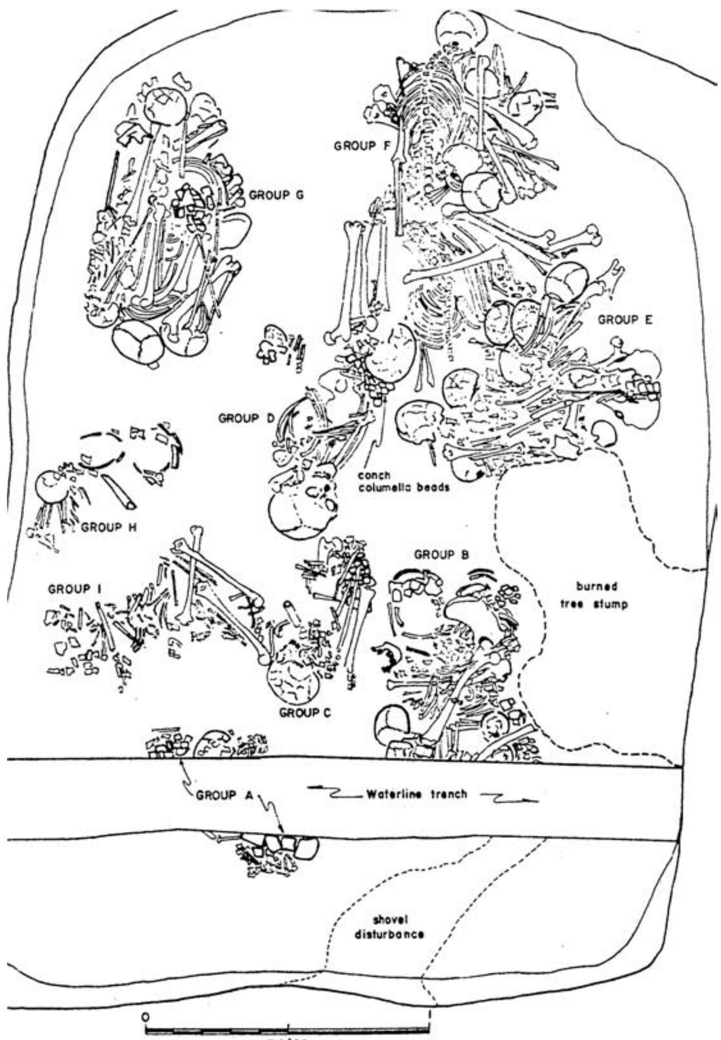

Figure 17: Hollowell (31CO5) Site Map (Phelps 1982:32)

The Hollowell ossuary, according to Phelps, was rectangular with rounded edges and measured approximately 3.6 meters by 2.5 meters, with a depth between 22 and 48 centimeters (1982:28). Minimum number of individuals uncovered by the research team amounted to 40 in nine different groups (Phelps 1982:38); later studies determined the MNI to be 90 individuals (Hutchinson, 2002). Previous excavations of Colington ossuaries on the North Carolina coast provided smaller, round burials with 30 to 60 individuals deposited in a circular pit two meters in diameter (Phelps 1982:38). Because the individuals in the Hollowell ossuary had been grouped, Phelps, based on Ubelaker's (1974) description of the "Festival of the Dead," believes that this represents distinct family groups (1982:38). Phelps goes on to state that the Hollowell site has not been completely analyzed and that the odd shape and distribution of bones within the ossuary are unlike any other Colington phase ossuary in North Carolina (1982:39).

Thus, the question regarding Hollowell's cultural affiliation remains. Ceramic evidence shows a preponderance of Colington phase shards, but Cashie phase shards are also very common. The location of Hollowell, on the Chowan River, is on the edge of Algonkian territory. The structure of the ossuary is unlike any other discovered in eastern North Carolina, yet is similar in some ways to other coastal ossuaries (Mathis, personal communication, 2002).

Terry Collection

The Terry Collection is the result of the work of Robert J. Terry, professor of anatomy at Washington University Medical School, who was aware of the paucity of documented anatomical and osteological specimens held at institutions of medicine and higher learning. About half of the 1,728 specimens in the collection are from decedents whose bodies were never claimed or whose relatives signed over control of the remains. This first half collected by Dr. Terry in the 1920s went to the Medical School of Washington University for cadaver research. In 1956, a law was passed in Missouri that required the individual or his immediate family to sign a release in order for the body to be used for scientific purposes. The second half of the collection is primarily composed of people from middle- or upper-class income brackets.

By the early 1920s, Dr. Terry established guidelines for collecting, cataloguing, maceration, and storage of the specimens. Most bodies were used for soft tissue dissection, leaving the underlying bones intact, but some were sectioned at the cranium. Terry did not want to completely strip the bones of their fat, as he felt they would be more likely to be preserved with some fat remaining. Considering some of the specimens are well over 80 years old at this point, it seems that Dr. Terry's foresight was correct.

Some documentation of the individuals exists in the form of morgue records, including the name, sex, age, ethnicity, cause of death, and date of death. Pathological variants and nonmetric traits were observed for several individuals. About 60% of the

Terry Collection includes measurements of the cadaver and photographs, and there are over 800 death masks associated with these specimens.

In 1941, Dr. Terry retired and left his collection in the hands of Mildred Trotter. Dr. Trotter began corresponding with T. Dale Stewart of the Smithsonian about permanent curation of the collection. In 1967, the collection came to the National Museum of Natural History's Anthropology Department from the Anatomy Department at Washington University Medical School.

Of the 1,728 specimens in the collection, there are 461 white males, 546 black males, 323 white females, 392 black females, 5 Asian males, and 1 individual of unknown origin. Age at death ranges from 16 to 102 years old, dates of birth 1822 to 1943, and the average age of individuals is between 60 and 70 (Hunt, 2000; Carpenter, 1976).

For this study, 52 individuals from the Terry Collection were examined at the National Museum of Natural History in Washington, D.C. Twenty-six each of white males and females were examined for the same 25 nonmetric traits used in this research to determine mean measure of divergence between Native American groups in North Carolina. The purpose of examining the Terry Collection is to provide a control group against which the Native Americans can be statistically analyzed.

Summary

Fourteen sites of Algonkian, Iroquoian, and Siouan affiliation were examined for this report, 12 from the North Carolina coastal plain and two (Hand and Abbyville) from the Virginia coastal plain. All exhibited an ossuary form of burial and date to the Late Woodland period of North Carolina history (AD 800 to various dates of European colonial intrusion). In addition, several specimens from the Terry Collection were examined to provide a control group. A concise table of sites and their cultural affiliations is presented below (Table 1).

Site	Name	Date@	Affiliation*	MNI	Reference	Sample Size
31CK9	Baum	AD 1500s	Algonkian	204	Hutchinson, 2002	90
31CK22	West	Late Woodland	Algonkian	134	Hutchinson, 2002	32
31CR14	Piggot	AD 1460@	Algonkian	84	Truesdell, 1995	8
31CR86	Garbacon Creek	post AD 1300	Algonkian	31	Kakaliouras, 1997	26
31CR218	Broad Reach	AD 1168@	Algonkian	36	Driscoll and Weaver, 2000	17
31ON305	Flynt	AD 1361@	Algonkian	158	Bogdan, 1989	18
31ON309	Jarretts Point	AD 1368@	Algonkian	37-68	Loftfield and McCall, 1986	37
31BR5	Sans Souci	Late Woodland	Iroquoian	33	Hutchinson, 2002	13
31BR7	Jordan's Landing	AD 1425	Iroquoian	43	Hutchinson, 2002	12
44HA65	Abbyville	Late Woodland	Iroquoian	128	Wells, 2001	16
44SN22	Hand	AD 1605	Iroquoian	136	Smith, 1984	16
31BW67	McFayden	c. AD 1100	Siouan	10	Driscoll and Weaver, 2000	15
31NH28	Cold Morning	AD 984@	Siouan	10	Driscoll and Weaver, 2000	18
31CO5	Hollowell	Late Woodland	Unknown	90	Hutchinson, 2002	27
					Total Sample	313
	Terry Collection	Modern	Caucasian	1728	Hunt, 2000	52

*Affiliation determined by Mark Mathis, personal communication, January 2002

@^{14}C intercept dates courtesy Mark Mathis (April, 2002)

Table 1: Sites Used in this Research - Dates, Cultural Affiliation, MNI, Sample Size Used

Chapter III - Method and Theory

The Theoretical Polemic

During the time of Classical Greece, early scientists were already beginning to understand and record variations in the human body, and by the mid-nineteenth century, the biological nature of these differences was being studied (Saunders, 1989; Russell, 1900). One hundred years later, researchers working with mice observed that single gene mutations could produce a variety of skeletal variants, also called nonmetric traits because of their inability to be quantified (Grüneberg, 1952; Grewal, 1962).

Working along these lines, Berry (1963) studied nonmetric trait variance in wild mice and calculated the mean measure of divergence of the population using a multivariate statistical technique. The results of that study were inconclusive, but a later paper by Berry and Berry (1967) on nonmetric variation in the human cranium inaugurated the study of biodistance using skeletal remains. In that study, they claimed that nonmetric traits are superior to metric traits because the former are more likely to be genetically determined and thus better indicators of population relationships. Berry and Berry (ibid.) outline three reasons for believing that nonmetric traits are genetically determined. First, studies on families of mice and rhesus macaques have shown that nonmetric variants are inherited (Grüneberg, 1952; Cheverud and Buikstra, 1979; 1981). Second, studies of animals and of humans have shown that the frequency of any particular trait is constant in a given race, and geographical isoincidence lines can be drawn based on nonmetric traits just as they can be drawn from blood group frequencies. Third, Grüneberg found that mice inherit nonmetric variants. Although it is not certain that the same genetic processes are at work in mice or rhesus macaques and in humans, Berry and Berry (ibid.) feel it is also unreasonable to suppose that their genetic basis is completely different. They further emphasize, however, that "it is the *incidence* of a variant in a population that is a genetical characteristic and not its segregation in a family" (original emphasis; Berry and Berry, 1967:362). Because incidents of variants in two populations probably reflect genetic differences between those populations, nonmetric variation can thus be used to differentiate or calculate the biological distance between two populations. In terms of methodology, Berry and Berry (ibid.) state that effects of age, sex, side, intertrait correlation, and environmental influence are minimal in skeletal samples. They encourage the use of nonmetric trait analysis on fragmented skeletal populations when metric analysis is impossible and state that trait frequencies in skeletal samples can be used to evaluate biological variability in populations.

A major assumption must be made in order to perform population distance statistics: that gene flow is relatively static. That is, any change in the gene pool would affect phenotypic expression of traits (Griffin, 1993). If the change in the gene pool is small, then the biological distance is low. If there are numerous significant changes, biological distance is assumed to be great. Thus, the Berrys' 1967 study garnered its share of criticism in following years. Researchers were split into two camps: those who valued the utility of nonmetric traits in determining biodistance of fragmented skeletal populations, and those who felt that nonmetric traits were poor indicators of genetic identifiers. Opponents of nonmetric traits have focused on methodological problems and theoretical issues; methodological problems include the symmetry of traits, effects of age and sex, intertrait correlations, and observer error, and the theoretical issues pertain to inheritance of nonmetric traits. All will be discussed briefly below.

Although Berry and Berry (1967) concluded that sex and age differences only minimally affected nonmetric trait manifestation, other researchers found significant intersex (Grüneberg, 1952; Corruccini, 1974) and age (Ossenberg, 1969; Molto, 1983) variation in frequencies of expression. Sex-dependent variation can be minimized by discarding certain traits from analysis, omitting one sex from analysis, or keeping the proportion of sexes relatively equal (Saunders, 1989). However, omitting numerous individuals or traits from analysis could potentially prejudice the data, and thus is not an acceptable solution. Because sex differences in body size do not appear to be correlated directly with expression of nonmetric traits, other avenues of investigation are needed. Until then, a viable solution is to examine sex-correlated variants on a population basis by using χ^2 statistics for potential associations. Age variation is most obvious in the distinction between subadults and mature individuals because of the active growth process of the former. As a result, most workers exclude subadult individuals from analysis (Saunders, 1989).

Often, two or more traits are found to be directly correlated. These correlations can occur because of underlying genetic factors, common developmental phenomena, diet, or environmental factors (Benfer, 1970). Many researchers have held that intertrait correlations in humans are few and random (Berry and Berry, 1967; Kellock and Parsons, 1970a, 1970b; Suchey, 1975). However, Sjøvold (1977) maintains that discovery of correlations is merely a function of sample size–the larger the sample, the higher the chance of finding correlations. He also stated that, for the small sample sizes most people work with, the intercorrelations will not significantly affect biodistance assessment.

Issues with the theory behind using nonmetric traits for biological distance studies include the fact that a change in environment or genes can alter the heritability of nonmetric traits without altering its expression in a population (Berry and Berry, 1967; Saunders, 1989). The model for nonmetric traits assumes that gene frequency distances are equivalent to differences in the expression of nonmetric traits (Berry and Berry, 1967). Numerous researchers have applied this theory to studies of human skeletal populations (Carpenter, 1976; Ossenberg, 1976, 1977; Rightmire, 1972; Sjøvold, 1977, 1984); however, it is difficult to substantiate the biological validity of application to prehistoric samples because similarities or dissimilarities between populations could be a result of environmental differences that do not necessarily correlate to genetic hetero- or homogeneity (Saunders, 1989). Any study involving prehistoric remains, though, would suffer from the problem of substantiation of results. A researcher can only control all possible variables, such as sex correlations and intraobserver error.

Biodistance studies based on nonmetric variation have as their premise that these variables are largely under genetic control, that they are minimally affected by diet or the environment, that the traits can be reliably scored, that the sample population is of adequate size, and that the traits are independent of one another such that they can provide statistically valid information on biological distance (Griffin, 1993; Molto, 1983; Rösing, 1984). Most recent research as to the utility of nonmetric versus metric traits in determining population distance has concluded that both methods are at least equally valid (Balakrishan and Sanghvi, 1968; Berry and Berry, 1967; Carpenter, 1976; Cheverud et al., 1979; Corruccini, 1974; Finnegan, 1978; Ossenberg, 1976; Pietrusewsky, 1971; Rightmire, 1972). The usefulness of nonmetric traits has been shown by example, in that fragmented or incomplete skeletal populations often can only be analyzed by use of nonmetric traits. Because metric traits require a high degree of completeness, skeletal population size is reduced as the researcher is limited to searching for entire crania.

Nonmetric traits were selected for use in this study primarily because the samples at hand were from secondary interment in archaeological contexts. Issues with nonmetric trait analysis were taken into account including bilaterality of traits, age and sex effects on trait correlation, and observer error. Because each of these problems with nonmetric trait analysis could be controlled for and because of the nature of the archaeological samples, nonmetric trait analysis was felt to be a better option than metric analysis.

Data Collection

Ossuary Burials

During the Late Woodland period of North Carolina history, most groups on the coastal plain practiced deposition of their dead in ossuaries. Ubelaker (1974:8) defines an ossuary as, "The collective, secondary deposit of skeletal material representing individuals initially stored elsewhere." He goes on to postulate that ossuary burial along the Atlantic coast represents "nearly complete collections of aboriginal deaths for the time periods and populations the ossuaries served" (1974:14). Because the individuals in the ossuary have come there over a relatively short period of time, and thus shared similar natural and cultural environments, the variability in this population fairly represents the variation in the breeding population whence they came.

Since researchers feel that ossuary material does approximate the overall population at the time the ossuary was formed, valid statistics can be performed on the skeletal remains, including measures of interpopulation variation.

Repositories

Collections were examined at their respective repositories by the author. Table 2 shows where each site is housed.

Table 2: Repositories

National Museum of Natural History Department of Anthropology	Hand (44HA65) Abbyville (44SN22) Terry Collection
Phelps Archaeology Laboratory East Carolina University	Sans Souci (31BR5) Jordan's Landing (31BR7) Baum (31CK9) West (31CK22) Hollowell (31CO5)
Wake Forest University Physical Anthropology Laboratory	Piggot (31CR14) Broad Reach (31CR218) Flynt (31ON305)
North Carolina Office of State Archaeology Research Center	Jarretts Point (31ON309)
Research Laboratories of Anthropology University of North Carolina Chapel Hill	McFayden (31BW67) Garbacon Creek (31CR86) Cold Morning (31NH28)

Populations for this study were initially chosen based on minimum number of individuals present in the collection and ease of access to the remains. When collections from East Carolina University, Wake Forest University, and UNC - Chapel Hill were exhausted, further samples were added from the National Museum of Natural History and the North Carolina Office of State Archaeology. As a result, all Late Woodland ossuaries along the North Carolina coastal plain with a minimum number of individuals greater than eight were examined for this study. Two Virginia populations were added later to increase the Iroquoian sample size, and a sample of modern Caucasians was taken from the Terry Collection for use as a nonmetric benchmark. Complete background information on all sites mentioned in Table 2 above was previously presented in Chapter II.

Trait Selection

As mentioned above, nonmetric traits were selected for performing biological distance analysis in this study. These traits can be characterized mostly as sutures, ossicles, and foramina and were selected based on descriptions of nonmetric traits from Berry and Berry (1967), Ossenberg (1974), and Molto (1983).

Although hundreds of cranial nonmetric traits have been described in biodistance literature (q.v. Hauser and DeStefano, 1989; Ossenberg, 1970, 1974), care must be taken to tailor the trait list to the current research. Whereas some researchers have used upwards of thirty nonmetric variants (Berry and Berry, 1967), others have discovered valid biodistance relationships using as few as eleven nonmetric traits (Buikstra, 1976). Traits to be examined were also selected on the basis of ease of recording and completeness of description in nonmetric trait literature.

A prefatory analysis was conducted in order to determine the utility of the traits selected for this study. Ten crania from each of the three populations were examined and scored for the original 27 chosen nonmetric traits. During the sample data collection, two traits were found to be identical, one trait was not expressed in the sample population collected, and another trait was too difficult to score. These traits were eliminated. One trait was added following sample data collection, bringing the total scored in this study to 25. The final list of nonmetric traits used in analysis of the populations outlined in Chapter II is presented in Appendix A, and a description of each is presented in Appendix B.

Each trait was scored individually as "present" (1), "absent" (0), or "unknown" (2). In the final statistical analysis, the "unknowns" are discarded from the total number of individuals examined for a particular trait. Therefore, there are almost always fewer instances of "presence" and "absence" for a trait than there are recorded individuals. This binary system of presence and absence was applied to the entire cranium. That is, bilaterality of traits was not taken into account when noting presence of a trait. However, because of the lateral nature of most traits used in this study, I could not determine on many fragmented or damaged crania whether a particular trait was present (displaying variation on the missing side of the damaged cranium) or absent (not displaying variation on either side of the cranium). As such, when the location of the trait was missing or damaged, and the other side of the cranium would be scored as "absent," the trait was scored as "unknown." Bilaterality of traits has been used varyingly in biological distance studies, although most studies score simply "presence" and "absence" without regard to which side expresses the trait (Buikstra, 1972; Suchey, 1975; Saunders, 1978). The problem with the so-called "total side frequency" is that it is more realistic to think of individuals as part of a population rather than sides of a cranium, and this method exaggerates sample size while lending redundant information to the analysis (Griffin, 1993). However, see Wijsman and Neves (1986) or Ossenberg (1981) for examples of studies employing bilateral scoring of traits.

Sampling

Very little sampling was used on individual collections in this project, as the MNI for most sites was very small (q.v. Table 1). For most sites, every adult cranium was examined, and all disarticulated adult mandibles were examined as well. The only collection sampling came from the Terry Collection. I did not examine all 1,728 specimens in the collection. Sampling was limited to ethnically White individuals, 26 each of male and female, and care was taken to collect individuals from different adult age groups.

Because there are numerous Algonkian affiliated ossuary sites on the North Carolina coastal plain and a lack of Iroquoian and Siouan sites, I attempted to collect data on relatively equal numbers of each cultural group. This meant, at first, not collecting data on a second large Algonkian ossuary site, West (31CK22). However, since statistical analysis primarily treats each site separately in performing the mean measure of divergence, there was no reason not to include West. Therefore, for completeness of the data in this study, West was collected at a later date.

In looking at the MNIs for various sites (q.v. Table 1), it appears that 228 individuals were pulled from Algonkian-affiliated sites, 57 from Iroquoian-affiliated sites, and 33 from Siouan-affiliated sites. Two Iroquoian sites from Virginia (number of individuals = 32) were added to the North Carolina data (n=25) because so few Iroquoians were represented. However, no additional Siouan ossuary sites were found in North Carolina. Instead of extending this research into South Carolina as well, the Siouan sample remains at only a few dozen. For MMD based on individual site, sampling will not be necessary as the MMD includes a transformation that corrects for small sample sizes (Freeman and Tukey, 1950).

Age and Sex Estimation

Age estimations were not produced for this study, although several of the collections have been analyzed for age (Bogdan, 1989; Hutchinson, 2002; Kakaliouras, 1997; Loftfield and McCall, 1986; NMNH, 2002; Smith, 1984; Truesdell, 1995). The present study is limited to adult individuals, and therefore age estimation only mattered when dealing with potential subadult crania. All crania were examined for evidence of subadulthood. The easiest method of determining this was to examine the maxilla and mandible for evidence of third molar eruption. Third molars generally come into full occlusion between 17 and 20 years of age (Smith, 1991; Ubelaker, 1989). As such, any maxilla or mandible without full eruption of the third molars was classified as a subadult and excluded from the study.

Sex of individuals was determined variously by the author, by Dr. Dale Hutchinson, and by the Anthropology Department at the National Museum of Natural History. Table 3 shows a summary of each site based on sex. Several individual crania from Hand (44SN22) and Abbyville (44HA65) had sex estimations recorded in the collection notes (NMNH, 2002). The Terry Collection has definite sex determinations based on morgue records. Sex estimations for sites curated at the Phelps Archaeology Laboratory at East Carolina University were performed by Dr. Dale Hutchinson for Baum (31CK9), Sans Souci (31BR5), Jordan's Landing (31BR7), and Hollowell (31CO5) (Hutchinson, 2002).

Sites for which sex estimations for individual crania were unavailable included Piggot (31CR14), Garbacon Creek (31CR86), Flynt (31ON305), Jarretts Point (31ON309), Broad Reach (31CR218), McFayden (31BW67), and Cold Morning (31NH28). For these sites, sex was estimated by the author based primarily on gross morphology of the cranium. Robusticity of cranial features such as the supraorbital ridge, the external occipital protuberance, the mandible, and the mastoid process was examined; the more robust the individual, the more likely he was male (q.v. Buikstra and Ubelaker, 1994). Other morphological variations taken into account when assessing sex included parietal bossing and the shape of the eye orbits and

Site	Name	Female	Probably Female	Indeterminate	Probably Male	Male	Total
31BR5	Sans Souci	9	0	2	1	1	13
31BR7	Jordan's Landing	7	0	0	1	4	12
31CK9	Baum	25	11	15	8	31	90
31CR14	Piggot	0	0	2	4	2	8
31CK22	West	5	1	17	4	5	32
31CR218	Broad Reach	0	3	3	4	7	17
31NH28	Cold Morning	4	3	4	5	2	18
31CO5	Hollowell	5	1	10	4	7	27
44HA65	Abbyville	5	0	0	4	7	16
44SN22	Hand	8	0	0	0	8	16
31ON309	Jarretts Point	2	5	19	9	2	37
31CR86	Garbacon Creek	3	2	5	10	6	26
31BW67	McFayden	1	5	4	3	2	15
31ON305	Flynt	3	2	6	3	4	18
	Total	77	33	87	60	88	345
	Percent of Sample	22.4%	9.5%	25.2%	17.4%	25.5%	100%
	PF/F and PM/M combined	32%		25%		43%	100%

Table 3: Sex Estimation

nasal opening (Bass, 1971). Sex was then estimated on the following continuum from female to male, with each of the end points meaning the individual cranium showed a preponderance of traits assigned to that sex:

Female——Probably Female——Indeterminate——Probably Male——Male

In spite of attempting to keep the male/female ratio as even as possible in data collection, it appears from Table 3 that females are underrepresented in the skeletal samples, especially when the groups of "probably female/male" and "decidedly female/male" are combined. When these are not combined, there is more of a balance between females (23%) and males (27%).

The purpose of collecting information on sex is both to eliminate sex-biased traits and to provide answers to several research questions, including that of Iroquoian marriage and residence patterns. Chapter V will discuss how the underrepresentation of females in these skeletal samples affects the question of marriage and residence patterns.

Preliminary Analysis

Intraobserver Error

Whenever a study is performed in which the data could be considered somewhat subjective, a quick analysis of intraobserver error should be accomplished. Cranial nonmetric traits, especially when scored as present or absent, are more clear-cut than traits such as dental nonmetric traits which are scored in degrees of expression. Nevertheless, several researchers who use cranial nonmetric traits have performed studies of intraobserver error as a check in their research (e.g., Suchey, 1975; Molto, 1979). Although interobserver error can be significant when scoring nonmetric traits (Page, 1976), Molto (1979) found that intraobserver error was less than 20% and occurred randomly with cranial nonmetric observations in his study.

All data observed in the present study were collected by the author. Therefore, no interobserver error exists. However, intraobserver error was examined to determine how reliably the author scored the traits. A comparison was made between the original sample of 30 individuals from three different cultural associations and the final data collection, which was performed several months following the sample collection.

Comparing the two samples was accomplished by examining both percent of instances in which the score for a trait differed between sessions and the percent of cases in which a trait was scored as present in one session but not in the other per Nichol and Turner (1986). The overall error percentage in comparing the two samples was 17.4%, lower than that reported by other researchers for nonmetric cranial observations (e.g. Molto, 1979). In examining individual trait errors, several had an error of over 25%. However, upon closer examination of each trait, it should be noted that, whereas the initial sample data collection included numerous scores of "unknown" or (2), the final data collection, performed several months later and after more familiarity was gained with observation of expression of nonmetric traits, matched scores of "absent" (0) and "present" (1) with the "unknown" (2) scores in the initial sample collection. Because Nichol and Turner suggest determining error based on percent of cases in which a trait was incorrectly scored as present or absent, scores of (2) from the initial data collection were then excluded and percentages recalculated. When the recalculation was performed, only one trait remained with an error of over 20%: *highest nuchal line*. Even though the overall error was only around 17%, I decided to omit *highest nuchal line* from further analysis of the data, including MMD, cluster analysis, multidimensional scaling, and trait correlation procedures. Obviously, some intraobserver error existed with regard to this trait, as the *highest nuchal line* is often hard to distinguish. After the *highest nuchal line* is omitted from the error analysis, overall error between the two samples falls to 16.7%.

Trait Correlation

Nonmetric traits, because they are assumed to be genetically controlled, often have correlations among themselves such that expression of one trait often means expression of a different trait as well. The primary ways of analyzing trait correlation are through sex and age analysis.

Age bias generally occurs between young and old individuals, as nonmetric traits are not always completely expressed at a young age and the skeleton remodels throughout one's life (Griffin, 1993). Several researchers have taken age correlation into account in their own studies (Kennedy, 1981; Molto, 1983; Ossenberg, 1969;

Pietrusewsky, 1984). However, because this study involved only adult individuals and because of the fragmentary nature of the remains leading to difficulty in determining age, correlation based on this will not be examined.

Correlation among metric traits based on sex is a problem in biodistance studies, as sexual dimorphism is significant. However, some researchers have concluded that sex-bias in nonmetric traits is minimal (e.g., Berry and Berry, 1967). The most useful examination of nonmetric trait correlation based on sex is Corruccini (1974), who examined over 300 specimens from the Terry Collection for 72 nonmetric traits. He found a high degree of sex-correlated traits in this collection, even after controlling for age and race.

Techniques for discovering sex-correlated traits include literature review (Buikstra, 1976; Kennedy, 1981), chi-square (χ^2) analysis (Buikstra, 1976; Corruccini, 1974; Griffin, 1993; Molto, 1983), ϕ coefficient (Cheverud et al., 1979; Molto, 1983), and tau-b (τ_b) analysis (Griffin, 1989, 1993, 2001; Molto, 1983).

Literature review of sex-correlated traits can be useful when there are difficulties in assessing sex in an archaeological skeletal population. Numerous researchers, such as Berry and Berry (1967), A.C. Berry (1974), Russell (1900), and Corruccini (1974), examined populations of individuals of known sex and recorded assessments of sex-correlated traits. However, it is more useful to discover sex-correlated traits on a study-by-study basis so as to minimize other factors that can vary from population to population, such as age, race, and different environmental variables.

The χ^2 statistic should not be used as an indicator of *strength* of a relationship, as it is a direct function of sample size, but it is useful in determining if there is any *association* between two variables (Thomas, 1986). τ_b and the ϕ coefficient are similar to each other, in that the relationship exists such that $\tau_b = \phi^2$, but the difference between use of these two statistics is that ϕ is used for dichotomous data, whereas τ_b is more useful when a range of possibilities exist. Thus, τ_b is most often used with dental nonmetric data, because those are usually scored with variable expression. Many biodistance researchers tend to employ more than one method of removing sex-biased traits (e.g., Buikstra, 1976; Griffin, 1993; Molto, 1983). For this study, ϕ coefficient, τ_b, and χ^2 were analyzed for signs of sex-associated traits.

χ^2 values were calculated based on presence/absence of each trait for males and females, and ϕ was calculated based on a 2 x 2 contingency table as in the following example:

a	b
c	d

By dividing the χ^2 statistic by n, the sample size, the χ^2 statistic is freed from inflation due to increasing sample size (Thomas, 1986). The result of this division is the new statistic ϕ^2. We can thus take the square root of ϕ^2 to obtain the new statistic ϕ, represented by the following formula:

$$\phi = \frac{ad - bc}{\sqrt{(a+b)(a+c)(b+d)(c+d)}} \tag{1}$$

Presented below in Table 4 is a list of ϕ, τ_b, and χ^2 coefficients for traits based on sex. The χ^2 statistic indicates that there is a statistically significant relationship between sex and trait expression for *infraorbital suture*, *mastoid foramen extrasutural*, and *gonial eversion*. However, as mentioned above, the χ^2 statistic measures the association between sex and trait expression, not the strength of the relationship. Thus, we have to look at the ϕ and τ_b coefficients to assess whether or not to consider these three traits sex-correlated.

For *infraorbital foramen*, both ϕ and χ^2 are less than 0.1, suggesting a very weak association. For *mastoid foramen extrasutural*, ϕ is less than 0.3 and τ_b is less than 0.1, suggesting a slight association. Finally, for *gonial eversion*, ϕ is 0.45 and τ_b is 0.21, suggesting a moderate association. In spite of the χ^2 assessment that these three variants are statistically significant, in looking at ϕ and τ_b, the only variant that is moderately associated with sex appears to be *gonial eversion*.

The easiest way of dealing with correlations based on sex when the study has already been completed is to eliminate biased traits from the study (Kennedy, 1981). Therefore, for the overall MMD statistic, the sex-biased trait *gonial eversion* was discarded prior to analysis of the data. For the purpose of analysis of marriage patterns, though, sex-linked correlations are important. Therefore, no sex-correlated traits were omitted from the statistics performed on male/female groupings.

Trait	ϕ	τ_b	χ^2
infraorbital suture	-0.0991	0.0098	5.5615*
extra infraorbital foramen	0.0901	0.0081	0.3265
zygomaticofacial foramen	0.1703	0.0290	0.0134
os japonicum	-0.0359	0.0013	0.2002
supraorbital foramen	0.1735	0.0301	0.2417
supraorbital notch	0.3221	0.1037	0.0281
metopic suture	0.0068	0.000047	0.0015
coronal ossicle	0.1029	0.0106	1.7257
bregmatic bone	0.0623	0.0039	0.8429
sagittal bone	0.0057	0.000033	0.0016
parietal foramen	0.2160	0.0467	0.0129
pterionic ossicle	0.1071	0.0115	0.9650
mastoid foramen extrasutural	0.2719	0.0739	4.3243**
mastoid foramen absent	-0.0232	0.0005	0.2592
parietal notch ossicle	0.1493	0.0223	3.0322
occipitomastoid ossicle	0.0703	0.0049	0.2971
asterionic ossicle	0.1697	0.0288	3.3083
lambdic ossicle	-0.0453	0.0021	0.9062
os inca	-0.0929	0.0086	2.0720
lambdoidal suture ossicle	0.2406	0.0579	0.8591
divided hypoglossal canal	0.0541	0.0029	0.1133
condylar facet double	0.1380	0.0190	1.5238
mental foramen multiple	0.1408	0.0198	3.6951
gonial eversion	0.4563	0.2083	4.5129**

* significant at the $p \leq 0.025$ level

** significant at the $p \leq 0.05$ level

Table 4: ϕ, τ_b, and χ^2 Coefficients for Trait Associations by Sex

Biodistance Statistics

Mean Measure of Divergence

C.A.B. Smith's mean measure of divergence statistic has been used by several researchers and remains the most widely-used statistic in determining biological distance (e.g., Griffin, 1993; Molto, 1983; Pietrusewsky, 1969; Sjøvold, 1973, 1977). In contrast to using single traits to evaluate population distance (univariate statistics), the MMD is calculated by adding the squared differences between variables of two populations (multivariate statistics). As mentioned, when two populations are different, we would expect a large MMD value, and when they are similar, a smaller MMD value would result. This dissimilarity between populations is what is termed "biological distance," referring to Euclidean distance.

Smith's MMD includes an angular transformation for trait frequencies for each population, which helps prevent sampling error from distorting the biodistance statistic. With the MMD, there is the necessity to correct for small sample sizes as well by using another transformation. The transformation used in this study is that of Freeman and Tukey (1950), as it best corrects small sample sizes that are found in archaeological populations, as small as n=10 (Green and Suchey, 1976).

The MMD statistic used in this study is as follows:

$$MMD = \frac{\sum_{i=1}^{r}(\Theta_{1i} - \Theta_{2i})^2 - \left(\frac{1}{n_{1i}+\frac{1}{2}} + \frac{1}{n_{2i}+\frac{1}{2}}\right)}{r} \tag{2}$$

in which r is the number of traits used, Θ_{1i} and Θ_{2i} are the transformed frequencies in radians of the i^{th} trait in the comparison groups, and n_{1i} and n_{2i} are the numbers of individuals who are scored for the i^{th} trait in the group.

Freeman and Tukey's angular transformation is as follows:

$$\Theta = \frac{1}{2}\sin^{-1}\left(1 - \frac{2k}{n+1}\right) + \frac{1}{2}\sin^{-1}\left(1 - \frac{2(k+1)}{n+1}\right) \tag{3}$$

in which k is the number of individuals scored as "yes," and n is the total number of individuals scored in the population (i.e., scored as either "yes" or "no").

Finally, the variance and standard deviation of the MMD are calculated using the following formulae based on Sofaer (1986):

$$Var_{MMD} = \frac{2}{r^2}\sum_{i=1}^{r}\left[\frac{1}{n_{1i}+\frac{1}{2}} + \frac{1}{n_{2i}+\frac{1}{2}}\right]^2 \tag{4}$$

$$sd_{MMD} = \sqrt{Var_{MMD}} \tag{5}$$

In order to interpret the mean measure of divergence statistic, it is necessary to know at which level one of the values between pairs of sites is statistically significant. According to Sjøvold (1977), when the MMD is equal to or greater than twice the amount of the standard deviation, the value is significant at the $p \leq 0.05$ level. Negative MMD values result from closely associated groups or as a result of too small a sample size (Turner and Bird, 1981). There are some problems with interpreting the MMD statistic. An insignificant MMD statistic can mean that there is close association between populations (Constandse-Westermann, 1972), and a significant MMD could be the result of random genetic drift over time in the same population (Grüneberg, 1952, 1963).

For this analysis, both MMD and standardized MMD were calculated. The latter value can be obtained by dividing the MMD by the standard deviation (Sofaer et al., 1986). The reasoning behind this is that when different sample sizes are used, the variance will vary. For purposes of statistical significance, only original MMD calculations were used. For purposes of visualizing the data, such as in multi-dimensional scaling, the standardized MMD values were used. Standardized MMD values correct for differences in variance and serve to "amplify" the data so that they can be plotted more easily in graphical representations such as those that multidimensional scaling produces.

The MMD statistics, as well as Θ values and standardized MMD values, were produced by a computer program written for the author by Patrick Reynolds, a computer science Ph.D. student at Duke University. This program reads in raw data as a comma-delimited table of the values (0), (1), and (2), tallies the counts of "present" and "absent," and produces the above-mentioned statistics, as well as MMD tables (q.v. Table 5).

Cluster Analysis

Cluster analysis serves to elucidate population affinity by creating groups such that similar sites are placed into the same group. Using the arcsine transformed trait variances (Θ values) mentioned above, groups are formed based on agglomeration. Each group starts out as isolated, and when the tolerance is lowered, eventually all individual groups will form one large group. Θ values are used in cluster analysis instead of mean measure of divergence data because a distance matrix is unnecessary for clustering. This statistical method is best used to group data, and the Θ values are the end result of multivariate statistics to produce one value by which to compare one population to another.

The best cluster analysis technique for biological distance is that of Ward's minimum variance (1963), which was used with statistically significant results by Molto (1983) and Griffin (1993). Ward's variance was designed such that variance within clusters is minimal. Each step of the variance transformation combines two clusters that result in the smallest increase in the within group sum of squares.

Cluster analysis statistics are often represented by a chart much like one depicting the evolution of languages around the world or like a stem chart of a family tree, known as a dendrogram. Interpretation of the dendrogram is performed by examining the "far" branches (usually the left-hand side of the graph) and the "near" branches (the right-hand side of the graph). A dendrogram that clearly delineates two groups will have small distances in the far branches and large differences in the near branches.

When the distances on the far branches are large, however, the grouping is not very effective and the dendrogram needs to be interpreted with caution. Dendrograms can also help discover "runts" in the data, or objects that do not join another group until the last few steps of the clustering.

A statistical computer package, such as SPSS or Systat, will easily perform a cluster analysis and generate a dendrogram of the data. Both programs were utilized in performing cluster analysis on the present data, but all dendrograms are the result of Systat output.

Multidimensional Scaling

Multidimensional scaling attempts to position numbers in three-dimensional space rather than clustering them using population samples and standardized mean measures of divergence discussed above. In contrast to simple data, which can often be fitted to a line (one-dimensional), multidimensional scaling allows for graphical representation and interpretation of two- or three-dimensional data, or those that can be represented by points on a map or points in space.

The main goal of MDS is to uncover underlying dimensions of the data that can help to explain similarities or dissimilarities between populations. Basically, MDS is a graphical representation of distance data. If, for instance, a distance matrix such as is often found in a road atlas is analyzed using MDS, a scatterplot of the distances would be the result. If the data set includes cities of the United States, the resultant MDS scatterplot would show New York and Boston closer together on the plot than they would be to Kansas City, which in turn would be about half-way between East Coast cities and a West Coast locale such as Los Angeles. Using this simple example, it is easy to see why multidimensional scaling would be useful for uncovering associations in the biological distance data that the MMD statistic might determine as statistically insignificant.

A technical definition of multidimensional scaling is that it finds a set of vectors in p-dimensional space such that the matrix of Euclidean distances among them corresponds as closely as possible to some function of the input matrix according to a criterion function called stress (Shiffman et al., 1981). The concept of stress in MDS is a complicated one, but the smaller the stress, the better the representation of the distance data within the matrix. Statistical packages such as SPSS and Systat will calculate the MDS and the stress for you, such that all that remains for the researcher to do is carefully interpret the results.

The key thing to remember in interpreting an MDS graph is that the axes are meaningless. As in the example above with U.S. cities, orientation of the cities in a scatterplot does not have to correspond to compass points–New York and Boston could be located in the bottom left quadrant of the plot. However, the relationships between points in the matrix remain the same. In general, larger distances are more accurate, as they are not as prone to distortion due to stress, and smaller distances should be interpreted with caution. Two things to look for in an MDS graph are clusters and dimensions. Clusters obtain when observations are closer to each other than to other observations, while dimensions are thought to explain the perceived similarity between items. Dimensions are more useful to examine when dealing with perceptive or judgment data, and as such will not be examined for this study.

In sum, multidimensional scaling is a method for visualizing distance data and for uncovering latent dimensions to a data set. It will be used in this study in the former way, to help elucidate relationships among archaeological populations. Both SPSS and Systat were used in generating MDS statistics and scatterplots, but the resulting scatterplot figures in this research were generated by Systat.

Summary

Ever since people began to critically examine the human skeleton, nonmetric variation has been recorded. In the 1960s, Berry and Berry published a precedential study on nonmetric variation in the human skeleton based on their previous studies in wild mice. Nonmetric traits assume that gene flow is relatively static, such that any change in the gene pool affects phenotypic expression of traits, which can translate to increased biological distance. Research into the utility of metric versus nonmetric traits has concluded that both are equally valid. As the sites examined in this study were from secondary burial in ossuaries, nonmetric traits were selected for analysis. Nonmetric traits were selected primarily on the basis of ease of recognition both in biodistance literature and on individual crania. Twenty-five variants were selected and scored as "present," "absent," or "unknown" from the fourteen archaeological sites and one modern collection. Overall intraobserver error was examined and found to be within reasonable limits. However, observer error for one particular trait was overly high, and as such it will be excluded from further analysis in Chapter IV. Trait correlation was examined on the basis of sex; age correlation was not assessed as this study only includes adult individuals. Based on ϕ, τ_b, and χ^2, it was discovered that one trait was most likely sex-correlated. Therefore, it will also be excluded from further population distance analyses but not from analysis of marriage and residence patterns. Statistics employed in this study are C.A.B. Smith's mean measure of divergence, cluster analysis, and multi-dimensional scaling. Results of these statistics will be presented in Chapter IV. Questions other than biological relationships between Native American groups will also be answered in succeeding chapters, including those regarding marriage patterns and possible affiliation of so-called border sites.

Chapter IV - Results

Mean Measure of Divergence

Cultural Group Differentiation

Mean measure of divergence statistics and cluster analysis were performed on the nonmetric trait data in order to test two hypotheses. Hypothesis 1 states that there is little to no difference between archaeologists' so-called cultural groups (Algonkian, Iroquoian, and Siouan), and Hypothesis 3 states that so-called border sites that are difficult to type archaeologically could be clarified based on MMD data.

Table 5: Mean Measures of Divergence between Cultural Groups

	Iroquoian	Siouan	Algonkian	Hollowell	Caucasian
Iroquoian	—	-0.0674	0.0915	-0.1541	**0.0704**
Siouan	-0.3844	—	-0.0949	-0.4646	0.0574
Algonkian	4.3187	-0.5680	—	-0.0912	**0.1793**
Hollowell	-0.7828	-1.3785	-0.4791	—	-0.0763
Caucasian	**3.3220**	0.3450	**16.1942**	-0.4029	—

Figures above the diagonal are MMD statistics; below the diagonal are standardized MMDs.
Figures in bold are significant at the $p \leq .05$ level.

The results of the MMD are presented in Table 5 above. MMD statistics are most often presented in a cross-wise table, with the MMD statistic above the diagonal and the standardized MMD below the diagonal. The MMD for each pair of populations is shown at the intersection of the rows and columns for those populations. From the table above, the MMD between Iroquoians and Caucasian populations is 0.0704, while the standardized MMD for the same pairing is 3.3220. As shown in the table by boldface numerals, the only statistically significant differences among the five groups–Algonkian, Iroquoian, Siouan, Hollowell, and the Terry Collection–are between Caucasian and Iroquoian groups and between Caucasian and Algonkian groups.

Hypothesis 1 thus cannot be rejected, as there are no statistically significant differences among the three main cultural groups archaeologists have delineated on the North Carolina coastal plain. Hypothesis 3 cannot be accepted, as the MMD statistic does not clarify whether a relationship exists between Hollowell and any other cultural group. However, Hypothesis 3 also cannot be rejected at this time, pending further statistical analysis that could further explicate Hollowell's cultural affiliation.

Site Differentiation

In order to test Hypotheses 2, that there is little difference among archaeological populations on the North Carolina coastal plain during the Late Woodland period, both MMD and cluster analysis statistics were used to clarify population relationships.

Table 6 provides the MMD statistics between all possible combinations of archaeological populations and the Terry Collection sample of Caucasian individuals. As shown in the table, the only statistically significant measure of divergence among all 15 sites is between 31CK9, the Baum site, and the Terry Collection.

Hypothesis 2, therefore, is not rejected, as there are no statistically significant differences among the North Carolina or Virginia archaeological populations. The one statistically significant difference is between an archaeological population and the Terry Collection of Caucasian individuals. The reasons for lack of differences between other archaeological populations and the Terry Collection will be addressed in Chapter V.

Residence Patterns

In order to test Hypothesis 4, that marriage and residence patterns can be discovered using nonmetric trait data and the MMD statistic, the MMD was performed on the populations given in Table 1 as probably of Iroquoian ancestry. Choice of the Iroquoian-speaking populations was made because ethnographic information states that the Iroquois were a matrilineal and matrilocal society (Lane and Sublett, 1972).

Lane and Sublett (1972:198) discovered that the Iroquois from their sample of AD 1850 to AD 1930 populations from Pennsylvania most likely practiced a patrilocal residence. Their conclusion is supported by ethnographic data that noted that,

Table 6: Mean Measures of Divergence between Archaeological Populations

	31BR5	31BR7	31BW67	31CK22	31CK9	31CO5	31CR14	31CR218	31CR86	31NH28	31ON305	31ON309	44HA65	44SN22	TC
31BR5	—	-0.4603	-0.7173	-0.5721	-0.3007	-0.7421	-0.5298	-0.5397	-0.6603	-1.1015	-0.7029	-1.0799	-0.3793	-0.4814	-0.3194
31BR7	-1.1769	—	-0.2652	-0.0977	0.0002	-0.2185	-0.2675	-0.2634	-0.2305	-0.5369	-0.0291	-0.4879	-0.1613	-0.2415	0.0032
31BW67	-1.5452	-1.0179	—	-0.1266	-0.1805	-0.5068	-0.4861	-0.5221	-0.3589	-0.8816	-0.3832	-0.7993	-0.2306	-0.2783	-0.0311
31CK22	-1.5622	-0.6316	-0.5382	—	-0.0406	-0.2141	-0.0744	0.0052	-0.2009	-0.3399	-0.0813	-0.6866	-0.0484	-0.1719	-0.0264
31CK9	-0.9605	0.0017	-0.9652	-0.5424	—	-0.0829	0.0172	0.0997	-0.0917	-0.3734	0.0641	-0.5533	0.0635	0.0036	**0.1771**
31CO5	-1.5826	-0.8338	-1.4529	-0.9087	-0.4320	—	-0.1412	-0.3290	-0.3049	-0.7352	-0.3749	-0.7648	-0.2258	-0.2079	-0.0763
31CR14	-1.2322	-1.1457	-1.5438	-0.3569	0.1111	-0.4662	—	-0.5016	-0.2203	-0.5137	-0.2251	-0.7884	0.0187	-0.2171	0.2457
31CR218	-1.2287	-1.1137	-1.6847	0.0246	0.6166	-0.9948	-1.7715	—	-0.1530	-0.6046	-0.1693	-0.6732	-0.0038	-0.1571	0.2153
31CR86	-1.6239	-1.0998	-1.2971	-1.0978	-0.6630	-0.9953	-0.8805	-0.5385	—	-0.7054	-0.2342	-0.7604	-0.0189	-0.1782	0.0462
31NH28	-1.7747	-1.3215	-1.8275	-0.8914	-1.1449	-1.5310	-1.1377	-1.3283	-1.6804	—	-0.5018	-1.0672	-0.3210	-0.2920	-0.1933
31ON305	-1.6367	-0.1272	-1.2720	-0.4017	0.4188	-1.1573	-0.8249	-0.5639	-0.8412	-1.1307	—	-0.6362	-0.0577	-0.0504	0.0545
31ON309	-1.8309	-1.1550	-1.5947	-1.6873	-1.5391	-1.5505	-1.6558	-1.4133	-1.7188	-1.7298	-1.3697	—	-0.3930	-0.4963	-0.2204
44HA65	-1.1311	-1.2907	-1.1069	-0.4868	1.5154	-1.0842	0.1045	-0.0212	-0.1221	-0.9185	-0.3349	-1.0410	—	-0.1115	0.0367
44SN22	-1.3531	-1.6568	-1.2065	-1.3511	0.0511	-0.9243	-1.0699	-0.7812	-1.0483	-0.7870	-0.2649	-1.2259	-1.1956	—	0.0207
TC	-1.0309	0.0326	-0.1685	-0.3657	**12.8022**	-0.4029	1.6107	1.3540	0.3391	-0.5985	0.3607	-0.6165	0.9306	0.3093	—

Figures above the diagonal are MMD statistics; below the diagonal are standardized MMDs.

Figures in bold are significant at the $p \leq .05$ level.

around this time period, most Iroquois practiced patrilocal residence, even though previous ethnographers such as Lewis Henry Morgan felt the Iroquois were the model of matrilocal society (Lane and Sublett, 1972).

The aforementioned study was unprecedented in its combination of ethnohistory and osteological data to uncover information about cultural practices in the archaeological past. While this study produced fascinating results about Iroquoian residence patterns, unfortunately the data from North Carolina populations was not as conducive to analysis.

No statistically significant differences exist in comparing females and males from each North Carolina Iroquoian-speaking population, or what Lane and Sublett call *intra-cemetery variation*. Table 7 below gives MMD and standard deviation for these comparisons. As mentioned earlier, a statistically significant MMD is greater than twice its standard deviation. Since none of these cases fulfills that requirement, there are no statistically significant differences between non-metric trait expression of males and females from each of these populations.

Table 7: Intra-cemetery Iroquoian Males and Females (MMD)

Site	Sex 1	Sex 2	MMD	st dev	MMD/sd
31BR5	F	M	-1.3870	0.6298	-2.2021
31BR7	F	M	-0.6380	0.3923	-1.6260
44HA65	F	M	-0.2944	0.1514	-1.9438
44SN22	F	M	-0.2858	0.2305	-1.2398

As well, no statistically significant differences exist in comparing males and females across Iroquoian-speaking populations in North Carolina, or what Lane and Sublett call *inter-cemetery variation.* Table 8 below gives MMD and standard deviation values for males by population and then females by population. As above, there are no statistically significant differences in non-metric trait expression among males or females in these populations.

Table 8: Inter-cemetery Iroquoian Males and Females (MMD)

Site 1	Site 2	Sex	MMD	st dev	MMD/sd
31BR5	31BR7	M	-1.0971	0.5846	-1.8768
31BR5	44HA65	M	-0.7233	0.3902	-1.8538
31BR5	44SN22	M	-0.9621	0.4383	-2.1946
31BR7	44HA65	M	-0.5282	0.3101	-1.7034
31BR7	44SN22	M	-0.5482	0.3502	-1.5653
44HA65	44SN22	M	-0.2991	0.1372	-2.1799
31BR5	31BR7	F	-0.5954	0.4381	-1.3591
31BR5	44HA65	F	-0.6368	0.3927	-1.6214
31BR5	44SN22	F	-0.6109	0.4110	-1.4864
31BR7	44HA65	F	-0.1859	0.2572	-0.7229
31BR7	44SN22	F	-0.4481	0.2737	-1.6372
44HA65	44SN22	F	-0.1742	0.2398	-0.7263

Because the data do not support statistically significant differences between males and females in the Iroquoian-speaking populations, it must be concluded that residence and marriage patterns cannot be inferred from this sample, thereby nullifying Hypothesis 4.

Cluster Analysis

In order to further examine the distance data generated by the MMD statistic, two methods of cluster analysis were employed. First, hierarchical clustering based on cultural group was performed in order to assess Hypothesis 1, whether culturally-determined population groups were substantiated by nonmetric crania data. The results of clustering based on groups is presented in Figure 18 below.

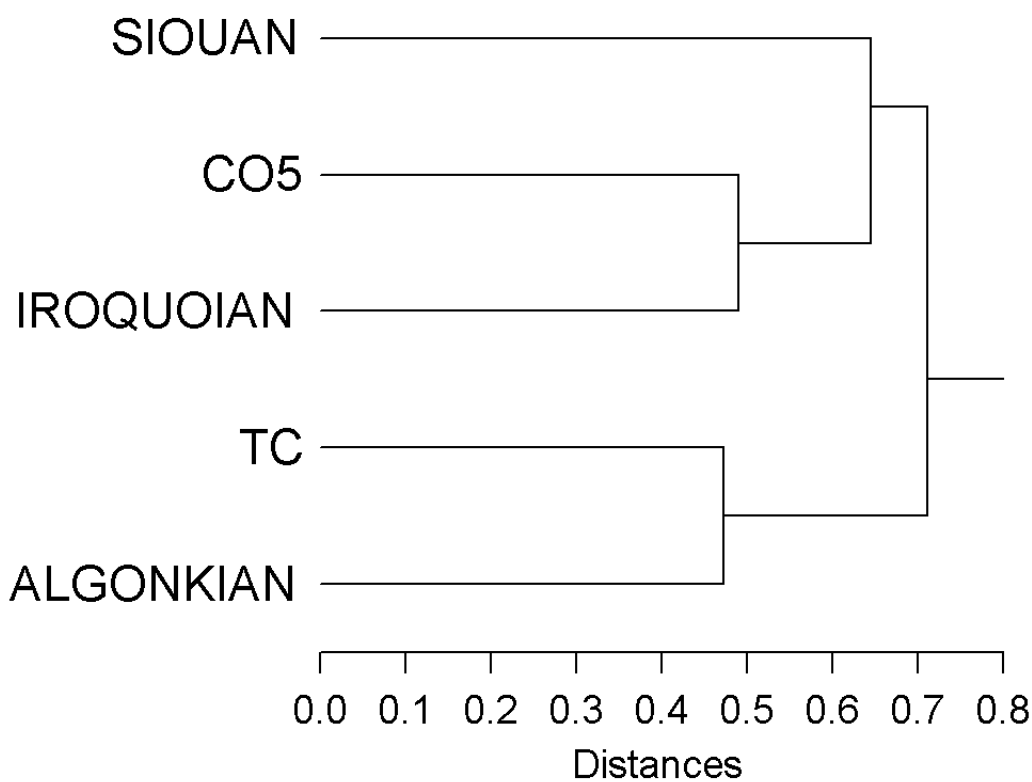

Figure 18: Cluster Analysis - North Carolina Cultural Groups and Terry Collection

This cluster analysis shows that Siouans and Iroquoians form a group before Algonkians. This means that based on the North Carolina data, Iroquoians and Siouans are more similar to each other than either of them is to the Algonkians.

The other question this cluster analysis helps answer is that of Hypothesis 3, whether border sites such as Hollowell can be affiliated based on skeletal data. The above cluster analysis graph shows that Hollowell clusters closer to the other Iroquoian groups (Hand, Abbyville, Jordan's Landing, and Sans Souci) than to the Algonkian or Siouan groups. The fact that the Terry sample clusters with the Algonkian one, in spite of its statistically significant MMD value, will be discussed in Chapter V.

A second cluster analysis was performed for all archaeological populations separately, presented in Figure 19 below, in order to help answer Hypothesis 1, whether or not groups on the North Carolina coastal plain during the Late Woodland were significantly different in terms of skeletal biology.

Again, although the distance data on which this cluster analysis is based are not statistically significant (with the exception of Baum to Terry), relationships between the sites still obtain. There are a few outliers or runts in this cluster–sites that cluster very late and are therefore probably more different from the other sites. The odd sites in the clustering are Cold Morning (31NH28), Piggot (31CR14), and Jarretts Point (31ON309). Some caveats must be given in these interpretations: namely, Piggot had the smallest sample size of all examined populations (n=8); Jarretts Point consists of both 31ON309 and 31ON304, possibly two small, separate ossuaries; and Cold Morning is of questionable Siouan affiliation. It is therefore not surprising that these sites cluster later than the rest.

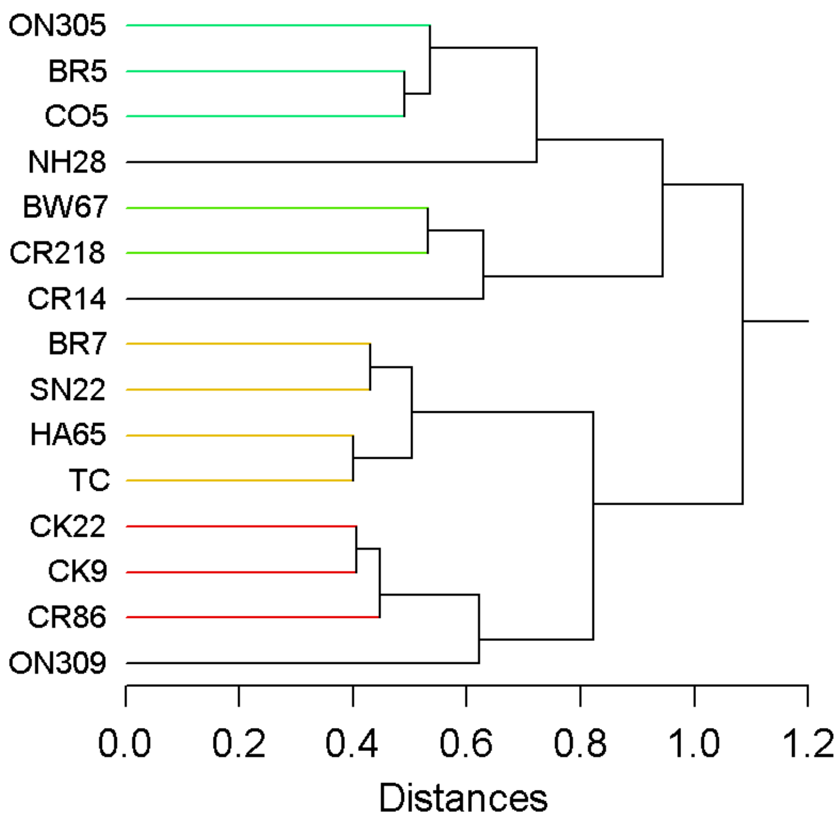

Figure 19: Cluster Analysis - North Carolina Archaeological Populations and Terry Collection

To examine Hypothesis 2, whether cultural groups are valid demarcations of populations, one can look at the smaller clusters of sites. For instance, three of the four Iroquoian sites cluster together–Jordan's Landing (31BR7), Hand (44SN22), and Abbyville (44HA65). Also, there is a large cluster of Algonkian-affiliated sites in West (31CK22), Baum (31CK9), Garbacon Creek (31CR86), and Jarretts Point (31ON309). From the cluster analysis, it would appear that there is some skeletal basis to the current culture-history model. However, not all sites cluster neatly into Algonkian, Siouan, and Iroquoian groups, so Hypothesis 2 cannot be rejected.

Finally, to further examine Hypothesis 3, that Hollowell and other border sites can be culturally affiliated based on skeletal data, the site cluster analysis was examined. Figure 19 shows Hollowell clustering with Sans Souci (31BR5), a site that is most likely Iroquoian. Their clustering away from the other three Iroquoian sites is problematic, but multidimensional scaling will show a more comprehensible visualization of the distance data than cluster analysis often provides.

Multidimensional Scaling

The final tool for visualizing distance data used by researchers is multidimensional scaling. While some researchers use three dimensions to visualize distance, two dimensions suffice for the data at hand and prove easier to read. Figure 20 below is a two-dimensional MDS graph based on the standardized MMD values.

The MDS graph clearly shows Jarretts Point (31ON309) as an outlier, or a point that is not close to any other point in both dimensions. Sans Souci (31BR5) is also an outlier in two dimensions, but in one dimension it is close to Jordan's Landing (31BR7) and Hollowell (31CO5). Again, most points cluster around the middle of the graph because the standardized MMD values were very low.

There are no very clear clusters in this MDS graph, except Baum (31CK9) and Terry are relatively close. The reason for this association will be addressed further in Chapter V. With the exception of Jarretts Point (31ON309), all of the Algonkian-affiliated sites are in the upper half of the graph, and most of those are located in

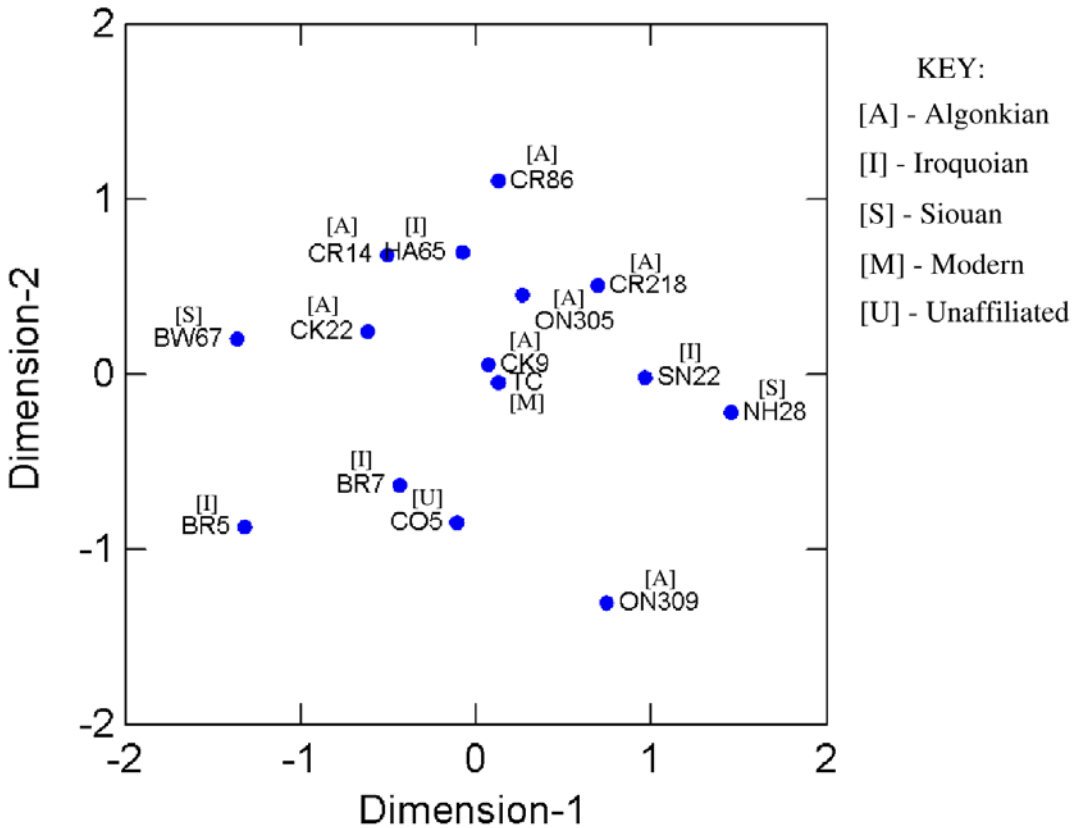

Figure 20: Multidimensional Scaling Based on Standardized MMD Values

the upper left quadrant. The Iroquoian-affiliated sites, however, are all below the midline.

Summary

In this chapter, statistical results from C.A.B. Smith's mean measure of divergence, cluster analysis, and multidimensional scaling were examined in order to test the main hypotheses of this study. Hypothesis 1, that there are no major differences among archaeologists' cultural groups of Native Americans, was not rejected based on insignificant MMDs. Cluster analysis, however, showed slight association between Iroquoian and Siouan groups. Hypothesis 2, that there are no major differences among archaeological populations on the North Carolina coastal plain individually, was also tested using the MMD statistic, cluster analysis, and multidimensional scaling. No statistically significant MMDs were obtained between any Native American pairing, although one was obtained between Baum (31CK9) and the Terry Collection. Based on the MMD, Hypothesis 2 could not be rejected. Further cluster analysis and multidimensional scaling show certain sites that join the cluster late, but multidimensional scaling did not contribute much to the understanding of this hypothesis. Hypothesis 3, that border sites could be identified and possibly associated based on skeletal data, was tested using the MMD statistic, as well as cluster analysis and multidimensional scaling. A cultural group MMD did not generate any statistically significant differences between Hollowell (31CO5) and any of the three cultural groups. Cluster analysis and multidimensional scaling, however, suggest that Hollowell most likely belongs with the Iroquoian group. Finally, Hypothesis 4, that marriage and residence patterns can be uncovered from the present archaeological data, was tested using the MMD statistic. However, because of a lack of significance in the statistics, nothing could be concluded about Iroquoian residence or marriage patterns on the North Carolina coastal plain during the Late Woodland.

Chapter V - Conclusions and Discussion

Biological Diversity

The lack of biological diversity shown in the between-sites MMD statistic is expected for populations inhabiting the North Carolina coastal plain during the Late Woodland period. The Late Woodland spans a time period from AD 800 to contact–approximately AD 1600 in this area of the country. It is unlikely that no interaction between cultural groups occurred during this 800-year period. Exogamous pairings between populations are likely to have occurred, resulting in lack of biological continuity during this period. However, as nonmetric trait variation has the ability to distinguish between very closely tied groups of individuals, the lack of variation cannot be dismissed this easily.

To compound this problem, only one statistically significant difference was obtained between Native American archaeological sites and the sample of Caucasian individuals from the Terry Collection. Three possibilities were explored to determine why more differences did not result from the data at hand:

1. Sample size of the archaeological sites was too small.

2. Terry Collection individuals do not constitute a homogeneous sample.

3. Archaeological populations do not constitute a representative sample of the actual population.

First, sample size of the archaeological sites was explored. The Baum site (31CK9) was by far the largest sample in this study (n=90), so I hypothesized that the large number of individuals in the sample contributed to the statistically significant MMD between Baum and Terry. To test this, I took a random sample of the Baum individuals of n=27, which represents the average number of individuals examined per archaeological population. Statistical significance was still obtained between Baum and Terry, in spite of the sampling ($MMD = 0.1024, sd = 0.0305, p \leq .05$).

Second, I thought that the Terry Collection might not represent a homogeneous sample, as individuals identified as "white" could come from largely different ethnic backgrounds. However, researchers such as Finnegan (1978) and Corruccini (1975) have attested to the homogeneity of the Terry Collection, particularly in reference to the Caucasian individuals. In fact, the Caucasian sample from Terry is considered to be more homogeneous than the Black sample from Terry, as there is up to 15% gene admixture with Caucasians in this population (Corruccini, 1975; Finnegan, 1978).

However, I decided to test the Caucasian sample used in this study for homogeneity. Ossenberg (1976) used the MMD obtained when comparing a population to itself as a rough guide for continuity of a sample. Following that, the MMD obtained in comparing Terry to itself is -0.0403 with standard deviation of 0.0119. In addition, when I randomly split Terry into four groups of 13 individuals and compared those MMD statistics as if they were from four different groups, the resulting MMDs range from -0.0181 to -0.0843. All of these MMD statistics show no statistically significant differences–in fact, the MMD results obtained are among the lowest and most consistent in this study. Therefore, the Terry sample is most likely homogeneous.

The third possibility examined was that the archaeological populations do not constitute a representative sample of the actual populations. Testing this assumption involved tabulating further MMD statistics. An MMD was computed between Terry and all other sites treated as one large Native American population. This result was statistically significant ($MMD = 0.1430, p \leq .05$), meaning all North Carolina Native American populations as an aggregate are different from the Caucasian sample. Further, to eliminate the possibility of inflated sample size when comparing Terry (n=52) to all Native American individuals (n=345), a stratified sample (relatively equal numbers of Algonkian, Iroquoian, and Siouan individuals) was taken from Native American groups of n=52 for ease of comparison with Terry. When this MMD was performed, the result was also statistically significant ($MMD = 0.1454, p \leq .05$).

To further test this third possibility, comparisons were made between the present data, including Terry, and data obtained from Mark Griffin's (1993) Ph.D. dissertation. Griffin examined nonmetric cranial and dental traits from three Guale sites and four comparative sites from the southeast United States and scored them for 21 nonmetric cranial traits, 14 of which overlapped with my chosen traits. I chose three of these populations for comparison to the North Carolina populations: Irene Mound in Chatham County, Georgia (n=248); Santa Catalina de Guale de Santa Maria on Amelia Island, Florida (n=112); and Ledford Island in east Tennessee (n=456). Temporal periods for these sites are, respectively, AD 1150-1550, AD 1686-1702, and AD 1400-1600 (Griffin, 1993:11). Because of the differences in geographical location, culture, and time period in the Florida and Tennessee samples, the North Carolina populations should be significantly different in terms of manifestation of cranial nonmetric traits.

Site 1	Site 2	MMD	st.dev.
31CK9	Terry	0.2274	0.0175
31CK9	Irene	0.1779	0.0162
31CK9	SCdG-SM	0.1468	0.0169
31CK9	Ledford	0.1600	0.0234
31CK22	Irene	0.2393	0.0795
31CK22	SCdG-SM	0.1865	0.0804
Terry	Irene	0.2066	0.0138
Terry	SCdG-SM	0.1361	0.0144
Terry	Ledford	0.1074	0.0211

Table 9: Statistically Significant North Carolina, Tennessee, and Georgia MMD Statistics

When the MMD statistic was performed across all population pairings, several statistically significant differences were obtained. Table 9 clearly shows that Baum is significantly different from the Florida and Tennessee samples, as is the Terry Collection. Surprisingly, West (31CK22) produced some significant MMD values, meaning that, as a sample, it is more homogeneous and larger than I previously thought. However, those values represented in Table 9 are the only statistically significant differences between Native American groups and other sample populations. It is not likely that every North Carolina population except West and Baum is not statistically different from the Tennessee, Georgia, and modern Caucasian populations. It is more likely that a combination of sample size and lack of continuity of the archaeological samples is resulting in non-significant MMD values. Figure 21 is a cluster analysis of the North Carolina samples, the Terry sample, and the Georgia and Tennessee populations from Mark Griffin's data. It is obvious just how different Griffin's samples are from the North Carolina and Terry samples.

While some archaeological populations such as Piggot (n=8) probably suffer from too small a sample size, most are over n=10, a number that researchers have determined is probably the smallest sample size on which an MMD can be based (Green and Suchey 1976; Freeman and Tukey, 1950). It is likely, though, that for these North Carolina populations sample size does not matter as much as consistency and preservation of the available sample. The Baum site is unique on the North Carolina coast in that it is a large, well-preserved collection of individuals who were most likely interred in a short time period, thereby fairly accurately representing the larger pop-

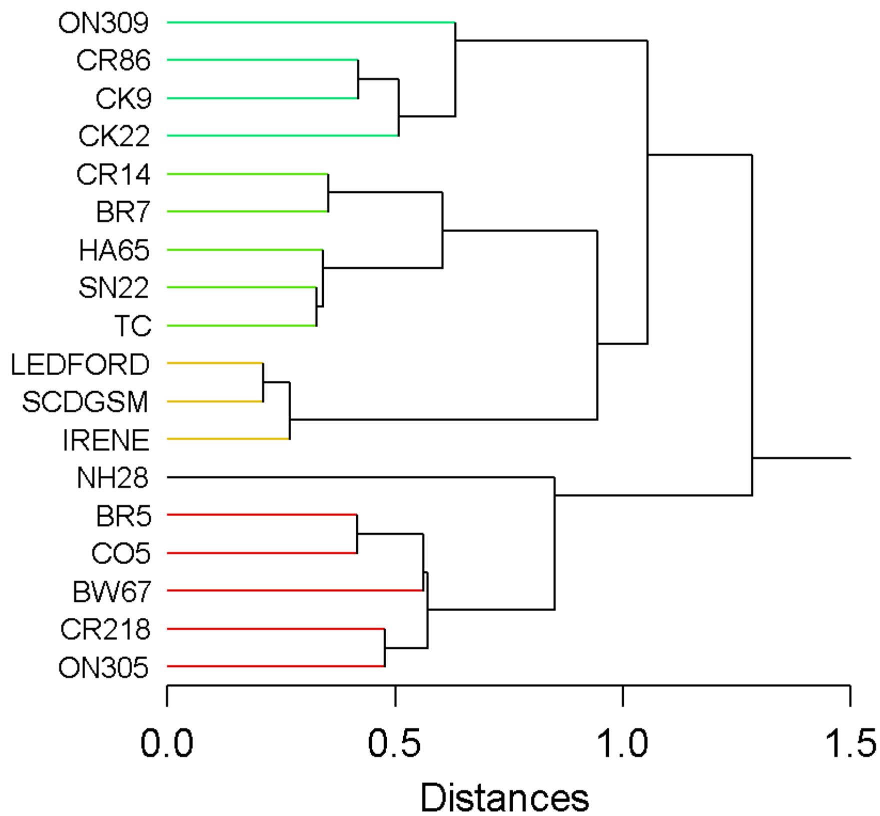

Figure 21: Cluster Analysis Graph of North Carolina, Georgia, Tennessee, and Terry Samples

ulation (Ubelaker, 1974). The Baum crania were excellently preserved, considering the location of the ossuary along a bank, resulting in more definitive observations of nonmetric traits and fewer instances of coding individual traits as indeterminate. The preservation and cohesiveness of the Baum sample is indicated in the fact that, even when Baum is sampled to n=27, statistically significant results still obtain between it and the Terry Collection. The West site is also relatively large with decent preservation of crania, evidenced by its ability to be easily differentiated from the Florida samples. However, if West were as tight a sample as Baum, statistically significant results between it and the Terry Collection and the Ledford Island sample likely would have been obtained.

There is a difference between adequacy of sample size and lack of consistency in a sample, although in many of these North Carolina archaeological populations the two are found in association. As mentioned, the Freeman and Tukey (1950) angular transformation for C.A.B. Smith's mean measure of divergence statistic corrects for small sample sizes, as small as n=10. Most of the North Carolina samples are larger than this, so no problems with sample size were expected. However, in tabulating frequencies for the MMD statistic, all instances of (2) or "not observable" are effectively discarded. In looking at Table 1 and Appendix D, for example, although for Baum the number of crania and mandible examined was 90, for the first trait examined, only 22 crania could be scored. For West, although n=32, the number of crania that could be examined for Trait 1 only totalled 4, meaning only 12.5% of individuals could be reliably scored. One of the strengths of nonmetric trait analysis is that it can be performed on incomplete crania such as are often found at archaeological sites. However, if the number of individuals examined for a single trait is very small, consistency of the sample must be questioned. For this reason, some researchers (e.g. Buikstra, 1976; Corruccini, 1974) remove traits that are expressed in less than 5% of the entire sample to be examined. Because of the already small sample sizes and poor preservation of many of the North Carolina sites, trait reduction was not performed. Should further comparisons be made between nonmetric cranial data and metric or nonmetric dental or postcranial data, a trait-reductionist approach would probably be useful.

The implications of this lack of cohesiveness and smallness of sample size in archaeological samples is that we must be careful in performing statistical analysis to take into account all factors that could influence a sample. Had only North Carolina populations been examined with no comparative populations, the conclusions in this paper would have been significantly different. I would have determined definitively that no statistically significant differences were present among Native American groups in the North Carolina coastal plain. However, in light of the above findings, this conclusion–while not completely irrelevant–must carry the caveat of careful interpretation. The MMD, though, is not the only statistic used in this research, and two descriptive statistics–cluster analysis and multidimensional scaling–help visualize the data and assess the conclusions.

Cluster analysis of the North Carolina archaeological populations as delineated in Table 1 revealed that Iroquoian and Siouan groups form a cluster among themselves and are thus more similar to each other than they are to the Algonkian group. Further cluster analysis based on individual archaeological populations revealed some clear clusters that are to be expected geographically. Referring to Figure 6 and Figure 19, Baum (31CK9) and West (31CK22) cluster together relatively early, as they are both located in Currituck County. As well, towards the bottom of Figure 19, Flynt (31ON305) and Broad Reach (31CR218) cluster, as they are very closely related geographically. Hollowell (31CO5) clusters early with Sans Souci (31BR5), a nearby Iroquoian site. Also, three of the four Iroquoian sites, Jordan's Landing (31BR7), Abbyville (44HA65), and Hand (44SN22), cluster together. Again, based on geography, many of these associations are to be expected. The most interesting cluster to result from this graph is that of Hollowell and Sans Souci, as the affiliation of Hollowell has been unclear for a long time. This association will be discussed further in a succeeding section.

Multidimensional scaling of the nonmetric distance data for archaeological populations for the most part clusters around zero, which is not helpful to the present discussion. However, there are some outliers, such as Jarretts Point (31ON309) and Cold Morning (31NH28), that were discovered by cluster analysis and MDS but not by the MMD statistic. Of course, just because cluster analysis and multidimensional scaling identify these sites as odd, that does not mean there is a clear interpretation to their eccentricity. Further analysis, outside the scope of this paper, could be performed on sites identified as odd, and should be performed before further research on skeletal data is accomplished. The MDS graph (Figure 20) does, however, show Hollowell (31CO5) as occupying close space with both Jordan's Landing (31BR7) and Sans Souci (31BR5). Implications of this association will be discussed in a succeeding section. It is interesting to note in this graph that Baum (31CK9) and the Terry Collection sample are closely associated. As was noted in the cultural grouping cluster analysis (Figure 18), Algonkians and Terry clustered before Algonkians clustered with either the Iroquoian or Siouan groups. The reason for this is outlined in the discussion of sample size and continuity above. Primarily because of the lack of continuity in many of the archaeological population samples, insignificant statistical results were obtained. This is not to say that statistical insignificance is not a valid conclusion, but that because of the problems with continuity and sample size, all MMD values should be guardedly analyzed. Without performing further tests, I am not completely sure why Terry and Baum cluster so neatly in multidimensional scaling, but I suspect that sample size and continuity are major factors.

The above-outlined issues, especially with regard to the MMD statistic, should not discourage further statistical analysis of skeletal data from North Carolina. In spite of problems with sample size and continuity, statistical analysis still remains a more valid way to discover associations among groups than merely visually examining a few specimens from each archaeological population. While there may be type skulls in palaeoanthropology or type ceramics in archaeology, when dealing with large skeletal series the most important aspect to examine is intra-population variation. Until variation within a site is examined, no comparisons should be made outside of that population. The mean measure of divergence statistic amalgamates data on intra-population variation and, through multivariate statistical techniques, creates new values that can be compared across populations. The fact that some archaeological sites have too small a sample size or continuity to obtain significantly different MMD values is only a further warning to anyone who wishes to create a model based in whole or in part on skeletal remains. If there is not enough variation in a sample population to obtain an MMD, it is impossible that there is enough variation to select one individual as representative of that population. In the past, archaeologists have avoided the sample size problem by collecting populations into cultural groups and then attempting to select one type skull (see Figure 5). While cluster analysis suggests that there might be some truth to an Algonkian/Iroquoian/Siouan delineation, no statistically significant results were obtained from cranial data for distance, neither in comparing archaeological populations to each other nor in comparing cultural groups.

It is hoped that Ann Kakaliouras' aforementioned dental nonmetric data or comparison between them and the present data will help elucidate questions about population relationships on the North Carolina coastal plain during the Late Woodland. Because her data consist of dental variations of both adults and subadults, it is hoped that no problems with sample size or continuity exist and that valid MMDs will be discovered. Further research collaboration between Kakaliouras' work and the present study will be discussed in a succeeding section.

Residence Patterns

Validating ethnographically-known residence patterns using osteological data is a fascinating bridging of two aspects of anthropology. One of the intents of this study was to determine whether marriage or residence patterns could be inferred from the skeletal data at hand, following the landmark study of Lane and Sublett (1972).

The data from this study, though, do not support statistically significant differences between males and females in the Iroquoian-speaking populations. In addition to the lack of divergence between the sexes, meaning an inability to assess marriage patterns, there is also no clear heterogeneity within the male or female samples, meaning residence patterns also cannot be examined. The present data also suffer from an underrepresentation of females in the Iroquoian sample, which could very well have affected the MMD. More likely, though, the sample size was not large or cohesive enough to produce statistically significant MMD statistics.

It has been said that the Iroquois were the model of the matriarchal society, although Lane and Sublett (1972) found that, at the time of contact with Europeans, the Iroquois had changed to a largely patriarchal society. Their biological distance data reiterated their conclusions. It is unfortunate that the North Carolina Iroquoian samples could not further bolster the conclusions about Iroquoian marriage and residence patterns. However, further studies of marriage and residence patterns among Iroquoian, Algonkian, and Siouan sites in North Carolina and Virginia could prove fruitful in helping assess the validity of ethnographic data.

Border Sites

Mean measure of divergence statistics do not conclusively place Hollowell (31CO5) into any cultural group. That having been said, however, in visualizing the extant data, cluster analysis and multidimensional scaling contribute to a better understanding of Hollowell's cultural affiliation.

When Hollowell is set aside to be compared with Algonkian, Iroquoian, Siouan, and Caucasian populations, the MMD that results is not significantly different from any of the four groups. Cluster analysis, though, clearly showed that Hollowell was closer to the four archaeologically Iroquoian populations than to either the Algonkians or the Siouans. Multidimensional scaling also shows Hollowell clustering with Jordan's Landing (31BR7) on one dimension, while it clusters with Sans Souci (31BR5) on two dimensions, suggesting a fairly close association.

If all archaeological populations were as consistent Baum (31CK9), it would probably be an easier task to differentiate border sites. But archaeological preservation is a reality in which we have to work. What this means for the present study is not that Hollowell cannot be reliably typed based on skeletal data; it means that the results obtained from this study must be assessed within the larger rubric of cultural and contextual information about Hollowell. Numerous Cashie phase ceramic shards were found at Hollowell, and the location of the ossuary was on the border of the Algonkian and Iroquoian regions. While Phelps (1982) suspected Hollowell was an Algonkian site, the physical remains appear to cluster more closely with those of suspected Iroquoian groups, such as Jordan's Landing and Sans Souci, than with nearby Algonkian groups, such as Baum and West. Analysis of skeletal remains can accurately place a site within a larger context, in the case of border sites, if the site to be determined is well-preserved and homogeneous.

Summary

Analysis of diversity of the Late Woodland inhabitants of the North Carolina coastal plain did not reveal any significant biological differences either among populations or among cultural groups. Possible conclusions that can be drawn from the mean measure of divergence statistic are: 1) that populations and cultural groups were likely not different and therefore likely included genetic admixture among populations; and 2) that sample size or continuity should be further examined before the statistical analysis is accepted as fact. Erring on the side of caution, the latter theory was examined, and it was discovered that sample size and sample continuity very likely contributed to at least some of the insignificant MMD results. As such, caution was taken to accurately analyze the data using MMD, cluster analysis, and multidimensional scaling techniques. No definitive conclusions were drawn regarding association between archaeological populations or between cultural groups. The border site examined in this study, however, was determined to be most likely affiliated with the Iroquoian group. Finally, marriage and residence pattern analysis did not reveal any clear trends, possibly owing to the sample problems outlined above.

Future Research

Following completion of this thesis, comparisons will be made with the work of Ann Kakaliouras, who is undertaking a biodistance study of the North Carolina coastal plain using dental traits for her Ph.D. dissertation at the University of North Carolina at Chapel Hill. Dental and cranial nonmetric trait analysis should correlate well with regard to population distance patterns, and together could provide a fuller picture of the biology of the people of the North Carolina coastal plain.

However, the coastal plain is in immediate need of a metric study of ossuary remains. Nonmetric analysis can uncover some genetic linkage in populations, arguably better than metrics because the latter is more prone to change in conjunction with variation in diet and the natural environment, but craniometric analysis can provide indices by which we could compare size variation among populations. There could be some truth to the "robust Algonkian" and "gracile Siouan" theory, but this proposed continuum needs to be systematically studied and quantified to be of any value to archaeologists or physical anthropologists. Research cannot be accomplished based on gross morphological assessments from workers untrained in examining the range of variation of a normal population.

David Phelps, in his precedential 1983 study in which he outlines an archaeological model for the North Carolina coastal plain, admits that "the major content of this paper, then, is an initial model of culture history for the region, fraught with all of the inadequacies of current data, but offered as a basis for future work" (1983:2). In spite of the author's caveat, though, this model has not been reexamined in light of advances in population studies and recent ossuary finds. Once the "robust" versus "gracile" type is fully explored, perhaps sparking a new generation of North Carolina archaeologists to develop an updated model, we will be able answer more pressing questions regarding the lifestyles and burial practices of prehistoric Native Americans.

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Appendices

Appendix A - Nonmetric Trait List

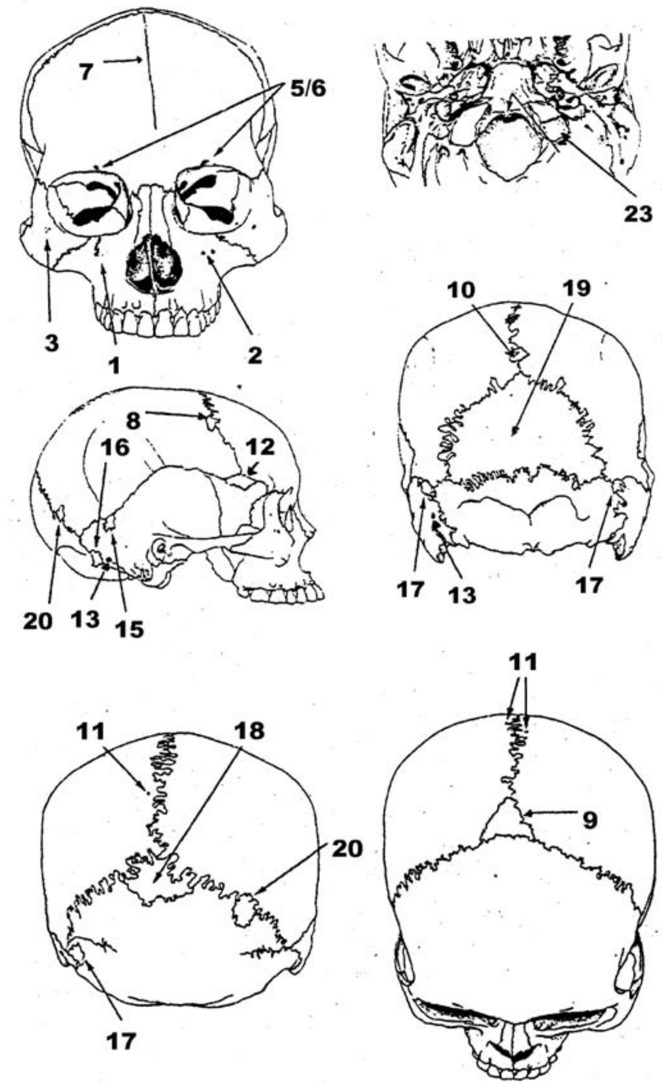
Master's Thesis Research - ECU *Nonmetric Trait Analysis Worksheet* *Kristina Killgrove, Dept. of Anthropology*

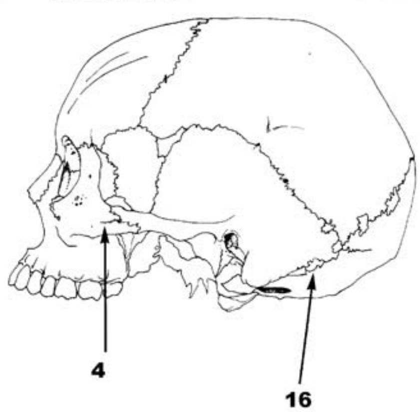
Site: _______________ Individual: _____________________ Sex: _________ Age: _______ Date: ____________________

M/F/I A/J

0 = absent 1 = present 2 = not observable

1. infraorbital suture _______
2. extra infraorbital foramen _______
3. zygomaticofacial foramen _______
4. os japonicum _______
5. supraorbital foramen _______
6. supraorbital notch _______
7. metopic suture present _______
8. coronal ossicle _______
9. bregmatic bone _______
10. sagittal bone _______
11. parietal foramen _______
12. pterionic ossicle _______
13. mastoid foramen extrasutural _______
14. mastoid foramen absent _______
15. parietal notch ossicle _______
16. occipitomastoid ossicle _______
17. asterionic ossicle _______
18. lambdic ossicle _______
19. os inca _______
20. lambdoidal suture ossicle _______
21. highest nuchal line present _______
22. divided hypoglossal canal _______
23. condylar facet double _______
24. mental foramen multiple _______
25. gonial eversion _______





Appendix B - Nonmetric Trait Descriptions

Trait No.	Trait	Description	Reference
1	infraorbital suture	A suture running from the medial articulation of the zygomatic and the maxilla posteriorly to the infraorbital foramen.	Molto, 1983
2	extra infraorbital foramen	The foramen that allows passage of the infraorbital nerve is sometimes divided by a bar of bone or occurs as two separate foramina.	Kennedy, 1981
3	multiple zygomaticofacial foramen	A foramen occurring on the external surface of the lateral portion of the zygomatic. It may be absent, single, or multiple.	Kennedy, 1981
4	os japonicum	The zygomatic is sometimes divided into superior and inferior portions, resulting in a suture due to incomplete fusion of the two primary growth centers. The inferior portion is called the os japonicum.	Kennedy, 1981
5	supraorbital foramen	Complete foramen immediately below the supraorbital ridge on the bony ridge of the upper eye socket.	Berry and Berry, 1967
6	surpraorbital notch	Incomplete foramen, or notch, immediately below the supraorbital ridge on the bony ridge of the upper eye socket.	Berry and Berry, 1967
7	metopic suture present	In a few individuals, the mediofrontal suture which usually disappears within the first two years of life persists into adulthood.	Berry and Berry, 1967
8	coronal ossicle	Ossicles are sometimes found in the coronal suture.	Berry and Berry, 1967
9	bregmatic bone	A sutural bone may occur at the junction of the sagittal suture with the coronal one.	Berry and Berry, 1967
10	sagittal bone	Ossicles in the sagittal suture.	Kennedy, 1981

Trait No.	Trait	Description	Reference
11	parietal foramen	This pierces the parietal bone near the sagittal suture a few centimetres in front of lambda.	Berry and Berry, 1967
12	pterionic ossicle	Also called *epipteric bone*. A sutural bone inserted between the anterior inferior angle of the parietal bone and the greater wing of the sphenoid.	Berry and Berry, 1967
13	mastoid foramen extrasutural	Sometimes the mastoid foramen lies outside the suture between the mastoid process of the temporal bone and the occipital bone.	Berry and Berry, 1967
14	mastoid foramen absent	Sometimes the mastoid foramen will be missing altogether.	Berry and Berry, 1967
15	parietal notch ossicle	A separate bone may form between the squamous and mastoid portions of the temporal bone at the parietal notch.	Berry and Berry, 1967
16	occipitomastoid ossicle	Occasionally, a bone is found in the suture between the temporal bone and the occipital bone.	Molto, 1983
17	asterionic ossicle	Asterion is located at the junction of the posterior inferior angle of the parietal bone with the occipital bone and mastoid process of the temporal bone. Ossicles can form at this junction.	Berry and Berry, 1967
18	lambdic ossicle	A bone occurring at the junction of the sagittal and lambdoid sutures.	Berry and Berry, 1967
19	os inca	Occasionally the inferior and superior squama of the occipital bone are separated by a suture which runs from asterion to asterion.	Kennedy, 1981
20	lambdoid suture ossicle	One or more ossicles may occur in the lambdoid suture.	Berry and Berry, 1967

Trait No.	Trait	Description	Reference
21	highest nuchal line present	The highest nuchal line is sometimes present above the inferior and superior nuchal lines. It arises with the superior at the external occipital protuberance, and arches anteriorly and laterally.	Berry and Berry, 1967
22	divided hypoglossal canal	This canal pierces the anterior part of the occipital condyle and transmits the hypoglossal nerve. The nerve originates in several segments and can cause the canal to be divided in two.	Berry and Berry, 1967
23	condylar facet double	Occasionally the articular surface of the occipital condyle is divided into two distinct facets.	Berry and Berry, 1967
24	mental foramen multiple	An extra discrete foramen slightly smaller than and usually posterior to the principal mental foramen of the mandible.	Kennedy, 1981
25	gonial eversion	The gonial angle where the rami of the mandible articulate with the body of the mandible are sometimes everted.	Lane and Sublett, 1972

Appendix C - Raw Data

Codes Used in Data Entry:

0 = absent
1 = present
2 = not observable

M = Male
F = Female
I = Indeterminate Sex
IPM = Indeterminate - Probably Male
IPF = Indeterminate - Probably Female

Trait numbers correspond to those in Appendices A and B.

Site	Individual	Sex	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
31BR5	1	F	2	2	2	2	1	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	2	2	0	0
31BR5	2 A	F	2	2	2	2	0	1	0	2	0	2	2	2	1	0	0	2	0	2	0	2	0	2	2	0	1
31BR5	2 B	F	2	2	2	2	2	2	0	2	0	0	2	2	2	2	0	0	0	0	0	1	0	2	2	2	2
31BR5	5 A	F	2	2	1	2	1	1	0	2	2	2	1	2	1	2	2	2	0	2	0	1	0	2	2	0	1
31BR5	5 B	F	2	2	2	2	1	0	0	0	0	0	2	2	2	2	0	2	2	0	0	0	0	2	2	0	0
31BR5	6	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31BR5	6 C	M	2	2	2	2	1	1	0	0	0	0	1	2	1	0	0	0	0	0	0	0	0	2	2	1	1
31BR5	6 D	F	2	2	2	2	0	1	0	0	0	0	1	2	2	2	0	2	0	0	0	1	0	2	2	2	2
31BR5	6 E	F	2	2	2	2	2	2	2	2	0	0	1	2	0	0	2	2	0	0	0	2	0	2	2	2	0
31BR5	7 C	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31BR5	7 D	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31BR5	7 E	F	2	2	2	2	1	1	2	2	2	2	2	2	1	0	0	2	0	0	0	1	2	2	2	0	1
31BR5	8	F	2	2	2	2	0	0	0	0	0	0	0	2	2	2	0	2	2	0	0	1	0	2	2	0	1
31BR7	10 A	F	2	2	2	2	1	1	2	0	0	0	0	2	0	0	0	1	1	0	0	1	0	2	2	0	1
31BR7	10 B	F	1	0	0	2	2	1	0	0	0	0	1	2	1	0	0	0	0	0	0	1	0	2	2	0	1
31BR7	11 A	M	2	2	2	0	0	1	0	2	0	0	1	2	2	2	0	1	1	0	0	1	1	2	0	0	1
31BR7	12	F	2	2	2	2	0	1	0	2	0	0	1	2	0	0	0	2	0	0	0	0	0	2	2	2	2
31BR7	13	F	2	2	2	2	2	2	0	2	2	2	2	2	2	0	2	2	2	2	0	2	0	2	2	2	1
31BR7	16	F	2	2	0	0	1	1	0	0	0	2	2	0	2	2	1	2	1	2	0	1	2	2	2	2	0
31BR7	2	IPM	2	2	2	2	2	2	2	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31BR7	20	F	2	2	2	2	0	1	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	1	2	0	1
31BR7	25	M	0	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31BR7	26	F	2	2	2	2	1	1	0	0	0	0	1	2	2	2	0	2	0	0	0	0	0	2	2	0	1
31BR7	4	M	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31BR7	7 A	M	2	2	2	2	0	1	2	2	0	0	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31BW67	Bur 1	I	2	2	2	2	2	2	2	2	0	2	2	2	2	2	2	2	2	0	0	2	2	2	2	2	1
31BW67	Bur 11	IPF	2	2	2	2	2	2	0	2	0	2	2	2	2	2	2	2	2	0	0	1	0	2	2	2	2
31BW67	Bur 12	IPF	2	2	2	2	1	2	2	2	0	2	2	2	2	2	2	2	2	2	0	2	1	2	2	2	2
31BW67	Bur 13	I	2	2	2	2	1	1	0	2	2	2	1	2	1	0	0	2	2	2	0	2	2	2	2	2	2
31BW67	Bur 24	I	2	2	2	2	2	2	2	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
31BW67	Bur 27	IPF	2	2	2	2	2	1	2	2	2	2	1	2	2	2	1	1	2	2	2	2	2	2	2	0	2
31BW67	Bur 29A	M	2	2	2	2	1	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
31BW67	Bur 29B	M	2	2	2	2	2	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
31BW67	Bur 2A	IPM	2	2	2	2	2	2	2	2	1	1	0	2	2	2	2	2	2	0	2	2	2	2	2	0	1
31BW67	Bur 2B	IPF	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	1	0	2	2	2	2
31BW67	Bur 3	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31BW67	Bur 31	IPM	2	2	2	2	1	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
31BW67	Bur 4	IPF	2	2	2	2	0	1	0	0	0	2	1	2	2	2	2	2	2	2	2	2	2	2	2	0	2
31BW67	Bur 5	I	2	2	2	2	2	2	2	2	0	0	0	2	2	2	2	2	2	0	0	2	2	2	2	2	2
31BW67	South's Adult	F	2	0	1	0	1	0	0	2	0	2	2	0	1	0	0	0	0	1	0	1	0	0	0	2	2
31CK9	1 A	F	0	0	1	2	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1
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31CK9	1 BB	M	2	2	1	0	1	1	0	0	0	2	1	2	1	0	0	0	0	0	0	2	2	0	2	0	1
31CK9	1 CC	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
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31CK9	1 I	M	1	2	2	2	1	0	0	2	2	0	0	2	2	0	2	2	2	0	0	0	1	0	0	2	1
31CK9	1 II A	M	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CK9	1 II B	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CK9	1 J	M	0	2	0	0	0	1	0	1	0	2	1	2	2	2	0	0	0	0	0	1	1	0	0	0	1
31CK9	1 KK	M	1	0	0	0	0	1	2	2	0	1	0	0	1	0	0	1	1	1	0	1	0	2	2	0	1
31CK9	1 LL	F	2	2	0	0	0	0	0	2	2	0	0	2	2	2	0	2	0	0	0	0	1	0	2	2	2
31CK9	1 M	M	0	1	1	2	1	0	0	0	0	2	2	0	1	0	0	2	1	0	0	2	1	2	2	0	1

Site	Individual	Sex	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
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31CK9	1 O	F	2	2	1	2	1	0	0	0	0	0	0	2	0	0	1	0	1	1	0	1	0	2	2	0	0
31CK9	1 OO	F	2	2	2	2	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	2	2	2
31CK9	1 P	IPM	2	2	2	2	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	2	0	1
31CK9	1 PP	F	2	2	2	2	1	1	0	0	0	0	0	2	0	0	1	0	1	0	0	1	0	0	0	0	1
31CK9	1 R	M	2	2	2	2	1	0	0	2	0	0	1	2	2	0	1	2	0	0	0	1	0	2	2	0	1
31CK9	1 RR	M	1	0	1	0	1	1	0	0	0	1	1	0	0	0	0	0	1	0	0	1	1	0	0	0	1
31CK9	1 T	F	0	0	0	0	1	0	0	0	0	2	2	0	1	0	0	2	0	0	0	0	0	1	0	2	2
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31CK9	1 UID	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0
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31CK9	1 V	F	0	0	2	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1
31CK9	1 Y	M	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
31CK9	1 Z	IPF	1	0	0	0	1	1	0	2	0	0	1	0	0	0	0	2	0	0	0	0	1	1	0	0	0
31CK9	3	IPM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1
31CK9	5	IPF	2	2	1	2	1	1	0	2	0	2	2	2	2	2	2	2	2	2	2	2	2	0	0	2	2
31CK9	5 (MAND 1)	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
31CK9	5 (MAND 2)	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31CK9	5 (MAND 3)	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
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31CK9	5 B	M	0	0	1	0	1	1	0	0	0	2	1	0	1	0	0	0	1	0	0	2	1	0	0	0	1
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31CK9	5 E	F	2	2	0	2	0	1	0	0	0	0	0	2	2	2	2	2	2	0	0	0	1	2	2	0	1
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31CK9	5 G	M	0	2	0	0	1	0	0	2	2	2	1	2	0	0	2	2	2	2	0	2	0	0	0	0	0
31CK9	5 H	F	2	2	2	2	0	1	0	2	2	1	1	2	2	2	2	2	2	1	0	1	0	2	2	2	2
31CK9	5 N	IPM	2	2	2	2	0	1	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31CK9	5 S	IPF	2	2	0	2	1	1	0	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	0	2
31CK9	5 Sect V	I	2	2	2	2	2	2	2	2	0	2	2	2	2	2	2	2	2	2	2	2	0	2	2	2	1
31CK9	5 Sect V&VIII - 1	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0
31CK9	5 Sect V&VIII - 2	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
31CK9	5 Sect V&VIII - 3	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0
31CK9	5 T	IPF	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	2	2	2
31CK9	5 UID	F	2	2	2	2	1	0	0	2	2	2	2	2	1	2	0	2	0	0	0	0	0	2	2	2	2
31CK9	5 UID	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0
31CK9	6 A	M	2	2	2	2	0	1	0	2	2	2	2	2	2	2	2	1	0	2	2	1	0	2	2	2	2
31CK9	6 B	I	2	2	2	2	0	1	0	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31CK9	6 C	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1	1	2	2	2	2
31CK9	6 D	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	2	0	2	2	2	1
31CK9	6 E	IPF	2	2	2	2	0	1	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
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31CK9	7 B	M	2	2	0	0	0	1	0	0	0	0	1	2	1	0	0	0	0	0	0	0	0	2	2	0	1
31CK9	7 C	M	2	2	1	0	1	1	1	0	0	0	0	2	1	0	0	0	1	0	0	0	0	1	0	0	1
31CK9	7 CC	F	2	2	0	2	0	1	0	2	0	0	0	2	2	2	0	2	1	0	1	1	0	2	2	0	1
31CK9	7 E	IPF	1	1	1	2	1	1	0	2	2	0	2	2	2	2	2	2	1	0	0	2	0	0	0	2	2
31CK9	7 G	M	0	2	0	2	1	2	2	0	0	0	2	2	1	0	0	0	1	2	0	1	1	2	2	0	1
31CK9	7 I	M	2	2	2	2	1	0	0	0	0	0	0	2	2	2	2	2	2	0	0	1	1	2	2	1	0
31CK9	7 J	M	2	2	0	2	1	0	0	2	0	2	0	2	2	2	1	2	2	2	2	2	0	2	2	2	2
31CK9	7 K	M	2	2	0	2	1	1	0	0	0	2	1	2	1	0	1	2	1	1	0	1	0	2	2	0	1
31CK9	7 L	M	2	2	1	0	1	1	0	0	0	0	1	0	2	2	0	0	1	1	0	1	1	2	2	0	1
31CK9	7 M	M	2	2	2	2	0	1	0	0	0	0	1	2	2	2	2	2	2	0	0	2	1	0	0	0	1
31CK9	7 N	F	1	2	2	2	0	1	0	0	0	0	0	2	1	0	2	2	2	0	0	0	0	1	0	0	1
31CK9	7 O	F	1	1	0	2	0	1	0	0	0	0	1	0	0	0	1	0	1	0	0	0	1	0	2	1	0
31CK9	7 P	F	2	2	0	2	1	1	0	0	0	0	1	2	1	0	0	2	0	0	0	0	0	0	0	0	0
31CK9	7 Q	M	2	0	1	2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	2	2	0	0
31CK9	7 R	F	0	0	1	2	1	0	0	0	0	0	1	2	1	0	0	0	0	0	0	0	1	2	2	2	2
31CK9	7 S	M	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1

Site	Individual	Sex	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
31CK9	7 T	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CK9	7 U	F	2	2	0	2	0	1	0	2	0	0	0	2	0	0	0	2	2	1	0	1	0	2	2	2	2
31CK9	7 UID 1	IPF	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0
31CK9	7 UID 2	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CK9	7 UID 3	IPF	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0
31CK9	7 UID 4	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	0
31CK9	7 VV	IPF	2	2	2	2	1	0	0	0	0	0	0	2	0	1	0	0	1	0	0	0	2	0	0	2	2
31CK9	7 W	F	1	1	2	2	1	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	2	0	1
31CK9	7 Y	M	2	1	0	2	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	1	2	2	1	1
31CK9	7 Z	F	2	2	2	2	0	1	0	2	0	0	1	2	0	0	0	0	0	1	0	0	1	2	2	2	2
31CK9	8	IPF	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31CK9	B1 BOX 12 BAG 17	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31CK22	Bur 2 C10	M	1	1	0	2	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	1	2	0	2	2	2
31CK22	Bur 2 C6	M	2	2	1	2	1	1	0	2	0	0	0	2	0	0	0	0	0	0	0	0	2	2	2	2	2
31CK22	Bur 2 C31	M	2	2	2	2	1	0	0	0	0	0	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31CK22	Bur 2 C5	IPM	2	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	0	2	2
31CK22	Bur 2 C25	IPM	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	0	2	2	2	2	2	2	2
31CK22	Bur 2 C40	IPF	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2	2	2	2	2
31CK22	Bur 2 C38	F	2	1	0	2	2	1	2	2	2	2	2	2	0	0	2	0	0	0	0	0	2	0	0	2	2
31CK22	Bur 2 C29	F	1	2	1	2	1	2	0	0	0	0	0	2	2	2	2	2	0	0	0	0	2	2	2	2	2
31CK22	Bur 2 C15	F	0	0	0	2	1	1	0	2	2	2	2	2	2	2	2	2	2	0	0	2	2	2	2	0	2
31CK22	Bur 2 C7	F	2	2	2	2	1	1	0	0	0	0	1	2	0	1	0	0	0	0	0	0	2	2	2	2	2
31CK22	Bur 2 D27 F19 #1	I	2	2	2	2	0	1	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31CK22	Bur 2 D27 F19 #2	I	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31CK22	Bur 2 D30 F3	M	2	2	2	2	1	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31CK22	Bur 2 C13	IPM	2	2	2	2	0	1	0	0	0	0	0	2	2	2	2	2	2	0	0	2	2	2	2	2	2
31CK22	Bur 2 C24	M	2	2	0	2	0	1	0	0	0	0	0	2	2	2	2	2	2	0	0	1	2	2	2	2	2
31CK22	Bur 2 C20	F	2	2	2	2	2	2	2	2	0	0	1	2	1	0	2	2	2	0	1	0	2	2	2	2	2
31CK22	Bur 2 C35	I	2	2	2	2	2	2	2	2	2	2	0	2	2	2	2	2	2	0	0	2	2	2	2	2	2
31CK22	D27	IPM	2	2	2	2	2	1	1	0	0	0	1	2	2	2	2	2	2	0	0	1	2	2	2	2	2
31CK22	D16 F20	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CK22	D5 F26	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CK22	D29 F8	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CK22	Beach Coll HB	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CK22	D30 F4	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0
31CK22	D14 F6 1	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0
31CK22	D14 F6 4	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
31CK22	Bank Coll 5/14 1	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CK22	Bank Coll 5/14 2	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
31CK22	Bank Coll 5/14 3	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2
31CK22	Bank Coll 5/14 4	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0
31CK22	Sect C2 D51	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CK22	Near C30 D4 F16	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0
31CK22	Bank Coll 5/14 D17 F5	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CO5	A	IPM	2	2	2	2	1	0	0	0	0	0	0	2	2	2	2	2	2	0	0	1	2	2	2	2	2
31CO5	B	F	2	2	2	2	1	2	2	0	0	0	0	2	2	2	2	2	2	2	2	1	2	2	2	2	2
31CO5	B	F	2	2	1	2	2	1	0	2	0	0	1	2	2	2	0	2	2	0	0	2	2	2	2	2	2
31CO5	C	F	2	2	2	2	1	1	2	0	0	0	0	2	0	0	2	2	2	0	0	2	2	2	2	0	0
31CO5	D	M	2	2	2	2	1	1	0	0	0	0	1	2	0	0	0	2	1	0	0	0	0	2	2	0	1
31CO5	E	F	2	2	2	2	2	1	2	2	2	0	1	2	0	1	0	0	0	0	0	1	0	0	0	0	1
31CO5	E	M	2	2	2	2	1	1	0	0	0	0	0	2	2	2	2	2	2	0	0	2	1	2	2	0	0
31CO5	F	M	2	2	1	0	1	1	0	0	0	0	0	2	1	0	0	0	0	2	0	0	2	2	2	0	1
31CO5	F	M	2	2	1	2	0	1	0	0	0	2	2	2	2	2	2	2	0	0	0	2	0	2	2	2	2
31CO5	G	F	2	2	2	2	0	1	2	0	0	0	0	2	2	0	2	2	2	0	0	2	0	2	2	2	2
31CO5	G	I	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CO5	G	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
31CO5	G	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0
31CO5	G	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Site	Individual	Sex	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
31CO5	G	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31CO5	G	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31CO5	G	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
31CO5	G	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31CO5	G	M	2	0	1	0	1	1	0	0	0	0	0	2	1	0	2	0	0	0	0	2	1	0	0	0	1
31CO5	H	IPF	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	2	2	2	2
31CO5	No Prov	I	2	2	2	2	2	2	0	2	0	2	1	2	1	0	2	2	2	0	0	1	2	2	2	2	2
31CO5	No Prov	IPM	2	2	2	2	1	1	0	2	0	0	0	2	2	2	2	2	2	0	0	1	1	2	2	2	2
31CO5	No Prov	M	2	2	2	2	0	0	2	0	0	0	1	2	0	0	0	2	0	0	0	1	0	2	2	2	2
31CO5		I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	2
31CO5		IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CO5		IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CO5		M	2	2	2	2	0	1	0	0	0	0	1	2	2	2	0	1	0	0	0	1	1	2	2	2	2
31CR14	Bur 1 D5	M	1	0	0	1	1	1	0	0	0	2	1	0	1	0	1	1	0	0	0	1	1	0	0	2	2
31CR14	D6	M	2	2	0	2	0	1	0	0	0	2	2	2	1	2	0	2	2	0	0	2	0	2	2	2	2
31CR14	Gp ? Bur 1 Mand 1	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0
31CR14	Gp ? Sk 2	IPM	2	2	2	2	0	1	0	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31CR14	Gp ? Sk 3	IPM	2	2	2	2	1	0	0	2	2	0	1	2	2	2	2	2	2	0	0	1	1	2	2	2	2
31CR14	Gp D Mand 8	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
31CR14	Gp D Sk 7	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	2	1	2	2	2	2
31CR14	Skull 3A	IPM	2	2	2	2	2	2	2	2	2	0	1	2	2	2	2	2	2	0	0	0	1	2	2	2	2
31CR86	Head 14	M	2	2	0	2	1	1	0	2	2	2	2	2	1	0	2	2	1	2	2	2	2	2	2	2	2
31CR86	Head 16	I	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	0	2	1	2	2	2	2	2
31CR86	Loc 1	I	0	0	1	0	2	2	2	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31CR86	Loc 1 Head 10	F	2	2	2	2	0	1	0	2	0	0	0	2	1	0	0	0	2	0	0	1	0	0	2	2	2
31CR86	Loc 10	IPF	2	2	0	1	1	2	2	0	0	1	1	2	1	0	0	0	0	0	0	1	0	2	2	2	2
31CR86	Loc 11	F	2	0	0	0	1	1	0	0	0	0	1	2	0	0	0	2	0	0	0	0	0	1	0	2	2
31CR86	Loc 13	M	2	2	2	2	1	0	0	0	0	2	2	2	0	0	0	2	0	0	0	1	1	2	2	2	2
31CR86	Loc 3 Head 2	IPM	2	2	2	2	1	1	0	2	0	2	2	2	0	0	0	2	2	2	0	2	0	2	2	2	2
31CR86	Loc 3 Mand 01A	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	2
31CR86	Loc 3 Mand 02	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	2
31CR86	Loc 4 Head 3 1C	IPM	2	2	2	2	1	1	0	2	2	2	0	2	2	2	2	2	2	0	0	2	0	2	2	2	2
31CR86	Loc 4 Head 5	F	2	2	2	2	1	0	0	0	0	0	1	2	2	2	2	2	2	0	0	2	2	2	2	2	2
31CR86	Loc 4 Head 6	IPM	2	2	2	2	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	1	0	2	2
31CR86	Loc 4 Mand 01B	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
31CR86	Loc 4 Mand 02	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0
31CR86	Loc 4 Mand 03	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CR86	Loc 4 Mand 04	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CR86	Loc 4 Max 01A	IPF	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31CR86	Loc 6 Mand 01A	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CR86	Loc 6 Mand 02B	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CR86	Loc 7 Head 4 1D	M	2	2	2	2	0	1	0	2	0	2	2	2	1	0	2	2	2	1	0	2	2	2	2	2	2
31CR86	Loc 7 Head 8	M	2	2	0	0	1	1	0	2	0	2	2	2	0	0	1	0	0	0	0	0	1	0	0	2	2
31CR86	Loc 7 Head 9	M	2	2	2	2	1	2	2	2	0	0	0	2	0	0	1	2	1	0	0	1	1	2	2	2	2
31CR86	Loc 7 Mand 01	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CR86	Loc 7 Mand 02	M	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CR86	Loc 7 Mand 03	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CR218	8A	M	2	2	2	2	0	1	0	2	2	0	0	2	2	2	2	2	2	0	0	1	1	2	2	0	1
31CR218	Bur 1	I	2	2	2	2	2	2	2	2	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31CR218	Bur 13	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CR218	Bur 16	M	2	2	2	2	1	0	2	2	0	2	1	2	2	2	2	2	2	0	0	2	1	2	2	0	1
31CR218	Bur 6 Bun 1	M	2	2	1	2	1	1	0	0	0	1	1	2	1	2	2	2	2	2	0	1	1	2	2	0	1
31CR218	Bur 6 Bun 2A	M	1	0	1	2	1	1	0	1	0	0	1	2	1	0	1	2	2	0	0	1	1	2	2	1	1
31CR218	Bur 6 Bun 2B	IPF	2	2	1	2	0	1	0	2	0	0	0	2	2	2	2	2	2	0	0	2	1	1	0	0	0
31CR218	Bur 6 Bun 3A	M	2	2	2	2	0	1	0	0	0	0	0	2	1	2	0	2	0	0	0	0	1	2	2	0	1
31CR218	Bur 6 Bun 3B	IPM	2	2	0	2	0	1	0	2	0	0	1	2	2	2	2	1	2	0	0	0	0	0	2	0	1
31CR218	Bur 6 Bun 4	M	2	2	1	2	0	1	2	2	0	0	1	2	2	2	2	2	2	0	0	2	0	0	0	0	0
31CR218	Bur 6 Bun 5	IPF	2	2	2	2	2	1	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CR218	Bur 6 Bun 6	IPF	2	2	2	2	2	2	2	2	2	0	2	2	1	0	0	1	0	0	0	0	1	2	2	0	0

Site	Individual	Sex	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
31CR218	Bur 6 Bun 7	M	2	2	0	0	0	1	0	2	0	2	1	2	2	2	0	2	2	0	0	1	1	2	2	0	0
31CR218	Bur 8	I	2	2	2	2	1	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31CR218	Mand 1A	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CR218	Mand 2A	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31CR218	Mand 3A	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31NH28	1	IPF	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	2	0	2	2	2	2
31NH28	12	IPF	2	2	2	2	0	1	0	2	2	1	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31NH28	13	M	2	2	2	2	0	1	0	2	2	0	1	2	1	0	0	0	1	0	0	2	1	2	2	2	1
31NH28	14 A	F	2	2	2	2	1	1	0	0	0	2	2	2	2	2	2	2	2	0	0	1	0	2	2	0	1
31NH28	14 B	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
31NH28	15	I	2	2	2	2	2	2	2	2	0	0	2	2	2	2	2	2	2	0	2	2	2	2	2	2	2
31NH28	16	IPM	2	2	1	2	0	1	0	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31NH28	17	IPM	2	2	2	2	2	2	2	2	0	0	0	2	2	2	2	2	2	2	0	1	0	2	2	2	2
31NH28	18	F	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31NH28	30	IPM	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31NH28	35	IPF	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	2	0	2	2	2	2
31NH28	4	F	2	2	2	2	2	2	2	2	2	0	0	2	2	2	2	2	2	0	0	2	1	2	2	2	2
31NH28	6	IPM	2	2	2	2	1	0	0	2	2	2	2	2	2	2	2	2	2	0	0	1	0	2	2	2	2
31NH28	65 A	M	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31NH28	65 B	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	2
31NH28	7	F	2	2	2	2	2	2	2	2	0	2	0	2	2	0	2	2	2	1	0	1	0	2	2	2	2
31NH28	MISC BONE	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
31NH28	U 12	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31ON305	110	F	2	2	2	2	1	1	0	2	0	0	1	2	1	0	2	2	2	0	0	1	1	2	2	2	2
31ON305	135	IPF	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	0	2	2	2	2
31ON305	145	M	2	2	2	2	2	2	2	2	2	2	1	2	1	0	1	2	2	0	0	0	1	2	2	2	2
31ON305	147	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31ON305	158	F	2	2	2	2	1	0	0	2	0	0	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31ON305	215	M	2	2	2	2	0	1	0	0	0	0	1	2	1	0	0	0	0	0	0	0	0	0	0	2	2
31ON305	223	M	2	2	2	2	0	1	0	0	0	2	2	2	1	0	2	2	2	2	2	2	2	2	2	0	0
31ON305	227	F	0	0	1	0	1	1	0	2	2	0	1	2	0	0	0	0	0	0	0	0	1	0	0	2	2
31ON305	232	IPM	2	2	1	2	1	1	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31ON305	3.3D	IPM	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31ON305	4.1	I	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31ON305	4.1831	IPF	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0
31ON305	4.314C	M	2	2	2	2	1	2	0	0	0	0	1	2	1	0	0	0	0	0	0	0	0	2	2	0	2
31ON305	52	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31ON305	53	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	2
31ON305	6.4A	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	2	2	2	2	2	2	2
31ON305	60	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31ON305	66	I	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31ON309	Cranium 1	I	2	2	2	2	2	2	2	2	0	0	0	2	2	2	2	2	2	0	2	2	2	2	2	2	2
31ON309	Cranium 10	F	2	2	2	2	1	2	0	2	0	0	0	2	2	2	2	2	2	0	2	2	0	2	2	2	2
31ON309	Cranium 11	I	2	2	2	2	1	0	2	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31ON309	Cranium 12	I	2	2	2	2	2	2	2	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31ON309	Cranium 13	I	2	2	2	2	2	2	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31ON309	Cranium 14	IPF	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31ON309	Cranium 15	IPM	2	2	2	2	1	1	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31ON309	Cranium 16	IPF	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	2	2	2	2
31ON309	Cranium 17	IPF	2	2	2	2	2	2	2	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31ON309	Cranium 18	IPF	2	2	2	2	0	1	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31ON309	Cranium 19	IPM	2	2	2	2	1	0	0	0	0	0	0	2	2	2	2	2	2	1	2	2	2	2	2	2	2
31ON309	Cranium 2	IPM	2	2	2	2	2	1	0	2	0	0	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31ON309	Cranium 20	M	2	2	2	2	1	1	0	2	2	2	2	2	2	2	2	2	2	0	0	2	1	2	2	2	2
31ON309	Cranium 21	I	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	0	0	1	1	2	2	2	2
31ON309	Cranium 3	I	2	2	2	2	2	2	2	2	0	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31ON309	Cranium 4	IPM	2	2	2	2	2	2	2	0	0	0	0	2	2	2	2	2	2	0	0	0	1	2	2	2	2
31ON309	Cranium 5	F	2	2	2	2	1	1	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31ON309	Cranium 6	IPM	2	2	2	2	2	2	2	0	0	0	0	2	2	2	2	2	2	0	0	2	1	2	2	2	2

Site	Individual	Sex	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
31ON309	Cranium 7	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	2	2
31ON309	Cranium 8	M	2	1	2	2	0	0	0	2	0	0	2	2	2	2	2	2	2	0	0	2	1	2	2	2	2
31ON309	Cranium 9	IPF	2	2	2	2	2	2	2	0	0	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31ON309	Cranium Frag 1	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	2	2
31ON309	Cranium Frag 2	I	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31ON309	Cranium Frag 3	I	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31ON309	Cranium Frag 4	I	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31ON309	Mandible 1	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
31ON309	Mandible 10	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31ON309	Mandible 11	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	2
31ON309	Mandible 12	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31ON309	Mandible 2	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31ON309	Mandible 3	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	2
31ON309	Mandible 4	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
31ON309	Mandible 5	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
31ON309	Mandible 6	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	2
31ON309	Mandible 7	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
31ON309	Mandible 8	I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0
31ON309	Mandible 9	IPM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	2
44HA65	382 623	M	2	2	2	2	2	1	0	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1
44HA65	382 626	F	2	2	2	2	2	2	2	2	2	0	0	2	2	2	0	0	0	0	0	0	1	2	2	1	1
44HA65	382 627	M	0	0	1	2	2	1	2	0	0	0	1	2	0	0	0	1	0	1	0	1	1	2	2	0	0
44HA65	382 634	M	1	0	1	2	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	1	2	0	1
44HA65	382 635	F	2	2	2	2	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1
44HA65	387 826	M	0	0	1	0	1	1	0	2	0	0	1	0	1	0	1	0	1	0	0	1	0	0	0	1	1
44HA65	387 831	M	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	2	2	0	1
44HA65	387 832	IPM	0	0	0	0	0	1	0	2	0	0	0	2	0	0	0	0	0	0	0	1	2	2	2	0	1
44HA65	387 835	F	0	0	2	2	2	2	2	0	0	0	1	2	2	2	0	2	2	0	1	1	2	2	2	0	1
44HA65	387 836	F	0	2	1	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	2	2	0	1
44HA65	387 837	IPM	2	2	2	2	1	2	2	2	0	2	1	0	0	1	0	0	0	2	2	2	2	0	0	0	1
44HA65	387 840	F	2	2	2	2	1	1	0	0	0	0	1	2	1	0	0	0	0	0	0	0	0	2	2	0	1
44HA65	387 841	M	0	0	1	0	1	1	0	0	0	0	0	0	1	0	1	1	0	0	0	1	1	2	2	1	1
44HA65	387 842	IPM	2	2	2	2	0	1	0	0	0	0	1	2	2	2	2	2	2	0	0	2	1	2	2	0	1
44HA65	387 843	M	2	2	1	2	0	1	0	0	0	0	1	2	2	2	2	2	2	0	0	1	0	1	2	1	1
44HA65	387 845	IPM	2	2	2	2	1	0	0	0	0	0	1	2	2	2	2	2	1	0	0	0	0	2	2	2	0
44SN22	382 769	F	1	0	0	2	1	1	0	0	0	0	1	0	2	2	0	2	0	0	0	0	0	1	0	0	1
44SN22	382 773	F	2	2	2	2	2	2	2	2	2	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	1
44SN22	382 775	M	2	2	2	2	1	1	2	0	0	0	1	0	0	0	0	0	0	0	0	0	1	2	2	0	1
44SN22	382 778	F	2	2	2	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	2	0	0	0	0
44SN22	382 789	M	2	2	2	2	0	0	0	0	0	2	2	0	2	2	0	2	0	0	0	0	1	2	2	2	2
44SN22	382 795	F	2	2	2	2	0	1	0	0	0	2	2	2	2	2	2	2	2	0	0	1	2	2	2	0	1
44SN22	382 798	M	0	0	1	0	1	1	0	0	0	1	2	0	0	0	1	1	0	0	0	0	1	1	0	0	1
44SN22	382 810	M	2	0	2	2	1	1	2	2	0	2	2	2	2	2	2	2	2	2	1	1	2	2	0	2	2
44SN22	382 812	F	2	2	2	2	1	2	2	2	0	2	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2
44SN22	382 816	M	1	0	2	2	0	1	0	2	2	2	2	2	1	0	2	2	2	0	0	1	0	2	2	0	1
44SN22	382 820	M	2	2	2	2	2	2	2	2	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	0	1
44SN22	382 822	M	2	2	2	2	2	2	2	2	0	0	2	2	2	2	2	2	2	2	0	2	2	0	2	0	1
44SN22	382 826	M	2	2	2	2	2	2	2	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1
44SN22	382 858	F	2	2	2	2	1	0	2	2	0	0	2	2	2	2	2	2	2	0	0	0	2	2	2	0	1
44SN22	382 864	F	2	2	2	2	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	1	2	2	2	0	1
44SN22	382 865	F	1	0	0	2	1	2	0	0	0	0	1	2	2	2	0	2	0	0	0	0	0	2	2	0	1

Site	Individual	Sex	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
TC	1037	F	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	1	1	1	0	1	0	1	0	0	1
TC	1158RR	M	0	1	1	0	0	1	0	0	2	2	2	2	0	0	0	0	0	2	2	2	2	0	0	0	1
TC	1296R	F	1	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	1	0	0	0
TC	1302RR	F	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	2	0	2	0	2	0	0	0	2	2
TC	543R	F	1	0	0	2	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	1	0	0	1
TC	552	M	0	0	1	0	0	1	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TC	555	M	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1
TC	557	M	0	0	0	0	0	1	0	2	0	2	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0
TC	563	M	0	0	1	0	0	1	1	0	0	0	1	0	1	0	0	0	0	0	0	1	1	0	1	0	1
TC	564	M	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1
TC	566	M	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	0	0	1
TC	572	M	0	0	1	0	0	1	0	0	0	2	1	0	0	0	0	0	0	0	0	1	0	1	0	0	1
TC	575	M	1	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
TC	605R	M	0	0	0	0	1	1	1	0	0	1	1	2	1	0	1	0	0	0	0	1	1	0	0	0	1
TC	607R	M	0	1	0	0	0	1	0	0	0	0	0	2	1	0	0	0	0	0	0	1	0	0	0	0	1
TC	608	M	0	1	1	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	1	0	1
TC	611	F	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1
TC	613R	M	0	0	1	0	0	1	0	0	0	2	1	2	0	0	0	0	0	0	0	0	0	1	0	0	1
TC	614	M	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	1	1	1	0	0	1
TC	620	M	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1
TC	665	M	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
TC	671	M	0	0	0	0	1	0	0	0	0	2	1	0	1	0	0	0	0	0	0	1	0	0	0	0	1
TC	672	M	0	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	1
TC	674	M	0	0	0	0	0	0	0	0	0	0	1	2	0	1	0	0	0	0	0	0	0	0	0	0	1
TC	678R	F	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	1
TC	680	F	1	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	1	0	1	0	0	0	0	1
TC	710R	F	0	0	1	0	1	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	1
TC	715	F	1	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1
TC	722RR	F	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
TC	745R	F	0	0	1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
TC	749R	F	1	0	0	0	0	1	0	0	0	2	2	2	1	0	0	2	2	2	0	2	0	1	1	0	1
TC	755	M	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	1
TC	756	M	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	1
TC	762	M	0	0	1	2	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	1	0	1	1	0	1
TC	763	M	0	0	0	0	1	1	0	0	0	2	2	0	1	0	0	0	0	0	0	1	1	0	1	1	1
TC	764	M	0	0	0	0	0	1	1	0	0	2	2	0	1	0	0	0	0	0	0	1	2	0	0	0	1
TC	772	M	0	0	0	0	0	1	0	0	0	0	2	0	1	0	0	0	0	1	0	1	1	1	1	0	1
TC	783R	M	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1
TC	804R	F	0	0	0	0	0	1	0	0	0	2	1	0	0	0	0	0	0	0	0	1	0	0	1	0	1
TC	808R	F	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1
TC	818R	F	0	0	0	0	1	1	1	0	0	0	1	0	2	2	0	2	0	2	0	2	1	1	0	0	0
TC	834R	F	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	1
TC	854	F	1	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1
TC	869	F	0	0	1	0	0	1	0	2	0	0	2	0	0	0	0	0	0	0	0	2	0	1	0	0	1
TC	880	F	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1
TC	928R	F	0	0	0	0	0	1	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0
TC	934	F	0	0	0	0	1	1	0	0	0	2	1	0	1	0	0	0	0	2	0	2	1	0	1	0	1
TC	939RR	F	0	0	1	0	0	0	0	2	2	2	1	0	0	0	0	2	0	0	0	2	0	0	0	0	1
TC	957R	F	1	0	1	0	0	1	0	0	0	0	1	2	1	0	0	0	0	0	0	0	0	0	0	0	1
TC	983	F	1	0	1	0	0	1	1	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	1
TC	985RR	F	0	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TC	992RR	F	0	0	1	0	0	1	0	0	0	2	0	0	1	0	0	0	0	2	0	1	1	0	0	0	1

Appendix D - Cranial Trait Frequencies

N(% present)

Trait	31BR5	31BR7	31BW67	31CK9	31CO5	31CR14	31CR218	31CR86	31NH28	31ON305	31ON309	44HA65	44SN22	TC	31CK22
1	0(0.0)	2(50.0)	0(0.0)	25(44.0)	0(0.0)	1(100.0)	1(100.0)	2(50.0)	0(0.0)	1(0.0)	0(0.0)	8(12.5)	4(75.0)	52(21.2)	4(50.0)
2	0(0.0)	2(0.0)	1(0.0)	22(50.0)	1(0.0)	1(0.0)	1(0.0)	3(33.3)	0(0.0)	2(0.0)	4(100.0)	7(0.0)	5(0.0)	52(7.7)	4(50.0)
3	1(100.0)	4(25.0)	1(100.0)	43(44.2)	5(100.0)	2(0.0)	6(66.7)	6(33.3)	2(100.0)	3(100.0)	0(0.0)	8(75.0)	3(33.3)	52(48.1)	8(25.0)
4	0(0.0)	3(0.0)	1(0.0)	21(9.5)	2(0.0)	1 (100.0)	1(0.0)	5(40.0)	0(0.0)	2(50.0)	0(0.0)	5(0.0)	1(0.0)	50(0.0)	1(0.0)
5	8(62.5)	8(37.5)	6(83.3)	63(63.5)	12(66.7)	4(50.0)	10(40.0)	12(75.0)	5(40.0)	7(71.4)	9(77.8)	12(58.3)	12(58.3)	52(30.8)	12(66.7)
6	8(62.5)	9(88.9)	6(50.0)	61(67.2)	13(84.6)	4(75.0)	10(90.0)	10(80.0)	5(80.0)	6(83.3)	8(62.5)	13(84.6)	10(60.0)	52(84.6)	13(84.6)
7	8(0.0)	8(0.0)	7(0.0)	58(1.7)	10(0.0)	4(0.0)	9(0.0)	10(0.0)	5(0.0)	7(0.0)	9(0.0)	12(0.0)	8(0.0)	52(13.5)	12(8.3)
8	5(0.0)	6(0.0)	1(0.0)	42(2.4)	11(0.0)	2(0.0)	3(33.3)	5(0.0)	1(0.0)	4(0.0)	9(0.0)	11(0.0)	8(0.0)	49(0.0)	9(0.0)
9	8(0.0)	9(0.0)	8(12.5)	54(0.0)	14(0.0)	3(0.0)	9(0.0)	11(0.0)	5(0.0)	6(0.0)	15(0.0)	15(0.0)	14(0.0)	50(0.0)	11(0.0)
10	7(0.0)	6(0.0)	2(50.0)	47(10.6)	13(0.0)	2(0.0)	9(11.1)	6(16.7)	5(20.0)	5(0.0)	7(0.0)	14(0.0)	10(10.0)	39(5.1)	10(0.0)
11	6(66.7)	6(83.3)	5(60.0)	50(50.0)	14(42.9)	3(100.0)	10(60.0)	8(50.0)	5(20.0)	7(100.0)	9(33.3)	15(66.7)	7(57.1)	46(65.2)	11(54.5)
12	0(0.0)	1(0.0)	1(0.0)	23(0.0)	0(0.0)	1(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	7(0.0)	6(0.0)	43(2.3)	2(0.0)
13	6(66.7)	3(33.3)	2(100.0)	44(47.7)	7(42.9)	2(100.0)	4(100.0)	10(40.0)	1(100.0)	6(83.3)	0(0.0)	10(30.0)	5(20.0)	51(39.2)	6(33.3)
14	5(0.0)	4(0.0)	2(0.0)	45(8.9)	8(12.5)	1(0.0)	2(0.0)	10(0.0)	2(0.0)	6(0.0)	0(0.0)	10(20.0)	5(0.0)	51(11.8)	6(33.3)
15	8(0.0)	6(16.7)	3(33.3)	47(21.3)	6(0.0)	2(50.0)	4(25.0)	8(25.0)	1(0.0)	4(25.0)	0(0.0)	12(16.7)	7(14.3)	52(3.8)	4(0.0)
16	3(0.0)	3(66.7)	2(50.0)	35(14.3)	4(25.0)	1(100.0)	2(100.0)	4(0.0)	1(0.0)	3(0.0)	0 (0.0)	11(36.4)	3(33.3)	48(2.1)	5(0.0)
17	8(0.0)	6(50.0)	1(0.0)	47(44.7)	7(14.3)	1(0.0)	2(0.0)	7(28.6)	1(100.0)	3(0.0)	1(0.0)	12(16.7)	7(0.0)	51(3.9)	6(0.0)
18	8(0.0)	5(0.0)	6(16.7)	53(18.9)	13(0.0)	4(0.0)	9(0.0)	11(9.1)	8(12.5)	6(0.0)	9(11.1)	14(7.1)	10(0.0)	45(13.3)	13(0.0)
19	10(10.0)	7(0.0)	7(0.0)	58(1.7)	14(0.0)	5(0.0)	10(0.0)	11(0.0)	8(0.0)	5(0.0)	6(0.0)	14(7.1)	12(8.3)	51(0.0)	12(8.3)
20	8(62.5)	6(66.7)	3(100.0)	51(49.0)	9(77.8)	3(66.7)	7(57.1)	8(62.5)	4(100.0)	5(20.0)	3(33.3)	13(69.2)	11(45.5)	43(55.8)	9(33.3)
22	0(0.0)	1(100.0)	1(0.0)	30(16.7)	2(0.0)	1(0.0)	3(33.3)	4(50.0)	0(0.0)	2(0.0)	2(0.0)	5(40.0)	4(50.0)	52(36.5)	3(33.3)
23	0(0.0)	1(0.0)	1(0.0)	23(0.0)	2(0.0)	1(0.0)	2(0.0)	3(0.0)	0(0.0)	2(0.0)	2(0.0)	3(0.0)	4(0.0)	52(23.1)	2(0.0)
24	9(11.1)	8(0.0)	4(0.0)	55(10.9)	10(0.0)	1(0.0)	15(6.7)	10(0.0)	4(0.0)	8(0.0)	9(0.0)	15(26.7)	12(8.3)	51(2.0)	10(10.0)

Appendix E - Theta Values for MMD

Cultural Groups

site	trait	Θ	site	trait	Θ	site	trait	Θ
Iroquoian	1	0.2706	Siouan	1	0.0000	Algonkian	1	0.0572
Iroquoian	2	1.3096	Siouan	2	0.7854	Algonkian	2	0.0263
Iroquoian	3	-0.1181	Siouan	3	-1.0472	Algonkian	3	0.1162
Iroquoian	4	1.2491	Siouan	4	0.7854	Algonkian	4	0.6363
Iroquoian	5	-0.0978	Siouan	5	-0.2536	Algonkian	5	-0.2835
Iroquoian	6	-0.5098	Siouan	6	-0.2536	Algonkian	6	-0.4782
Iroquoian	7	1.4057	Siouan	7	1.2898	Algonkian	7	1.2696
Iroquoian	8	1.3902	Siouan	8	0.9553	Algonkian	8	1.2054
Iroquoian	9	1.4244	Siouan	9	0.9127	Algonkian	9	1.4753
Iroquoian	10	1.1764	Siouan	10	0.3881	Algonkian	10	0.9751
Iroquoian	11	-0.3501	Siouan	11	0.1836	Algonkian	11	-0.1012
Iroquoian	12	1.3096	Siouan	12	0.7854	Algonkian	12	1.3771
Iroquoian	13	0.2426	Siouan	13	-1.0472	Algonkian	13	-0.0548
Iroquoian	14	0.9303	Siouan	14	1.1072	Algonkian	14	0.9564
Iroquoian	15	0.8271	Siouan	15	0.4224	Algonkian	15	0.5910
Iroquoian	16	0.2901	Siouan	16	0.2618	Algonkian	16	0.7300
Iroquoian	17	0.7437	Siouan	17	0.0000	Algonkian	17	0.3140
Iroquoian	18	1.1764	Siouan	18	0.7334	Algonkian	18	0.8699
Iroquoian	19	1.0003	Siouan	19	1.3181	Algonkian	19	1.2668
Iroquoian	20	-0.2067	Siouan	20	-1.2094	Algonkian	20	0.0460
Iroquoian	22	0.0000	Siouan	22	0.7854	Algonkian	22	0.6276
Iroquoian	23	1.2310	Siouan	23	0.7854	Algonkian	23	1.4034
Iroquoian	24	0.7916	Siouan	24	1.2310	Algonkian	24	1.0050
Hollowell	1	0.0000	Terry Coll.	1	0.6019			
Hollowell	2	0.7854	Terry Coll.	2	0.9803			
Hollowell	3	-1.1503	Terry Coll.	3	0.0378			
Hollowell	4	0.9553	Terry Coll.	4	1.4303			
Hollowell	5	-0.3138	Terry Coll.	5	0.3870			
Hollowell	6	-0.7019	Terry Coll.	6	-0.7470			
Hollowell	7	1.2645	Terry Coll.	7	0.7998			
Hollowell	8	1.2780	Terry Coll.	8	1.4289			
Hollowell	9	1.3096	Terry Coll.	9	1.4303			
Hollowell	10	1.3003	Terry Coll.	10	1.0679			
Hollowell	11	0.1340	Terry Coll.	11	-0.3025			
Hollowell	12	0.0000	Terry Coll.	12	1.2046			
Hollowell	13	0.1263	Terry Coll.	13	0.2132			
Hollowell	14	0.7401	Terry Coll.	14	0.8485			

site	trait	Θ	site	trait	Θ	site	trait	Θ
Hollowell	15	1.1832	Terry Coll.	15	1.1351			
Hollowell	16	0.4224	Terry Coll.	16	1.2240			
Hollowell	17	0.6858	Terry Coll.	17	1.1308			
Hollowell	18	1.3003	Terry Coll.	18	0.8006			
Hollowell	19	1.3096	Terry Coll.	19	1.4317			
Hollowell	20	-0.5275	Terry Coll.	20	-0.1139			
Hollowell	22	0.9553	Terry Coll.	22	0.2674			
Hollowell	23	0.9553	Terry Coll.	23	0.5568			
Hollowell	24	1.2645	Terry Coll.	24	1.2343			

Archaeological Populations

site	trait	Θ	site	trait	Θ	site	trait	Θ
31BR5	1	0.0000	31BR7	1	0.0000	31BW67	1	0.0000
31BR5	2	0.0000	31BR7	2	0.9553	31BW67	2	0.7854
31BR5	3	-0.7854	31BR7	3	0.4224	31BW67	3	-0.7854
31BR5	4	0.0000	31BR7	4	1.0472	31BW67	4	0.7854
31BR5	5	-0.2256	31BR7	5	0.2256	31BW67	5	-0.6193
31BR5	6	-0.2256	31BR7	6	-0.7854	31BW67	6	0.0000
31BR5	7	1.2310	31BR7	7	1.2310	31BW67	7	1.2094
31BR5	8	1.1503	31BR7	8	1.1832	31BW67	8	0.7854
31BR5	9	1.2310	31BR7	9	1.2491	31BW67	9	0.7401
31BR5	10	1.2094	31BR7	10	1.1832	31BW67	10	0.0000
31BR5	11	-0.2931	31BR7	11	-0.6193	31BW67	11	-0.1699
31BR5	12	0.0000	31BR7	12	0.7854	31BW67	12	0.7854
31BR5	13	-0.2931	31BR7	13	0.2618	31BW67	13	-0.9553
31BR5	14	1.1503	31BR7	14	1.1072	31BW67	14	0.9553
31BR5	15	1.2310	31BR7	15	0.6193	31BW67	15	0.2618
31BR5	16	1.0472	31BR7	16	-0.2618	31BW67	16	0.0000
31BR5	17	1.2310	31BR7	17	0.0000	31BW67	17	0.7854
31BR5	18	1.2310	31BR7	18	1.1503	31BW67	18	0.6193
31BR5	19	0.8240	31BR7	19	1.2094	31BW67	19	1.2094
31BR5	20	-0.2256	31BR7	20	-0.2931	31BW67	20	-1.0472
31BR5	22	0.0000	31BR7	22	-0.7854	31BW67	22	0.7854
31BR5	23	0.0000	31BR7	23	0.7854	31BW67	23	0.7854
31BR5	24	0.7854	31BR7	24	1.2310	31BW67	24	1.1072
31CK9	1	0.1157	31CK22	1	0.0000	31CO5	1	0.0000
31CK9	2	0.0000	31CK22	2	0.0000	31CO5	2	0.7854
31CK9	3	0.1139	31CK22	3	0.4644	31CO5	3	-1.1503
31CK9	4	0.8863	31CK22	4	0.7854	31CO5	4	0.9553
31CK9	5	-0.2689	31CK22	5	-0.3138	31CO5	5	-0.3138

site	trait	Θ	site	trait	Θ	site	trait	Θ
31CK9	6	-0.3456	31CK22	6	-0.7019	31CO5	6	-0.7019
31CK9	7	1.2551	31CK22	7	0.8867	31CO5	7	1.2645
31CK9	8	1.2003	31CK22	8	1.2491	31CO5	8	1.2780
31CK9	9	1.4355	31CK22	9	1.2780	31CO5	9	1.3096
31CK9	10	0.8808	31CK22	10	1.2645	31CO5	10	1.3003
31CK9	11	0.0000	31CK22	11	-0.0837	31CO5	11	0.1340
31CK9	12	1.3652	31CK22	12	0.9553	31CO5	12	0.0000
31CK9	13	0.0445	31CK22	13	0.2931	31CO5	13	0.1263
31CK9	14	0.9355	31CK22	14	0.2931	31CO5	14	0.7401
31CK9	15	0.5976	31CK22	15	1.1072	31CO5	15	1.1832
31CK9	16	0.7684	31CK22	16	1.1503	31CO5	16	0.4224
31CK9	17	0.1044	31CK22	17	1.1832	31CO5	17	0.6858
31CK9	18	0.6577	31CK22	18	1.3003	31CO5	18	1.3003
31CK9	19	1.2551	31CK22	19	0.8867	31CO5	19	1.3096
31CK9	20	0.0192	31CK22	20	0.3064	31CO5	20	-0.5275
31CK9	22	0.7020	31CK22	22	0.2618	31CO5	22	0.9553
31CK9	23	1.3652	31CK22	23	0.9553	31CO5	23	0.9553
31CK9	24	0.8760	31CK22	24	0.8240	31CO5	24	1.2645
31CR14	1	-0.7854	31CR86	1	0.0000	31CR218	1	-0.7854
31CR14	2	0.7854	31CR86	2	0.2618	31CR218	2	0.7854
31CR14	3	0.9553	31CR86	3	0.2931	31CR218	3	-0.2931
31CR14	4	-0.7854	31CR86	4	0.1699	31CR218	4	0.7854
31CR14	5	0.0000	31CR86	5	-0.4817	31CR218	5	0.1836
31CR14	6	-0.4224	31CR86	6	-0.5808	31CR218	6	-0.8240
31CR14	7	1.1072	31CR86	7	1.2645	31CR218	7	1.2491
31CR14	8	0.9553	31CR86	8	1.1503	31CR218	8	0.2618
31CR14	9	1.0472	31CR86	9	1.2780	31CR218	9	1.2491
31CR14	10	0.9553	31CR86	10	0.6193	31CR218	10	0.7854
31CR14	11	-1.0472	31CR86	11	0.0000	31CR218	11	-0.1836
31CR14	12	0.7854	31CR86	12	0.0000	31CR218	12	0.0000
31CR14	13	-0.9553	31CR86	13	0.1836	31CR218	13	-1.1072
31CR14	14	0.7854	31CR86	14	1.2645	31CR218	14	0.9553
31CR14	15	0.0000	31CR86	15	0.4644	31CR218	15	0.4224
31CR14	16	-0.7854	31CR86	16	1.1072	31CR218	16	-0.9553
31CR14	17	0.7854	31CR86	17	0.3881	31CR218	17	0.9553
31CR14	18	1.1072	31CR86	18	0.8574	31CR218	18	1.2491
31CR14	19	1.1503	31CR86	19	1.2780	31CR218	19	1.2645
31CR14	20	-0.2618	31CR86	20	-0.2256	31CR218	20	-0.1263
31CR14	22	0.7854	31CR86	22	0.0000	31CR218	22	0.2618
31CR14	23	0.7854	31CR86	23	1.0472	31CR218	23	0.9553
31CR14	24	0.7854	31CR86	24	1.2645	31CR218	24	0.9568

site	trait	Θ	site	trait	Θ	site	trait	Θ
31NH28	1	0.0000	31ON305	1	0.7854	31ON309	1	0.0000
31NH28	2	0.0000	31ON305	2	0.9553	31ON309	2	-1.1072
31NH28	3	-0.9553	31ON305	3	-1.0472	31ON309	3	0.0000
31NH28	4	0.0000	31ON305	4	0.0000	31ON309	4	0.0000
31NH28	5	0.1699	31ON305	5	-0.3881	31ON309	5	-0.5275
31NH28	6	-0.5348	31ON305	6	-0.6193	31ON309	6	-0.2256
31NH28	7	1.1503	31ON305	7	1.2094	31ON309	7	1.2491
31NH28	8	0.7854	31ON305	8	1.1072	31ON309	8	1.2491
31NH28	9	1.1503	31ON305	9	1.1832	31ON309	9	1.3181
31NH28	10	0.5348	31ON305	10	1.1503	31ON309	10	1.2094
31NH28	11	0.5348	31ON305	11	-1.2094	31ON309	11	0.3064
31NH28	12	0.0000	31ON305	12	0.0000	31ON309	12	0.0000
31NH28	13	-0.7854	31ON305	13	-0.6193	31ON309	13	0.0000
31NH28	14	0.9553	31ON305	14	1.1832	31ON309	14	0.0000
31NH28	15	0.7854	31ON305	15	0.4224	31ON309	15	0.0000
31NH28	16	0.7854	31ON305	16	1.0472	31ON309	16	0.0000
31NH28	17	-0.7854	31ON305	17	1.0472	31ON309	17	0.7854
31NH28	18	0.7401	31ON305	18	1.1832	31ON309	18	0.7854
31NH28	19	1.2310	31ON305	19	1.1503	31ON309	19	1.1832
31NH28	20	-1.1072	31ON305	20	0.5348	31ON309	20	0.2618
31NH28	22	0.0000	31ON305	22	0.9553	31ON309	22	0.9553
31NH28	23	0.0000	31ON305	23	0.9553	31ON309	23	0.9553
31NH28	24	1.1072	31ON305	24	1.2310	31ON309	24	1.2491
44HA65	1	0.7401	44SN22	1	-0.4224	TC	1	0.6019
44HA65	2	1.2094	44SN22	2	1.1503	TC	2	0.9803
44HA65	3	-0.4644	44SN22	3	0.2618	TC	3	0.0378
44HA65	4	1.1503	44SN22	4	0.7854	TC	4	1.4303
44HA65	5	-0.1549	44SN22	5	-0.1549	TC	5	0.3870
44HA65	6	-0.7019	44SN22	6	-0.1836	TC	6	-0.7470
44HA65	7	1.2898	44SN22	7	1.2310	TC	7	0.7998
44HA65	8	1.2780	44SN22	8	1.2310	TC	8	1.4289
44HA65	9	1.3181	44SN22	9	1.3096	TC	9	1.4303
44HA65	10	1.3096	44SN22	10	0.8240	TC	10	1.0679
44HA65	11	-0.3185	44SN22	11	-0.1263	TC	11	-0.3025
44HA65	12	1.2094	44SN22	12	1.1832	TC	12	1.2046
44HA65	13	0.3740	44SN22	13	0.5348	TC	13	0.2132
44HA65	14	0.5808	44SN22	14	1.1503	TC	14	0.8485
44HA65	15	0.6667	44SN22	15	0.6858	TC	15	1.1351
44HA65	16	0.2536	44SN22	16	0.2618	TC	16	1.2240
44HA65	17	0.6667	44SN22	17	1.2094	TC	17	1.1308
44HA65	18	0.9359	44SN22	18	1.2645	TC	18	0.8006

site	trait	Θ	site	trait	Θ	site	trait	Θ
44HA65	19	0.9359	44SN22	19	0.8867	TC	19	1.4317
44HA65	20	-0.3663	44SN22	20	0.0837	TC	20	-0.1139
44HA65	22	0.1699	44SN22	22	0.0000	TC	22	0.2674
44HA65	23	1.0472	44SN22	23	1.1072	TC	23	0.5568
44HA65	24	0.4540	44SN22	24	0.8867	TC	24	1.2343

Appendix F - Raw MMD Values

Cultural Groups

Site 1	Site 2	MMD	standard dev. (sd)	standardized (MMD/sd)
Iroquoian	Siouan	-0.0675	0.1755	-0.3844
Iroquoian	Algonkian	0.0915	0.0212	4.3187
Iroquoian	Hollowell	-0.1541	0.1968	-0.7828
Iroquoian	Terry	0.0704	0.0212	3.3220
Siouan	Algonkian	-0.0949	0.1670	-0.5680
Siouan	Hollowell	-0.4646	0.3371	-1.3785
Siouan	Terry	0.0574	0.1664	0.3450
Algonkian	Hollowell	-0.0912	0.1903	-0.4791
Algonkian	Terry	0.1793	0.0111	16.1942
Hollowell	Terry	-0.0763	0.1893	-0.4029

Archaeological Populations

Site 1	Site 2	MMD	standard dev. (sd)	standardized (MMD/sd)
31BR5	31BR7	-0.4603	0.3911	-1.1769
31BR5	31BW67	-0.7173	0.4642	-1.5452
31BR5	31CK22	-0.5721	0.3662	-1.5622
31BR5	31CK9	-0.3007	0.3131	-0.9605
31BR5	31CO5	-0.7421	0.4689	-1.5826
31BR5	31CR14	-0.5298	0.4300	-1.2322
31BR5	31CR218	-0.5397	0.4392	-1.2287
31BR5	31CR86	-0.6603	0.4066	-1.6239
31BR5	31NH28	-1.1015	0.6207	-1.7747
31BR5	31ON305	-0.7029	0.4294	-1.6368
31BR5	31ON309	-1.0799	0.5898	-1.8309
31BR5	44HA65	-0.3793	0.3353	-1.1311
31BR5	44SN22	-0.4814	0.3558	-1.3531
31BR5	TC	-0.3194	0.3098	-1.0309
31BR7	31BW67	-0.2652	0.2606	-1.0179
31BR7	31CK22	-0.0977	0.1547	-0.6316
31BR7	31CK9	0.0002	0.0999	0.0017
31BR7	31CO5	-0.2185	0.2621	-0.8338
31BR7	31CR14	-0.2675	0.2335	-1.1457
31BR7	31CR218	-0.2634	0.2365	-1.1137

Site 1	Site 2	MMD	standard dev. (sd)	standardized (MMD/sd)
31BR7	31CR86	-0.2305	0.2096	-1.0998
31BR7	31NH28	-0.5369	0.4063	-1.3215
31BR7	31ON305	-0.0291	0.2290	-0.1272
31BR7	31ON309	-0.4879	0.4224	-1.1550
31BR7	44HA65	-0.1613	0.1250	-1.2907
31BR7	44SN22	-0.2415	0.1458	-1.6568
31BR7	TC	0.0032	0.0972	0.0326
31BW67	31CK22	-0.1266	0.2353	-0.5382
31BW67	31CK9	-0.1805	0.1870	-0.9652
31BW67	31CO5	-0.5068	0.3489	-1.4529
31BW67	31CR14	-0.4861	0.3149	-1.5438
31BW67	31CR218	-0.5221	0.3099	-1.6847
31BW67	31CR86	-0.3589	0.2767	-1.2971
31BW67	31NH28	-0.8816	0.4824	-1.8275
31BW67	31ON305	-0.3832	0.3013	-1.2720
31BW67	31ON309	-0.7993	0.5013	-1.5947
31BW67	44HA65	-0.2306	0.2084	-1.1069
31BW67	44SN22	-0.2783	0.2307	-1.2065
31BW67	TC	-0.0311	0.1845	-0.1685
31CK22	31CK9	-0.0406	0.0749	-0.5424
31CK22	31CO5	-0.2141	0.2356	-0.9087
31CK22	31CR14	-0.0744	0.2086	-0.3569
31CK22	31CR218	0.0052	0.2126	0.0246
31CK22	31CR86	-0.2009	0.1830	-1.0978
31CK22	31NH28	-0.3399	0.3814	-0.8914
31CK22	31ON305	-0.0813	0.2023	-0.4017
31CK22	31ON309	-0.6866	0.4069	-1.6873
31CK22	44HA65	-0.0484	0.0995	-0.4868
31CK22	44SN22	-0.1719	0.1272	-1.3511
31CK22	TC	-0.0264	0.0721	-0.3657
31CK9	31CO5	-0.0829	0.1918	-0.4320
31CK9	31CR14	0.0172	0.1549	0.1111
31CK9	31CR218	0.0997	0.1616	0.6166
31CK9	31CR86	-0.0917	0.1382	-0.6630
31CK9	31NH28	-0.3734	0.3261	-1.1449
31CK9	31ON305	0.0642	0.1533	0.4188
31CK9	31ON309	-0.5533	0.3595	-1.5391
31CK9	44HA65	0.0636	0.0420	1.5154
31CK9	44SN22	0.0035	0.0694	0.0511
31CK9	TC	0.1771	0.0138	12.8022

Site 1	Site 2	MMD	standard dev. (sd)	standardized (MMD/sd)
31CO5	31CR14	-0.1412	0.3029	-0.4662
31CO5	31CR218	-0.3290	0.3307	-0.9948
31CO5	31CR86	-0.3049	0.3064	-0.9953
31CO5	31NH28	-0.7352	0.4802	-1.5310
31CO5	31ON305	-0.3749	0.3240	-1.1573
31CO5	31ON309	-0.7648	0.4933	-1.5505
31CO5	44HA65	-0.2258	0.2082	-1.0842
31CO5	44SN22	-0.2079	0.2249	-0.9243
31CO5	TC	-0.0763	0.1893	-0.4029
31CR14	31CR218	-0.5016	0.2832	-1.7715
31CR14	31CR86	-0.2203	0.2502	-0.8805
31CR14	31NH28	-0.5137	0.4516	-1.1377
31CR14	31ON305	-0.2251	0.2728	-0.8249
31CR14	31ON309	-0.7884	0.4762	-1.6558
31CR14	44HA65	0.0187	0.1790	0.1045
31CR14	44SN22	-0.2171	0.2029	-1.0699
31CR14	TC	0.2457	0.1525	1.6107
31CR218	31CR86	-0.1530	0.2841	-0.5385
31CR218	31NH28	-0.6046	0.4552	-1.3283
31CR218	31ON305	-0.1693	0.3003	-0.5639
31CR218	31ON309	-0.6732	0.4763	-1.4133
31CR218	44HA65	-0.0038	0.1806	-0.0212
31CR218	44SN22	-0.1571	0.2010	-0.7812
31CR218	TC	0.2153	0.1590	1.3537
31CR86	31NH28	-0.7054	0.4198	-1.6804
31CR86	31ON305	-0.2342	0.2783	-0.8412
31CR86	31ON309	-0.7604	0.4424	-1.7188
31CR86	44HA65	-0.0189	0.1545	-0.1221
31CR86	44SN22	-0.1782	0.1699	-1.0483
31CR86	TC	0.0462	0.1362	0.3391
31NH28	31ON305	-0.5018	0.4438	-1.1307
31NH28	31ON309	-1.0672	0.6169	-1.7298
31NH28	44HA65	-0.3210	0.3495	-0.9185
31NH28	44SN22	-0.2920	0.3710	-0.7870
31NH28	TC	-0.1933	0.3230	-0.5985
31ON305	31ON309	-0.6362	0.4645	-1.3697
31ON305	44HA65	-0.0577	0.1723	-0.3349
31ON305	44SN22	-0.0504	0.1904	-0.2649
31ON305	TC	0.0545	0.1510	0.3607
31ON309	44HA65	-0.3930	0.3775	-1.0410

Site 1	Site 2	MMD	standard dev. (sd)	standardized (MMD/sd)
31ON309	44SN22	-0.4963	0.4049	-1.2259
31ON309	TC	-0.2204	0.3574	-0.6165
44HA65	44SN22	-0.1115	0.0932	-1.1956
44HA65	TC	0.0367	0.0395	0.9306
44SN22	TC	0.0207	0.0669	0.3093

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Education

University of North Carolina **Chapel Hill, NC**
Enrolled in Classical Archæology Ph.D. program, August 2002 to present.

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Honors and Awards

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Membership in Professional Organizations

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Teaching and Research Experience

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