NORTHERN ILLINOIS UNIVERSITY

DENTAL VARIATION OF NATIVE POPULATIONS FROM NORTHERN SPANISH FLORIDA

A THESIS SUBMITTED TO THE GRADUATE SCHOOL
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE
MASTER OF ARTS

DEPARTMENT OF ANTHROPOLOGY

BY
MARK CLINE GRIFFIN

DEKALB, ILLINOIS
DECEMBER 1989

NORTHERN ILLINOIS UNIVERSITY

DENTAL VARIATION OF NATIVE POPULATIONS FROM NORTHERN SPANISH FLORIDA

A THESIS SUBMITTED TO THE GRADUATE SCHOOL
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE
MASTER OF ARTS

DEPARTMENT OF ANTHROPOLOGY

BY
MARK CLINE GRIFFIN

DEKALB, ILLINOIS
DECEMBER 1989

ABSTRACT

Name: Mark Cline Griffin
Department: Anthropology

Title: Dental Variation of Native Populations from Northern Spanish Florida

Major: Anthropology
Degree: Master of Arts

Approved by:
Date:

Thesis Director

NORTHERN ILLINOIS UNIVERSITY

ABSTRACT

The primary purpose of this thesis is to estimate population distance between two native American skeletal samples using dental non-metric traits as the principal comparative features. These samples represent the native American inhabitants of two Spanish missions, namely Santa Catalina de Guale (St. Catherines Island, Georgia) and Santa Catalina de Guale de Santa Maria (Amelia Island, Florida). Ethnographic and archaeological evidence indicates that the two samples are temporally successive (Santa Catalina de Guale: A.D. 1565 - A.D. 1680; Santa Catalina de Guale de Santa Maria: A.D. 1686 - A.D. 1702) and derived from the same historic population. Other studies have shown that early contact populations in the region experienced elevated stress levels (Larsen et al. n.d., Griffin and Larsen 1989, Shavit 1988). The population distance is estimated in order to assess the affinity of the two samples. The levels of stress will be evaluated as reflected by dental side asymmetry and reduction in morphological complexity. Stress, as used here, is restricted to the physiological aspects of biological stress: disease, nutrition, and

general health. Systematic inter- and intra- population sex and age variation is examined to determine their effect on the population distance estimation.

The results of this study indicate that the two samples are closely genetically affiliated. Inter- and intra- population sex and age variation is present but is not statistically significant ($p<0.05$). Other research has demonstrated that environmental stress can affect dental asymmetry expression (Baume and Crawford 1980, Garn et al. 1970, Harris and Nweeia 1980). The results of the present study suggest that (1) stress levels of both samples are comparable with those of other populations experiencing high levels of stress (Baume and Crawford 1979, 1980) and (2) there was no significant change in stress between the two population samples as reflected by dental asymmetry or reduction in morphological complexity.

ACKNOWLEDGEMENTS

As with any project, there are a number of people who without their help and guidance this thesis would not have been completed. I would like to thank my committee members, Drs. Clark Spencer Larsen, Daniel L. Gebo, and Susan Russell for their insight and guidance throughout this project. I would also like to thank Linda Lucek of the Computer User and Information Center and Dr. Balakrishan Hosmane of the Statistical Consulting Laboratory, NIU, for their help with computer and statistical problems. Brian E. Hemphill, University of Oregon, provided invaluable assistance in the calculation of the population distance estimates presented in Chapter V. A special thank you is extended to my wife, Holly Smith-Griffin, without whose love and support I could not have completed this project.

This study is part of a larger project funded by the St. Catherines Island Foundation, and the National Science Foundation grant awards (BNS-8406773 and BNS-8703849) to C.S. Larsen.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

FIGURE Page

LIST OF APPENDICES

APPENDIX Page

Chapter I

INTRODUCTION

This study examines the biological relationship between two Spanish mission cemetery population samples from the Southeastern United States, Atlantic coast. Santa Catalina de Guale was the northernmost outpost of the Spanish mission system in the Southeastern United States (Figure 1), and was occupied from A.D. 1565 to A.D. 1680. Following repeated harassment from the English-occcupied Carolina colony, the mission was temporarily relocated on Sapelo Island to the south, and then permanently relocated on Amelia Island, Florida, in 1686 (Jones 1978, Bushnell 1986, Milanich and Saunders 1986). The later mission, Santa Catalina de Guale de Santa Maria (Figure 2), was occupied by a native population until A.D. 1702.

Ethnographic and archaeological evidence indicates that the two samples are temporally successive and derived from the same historic population. Other studies have shown that early contact populations in the region

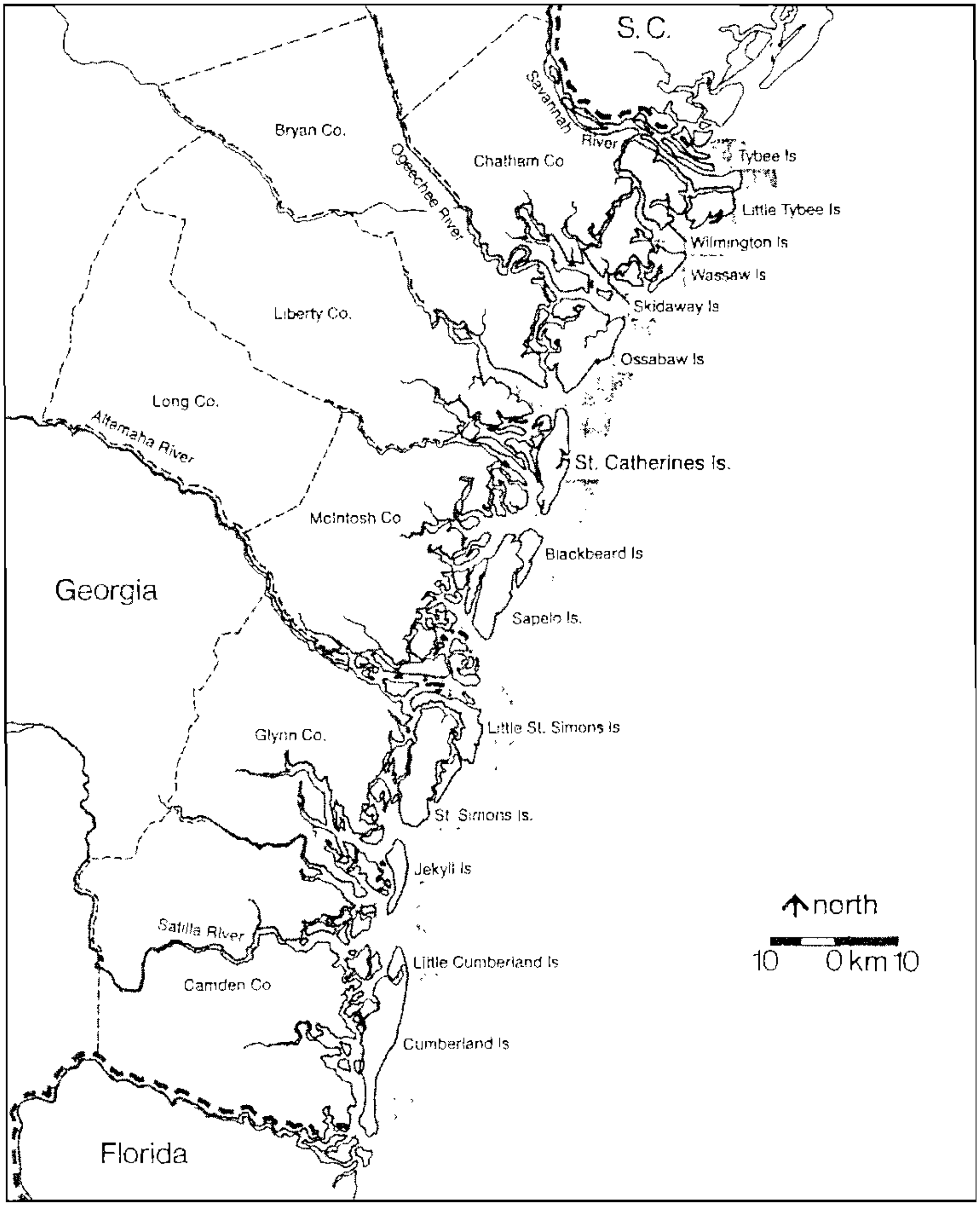

FIGURE 1. Location of Santa Catalina de Guale on St. Catherines Island, Georgia (from Thomas et al. 1978).

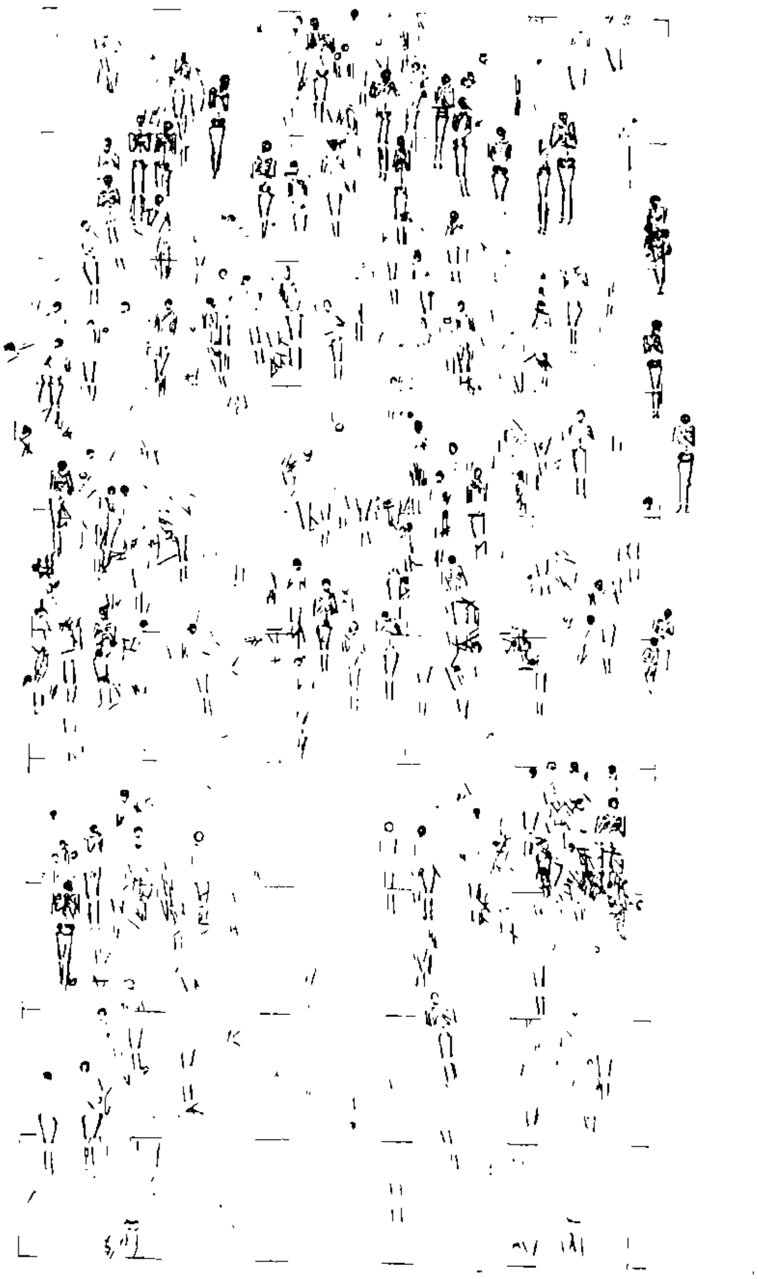

FIGURE 2. Location of Santa Catalina de Guale de Santa Maria on Amelia Island, Florida (from Thomas 1987).

experienced elevated stress levels (Larsen et al. n.d., Griffin and Larsen 1989, Shavit 1988). For this study, population distance is estimated in order to assess the affinity of the two samples. The levels of stress will be evaluated as reflected by dental side asymmetry and reduction in morphological complexity. Stress, as used here, is restricted to the physiological aspects of biological stress: disease, nutrition, and general health. Systematic inter- and intra- population sex and age variation is examined to determine their effect on the population distance estimation.

Anthropological research on St. Catherines Island has been conducted by the American Museum of Natural History since 1974 (Thomas 1987). Most of the early research was concerned with the excavation and analysis of prehistoric mortuary sites. The archaeological search for the Spanish mission site of Santa Catalina de Guale (hereafter referred to as Santa Catalina) began in 1981 (Thomas 1988). After extensive survey and testing, the remains of several structures were unearthed. Among the structures discovered were a church, kitchen, well, priest's quarters, and infantry barracks.

The church at Santa Catalina was a rectangular structure measuring 20 meters long and 11 meters wide. Three of the church walls were constructed of daub, and the fourth, the facade, was built of wattle and daub (Thomas 1988). The remains of 431 individuals were recovered from beneath the floor of the nave and the sanctuary within the church. The mortuary pattern of the burials conformed to that observed at most Spanish mission sites. According to Larsen (1989), "one-third of the burials occurred in primary context, buried in a supine postion with feet toward the altar and hands across the chest or abdomen" (Figure 3). The rest of the individuals were found scattered and disarticulated in the upper grave fill. These remains probably represent a zone of disturbance created as new interments impacted earlier ones. The cemetery at Santa Catalina produced a huge array of grave goods. The artifacts recovered include majolica plates, projectile points, a chunky stone, a rattlesnake shell gorget, wood and metal crosses, religious medals, mirrors, rings, bells, shroud pins, religious plaques, and tens of thousands of trade beads (Thomas 1988). The quantity and distribution of grave goods indicates a considerable wealth and possibly

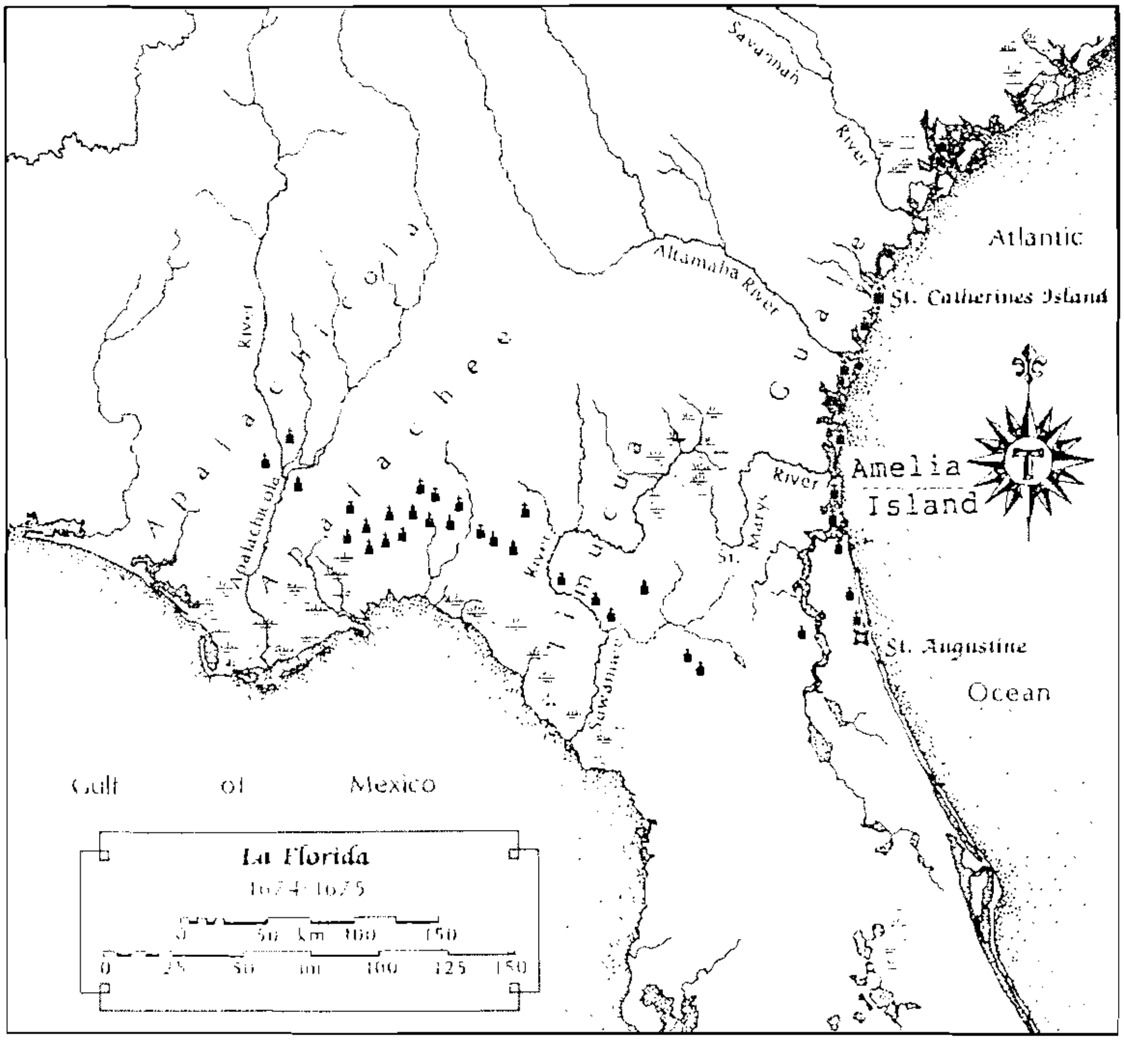

FIGURE 3. Santa Catalina de Guale: Location of Burials (from Larsen 1989).

a social hierarchy at the mission on St. Catherines Island (Thomas 1988).

Biocultural studies on the Santa Catalina population sample have focused primarily on human adaptation (Hutchinson 1986, Larsen 1989, Ruff and Larsen 1989, Shavit 1988). Preliminary findings indicate that although the native inhabitants must have experienced a great deal of biological stress with the arrival of Europeans, the initial changes were apparently cultural and not biological (Larsen 1989). Research has indicated that there was a greater biological change in the native inhabitants prehistorically with the shift to an agricultural subsistence pattern than with the initial contact with Europeans (Hutchinson 1986).

The site of Santa Catalina de Guale de Santa Maria (hereafter referred to as Santa Maria) was discovered in 1985 when a backhoe operator unearthed human bone while removing a tree on a resident's property (Hardin 1986). Architectual features at Santa Maria include part of a building 30 meters north of the cemetery, a moat, and a palisade. During excavation of the cemetery, an ossuary was encountered in the northeast corner. Although the human remains from this ossuary are currently being studied, their relationship to the cemetery population remains unclear.

The remains of 119 individuals were recovered from the Santa Maria cemetery which was located outside of the church. The individuals were buried in a supine position with hands folded over the chest. The orientation of the cemetery was 110 degrees east of north and the individuals were buried with heads oriented to the southeast (Figure 4). In contrast to the cemetery on St. Catherines Island, there were few disturbed burials . The lack of disturbance probably reflects the shorter duration of Santa Maria (about sixteen years).

A pattern of age segregation was apparent at the Santa Maria cemetery. That is, most of the preadults were buried on the western side of the cemetery. This age-based segregation was not evident at Santa Catalina. There is also a radical difference in the number of grave goods found at each site. The quantity of grave goods found at Santa Catalina far outnumbers those found at Santa Maria. Thomas (1988) posits that the abundance and variety of grave goods at Santa Catalina and the relative

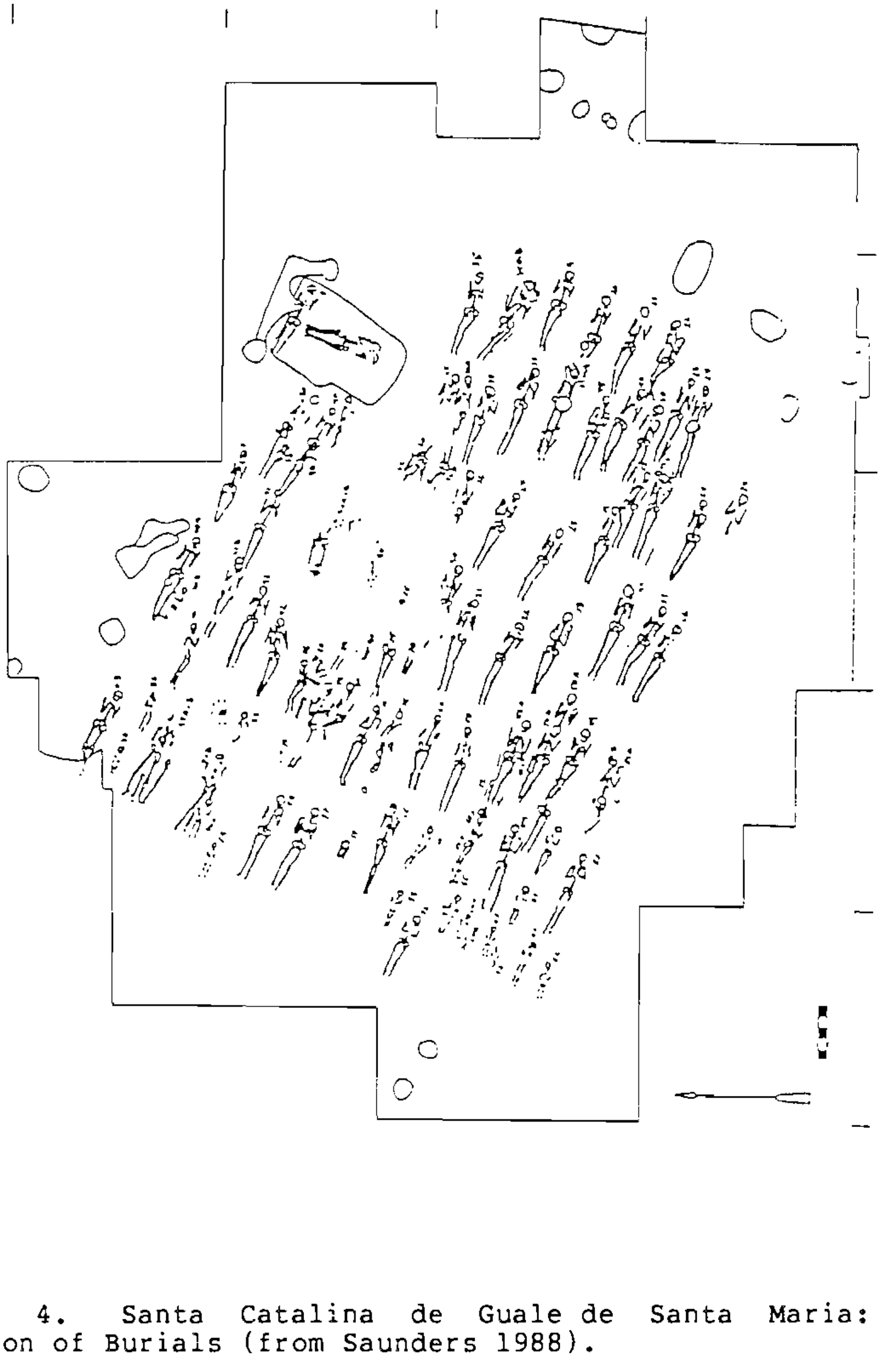

FIGURE 4. Santa Catalina de Guale de Santa Maria: Location of Burials (from Saunders 1988).

paucity of grave goods at Santa Maria may simply be an artifact of sampling or sample size. His argument is that one would naturally expect to find a greater number and variety of grave goods at Santa Catalina (with 431 individuals) than at Santa Maria (with 119 individuals) because there are simply more people represented at the former. Other factors were almost certainly involved (see Thomas 1988).

Saunders (1988) suggests that the paucity of grave goods at Santa Maria might reflect certain aspects of the social climate. In particular, because St. Catherines Island was the regional administrative center, burial in the church cemetery may have been restricted to high status individuals who had access to European trade goods. Alternatively, Saunders adds that "the lack of grave goods at Amelia Island may reflect the scarcity of trade goods and religious commodities in the later period and/or a break down in the social mechanisms that previously supported elaborate burial goods" (1988:10). Regardless, it is clear that the burial practices at the two missions differed somewhat. Whether these differences reflect modern scientific biases or the social biases of the original inhabitants is not clear.

Earlier research on the Santa Maria cemetery population indicates that the Guale were under increasing levels of biological stress after their move to Amelia Island (Griffin and Larsen 1989, Shavit 1988). This stress was manifested in the form of biological changes in the skeleton. The present study attempts to confirm that the cemetery populations from Santa Catalina de Guale and Santa Catalina de Guale de Santa Maria are derived from the same group. Any evidence for changes precipitated by European contact is examined.

Chapter II

HISTORY OF THE GUALE OF SPANISH FLORIDA

Humans have occupied the Georgia coast for some 4000 years prior to the arrival of Europeans (Thomas et al. 1978, Larsen 1982). The Georgia coast is part of a larger complex of barrier islands referred to as the Sea Islands (Thornbury 1965). The Sea Islands consist of a series of barrier islands of various origins arising from fluctuating sea levels, erosion, and the activities of humans. The early inhabitants of the Georgia coast were hunters and gatherers whose seasonal migrations followed the availability of food resources. Due to the abundance of marine resources in this type of estuarine habitat, these foodstuffs represented a large portion of the native diet.

In the mid-1500s, after brief contact with French and Spanish explorers earlier in the century, the inhabitants of the Georgia coast came under an extensive period of contact with Europeans. The mid-1500s marked the beginning of the ill-fated Spanish mission effort in

La Florida. _La Florida_, as used here, follows the definition outlined by Thomas (1987) for the First Spanish Period of St. Augustine (1566-1763), and so encompasses parts of the modern states of Georgia and South Carolina, in addition to most of Florida. European contact had a tremendous impact on the native inhabitants, especially in terms of the native subsistence strategy. The changes brought about by this early contact were to spell the effective extinction of the native Americans of the Georgia coast.

Archaeological and Ethnohistorical Context

The term Guale refers to a Muskhogean speaking aboriginal group who originally occupied the area of the Georgia coast lying between St. Andrews and St. Catherines sounds during the period from about 2200 B.C. to A.D. 1684 (Larson 1978). Much of the early archaeological research on the Georgia coast was concerned with constructing chronological sequences based on ceramic types (see Table 1). Later research focused

TABLE 1

Cultural Sequence for the Georgia Coast (after DePratter 1979).

Period	Ceramic Types	Dates
		A.D. 1700
Altamaha	Altamaha-Line Block, Incised, Plain, Check Stamped, Red Filmed	
		A.D. 1550
Irene	Irene-Incised, Complicated Stamped, Burnished Plain, Plain, Corn Cob Impressed	
		A.D. 1330
Savannah	Savannah-Complicated Stamped, Check Stamped, Fine cord Marked, Plain, Corn Cob Roughened	
		A.D. 1150
St. Catherines	St. Catherines-Plain, Net Marked, Fine Cord Marked, Burnished Plain	
		A.D. 1000
Wilmington	Wilmington-Plain, Burnished, Heavy Cord Marked, Check Stamped, Complicated Stamped	
		A.D. 500
Deptford	Deptford-Complicated Stamped, Cord Marked, Check Stamped, Refuge Simple Stamped, Refuge-Plain	
		400 B.C
Refuge	Deptford-Linear Check Stamped, Check Stamped; Refuge-Plain, Simple Stamped, Dentate Stamped, Punctated, Incised	
		1100 B.C.
St. Simons	St. Simons-Incised and Punctated, Incised, Punctated, Plain	
		2200 B.C.

on the reconstruction of past lifeways by the examination of subsistence patterns, settlement patterns, and ethnohistoric data.

Archaeology

Until about A.D. 1150, the inhabitants of the Georgia coast were primarily hunter-gatherers, with a diet consisting of marine, animal, and plant foods (DePratter 1979). Reitz (1983) asserts that the Georgia coast has some of the richest marine resources in the world. Accordingly, until about 800 B.C., marine resources constituted a large portion of the native subsistence. Around 800 B.C. a lowering of the sea level took place and the local subsistence strategy shifted to an increased focus on hunting (DePratter 1979). After A.D. 1150, the native subsistence strategy began an irreversable shift to agriculture, although according to Reitz and Scarry (1985) fish still represented a large percentage of the native diet. Fish, along with wild plants and shellfish, probably helped to sustain the Guale during years of failure of the maize crop.

Ethnohistory

With the arrival of the Spanish, it appears that there was a radical change in Guale settlement and subsistence patterns. Officially, the Spanish missions were established as "a place where tribal economies were reorganized, new crops and European methods of cultivation were introduced, scattered native American groups were nucleated into new settlements, where instruction included music, reading, and writing" (Thomas 1987:75). More likely, the Spanish molded the Native American cultures to suit their needs and exploited the native populations as a source of virtually free labor. The missionaries forced sedentism and intensive agriculture on the native populations in order to "promote Christianity, make allies, and generate stable supply lines" (Milanich 1978:82) -- or as Bolton (1917) suggests, to "convert, civilize and exploit."

This major shift in lifeway precipitated a number of changes that were to eventually spell the extinction of the Guale as a distinct group. Among these changes were the obliteration of tribal boundaries by nucleation of the native populations and the interruption of seasonal migrations by establishing large permanent settlements. These changes resulted in a profound degree of biological stress stemming from epidemics, chronic food shortages, and military action by Spanish, British, and aboriginal forces. Increased sedentism, demographic nucleation, and agricultural intensification were also an aggravating influence on the presence and severity of disease and nutritional stress.

During the final years of missionization, the Guale were increasingly exploited by the Spanish. As Bushnell relates, even in times of severe food shortages, the natives were called upon "to provision whole boatloads of persons travelling north on government business, even foreigners" (1986:9). After a visit to Santa Maria in 1700, Governor Don Jose de Zuniga y Cerda reported that there were no more than two hundred natives on the whole of the island and that they were "a miserable, low-spirited people, very poor and humble" (Bushnell 1986:11). On November 4, 1702, Governor James Moore routed Santa Maria two days prior to his siege of St. Augustine. This effectively marked the end of the Guale as a culturally distinct group.

The Spanish Missions Among the Guale

After brief contact with the Spanish and French in the early 1500s, the Guale were subject to "a long, intensive period of Spanish colonization" beginning in 1566 (Thomas 1988). By the mid-seventeenth century, La Florida had about 70 Franciscans serving approximately 25,000 Indians in 38 missions (Arana and Manucy 1977, Hann 1987, Thomas 1988). The size and scope of the Spanish missions in the Southeast, Thomas points out, was certainly comparable to the Franciscan missions flourishing in California and the Southwest at the same time. By 1680, prompted by the expansion of the Carolina colony southward and the consequent withdrawal of the Spanish to the south, the reduced Guale population was relocated. Only two small villages of Christianized Indians remained outside of St. Augustine by the 1750s. When the Spaniards turned over rule to the British in 1763, the remaining Native American converts fled from Florida as well (Siebert 1940, Deagan 1983).

Santa Catalina de Guale

In the mid- to late-1500s, the Spanish mission efforts in La Florida were minimal; only four Franciscan friars were stationed throughout the entire area. By 1597, however, 14 friars were stationed in La Florida and several of these served among the Guale (Geiger 1940). That same year, the Guale staged a major revolt, partly on St. Catherines Island. On St. Catherines Island, the iglesia (church) was burnt to the ground and the site abandoned, later to be resettled in 1604.

The Guale Indians were named by the Spanish for the chiefdom centered at the village of the same name on St. Catherines Island. The Franciscan mission on St. Catherines Island was thus christened Santa Catalina de Guale. After several unsuccessful attempts at establishing a mission on St. Catherines Island, a permanent, stable mission was started in the early 1600s. This mission was to remain stable until the British arrival in Guale territory in the 1670s.

After the Spanish resettled Northern coastal Georgia in the 1600s, they remained its sovereign rulers until 1670 when the English settled at Charles Town, South

Carolina (Ross 1926). The area from St. Catherines Island in the north to St. Augustine in the south became known as "the debatable land," a territory of contention between England and Spain that was to remain so until 1763 (Bolton and Ross 1925).

In 1680, seven years after an unsuccessful attempt to attack Charles Town by the Spanish and their establishment of a garrison on St. Catherines Island, the English began a steady southward push down the coast and westward across the Mississippi (Thomas 1988:19). That same year, a British-led force of 300 Yamassee Indians staged an attack on the mission which precipitated its immediate abandonment. At this point, the remaining Guale began a retreat toward the relative safety of St. Augustine. After a brief stay in a refugee camp on Sapelo Island, the Guale from Santa Catalina and Satouche (another Spanish mission located on Sapelo Island) were persuaded to move to Santa Maria on Amelia Island, Florida.

Santa Catalina de Guale de Santa Maria

The island of Santa Maria (Amelia Island) had been the general location of several largely unsuccessful Spanish missions since the early 1600s. The earliest mission, Santa Maria de la Sena, was originally located on the mainland, on the banks of the St. Mary's River (Thomas 1987). The later missions were located on the island itself in order to protect the residents from marauding pirates. The missions of Santa Maria were not associated exclusively with the Guale. From 1675-1683, the mission was occupied by the Yamassee, who were distant inland relatives of the Guale (Bushnell 1986). After a bloody raid by English and French pirates in 1683, the Yamassee fled north.

In 1684, Santa Maria was re-established by the Guale from Santa Catalina and Satouche. Mission Santa Catalina de Guale de Santa Maria served the relocated residents from 1686 to 1702 . The 1680s and 1690s were relatively peaceful for the inhabitants of Santa Maria. Even so, supplies were short and the Guale became increasingly intolerant of the Spanish demands on them (Bushnell 1986). In November 1702, Santa Maria was overrun and destroyed by British troops several days prior to Governor James Moore's siege of St. Augustine. The

Franciscans and Guales fled with what they could carry and sought shelter at San Juan del Puerto, located just south of Amelia Island on Fort George Island. After the siege of St. Augustine, the remaining Guale were assimilated into the surrounding tribal groups. "The last information that we have of their existence as a group is in 1735 when one Fray Tomas de Aguilar was reappointed professor of the Indian language of Guale" (Larson 1978:120).

Physical Anthropology of the Guale

Previous biological research of the native Guale population reveals that these people were under increasing stress following contact with Europeans. This study is only concerned with the physiological aspects of stress: disease, nutrition, and general health. Studies on the Guale have examined demography, growth disruption, pathology, morphology, and size. Examination of Guale skeletal remains from the prehistoric and historic Georgia coast reveals a pattern of declining health after European contact. Evidence for this decline comes primarily from observation of the prevalence of dental caries (Larsen 1982, Shavit 1988, Larsen et al. n.d.), dental enamel hypoplasias (Hutchinson 1986, Hutchinson and Larsen 1988), infection (Larsen 1989), and degenerative joint disease (Griffin and Larsen 1989). Additional evidence is provided by the examination of demography (Larsen 1982, Russell 1987, Larsen and Russell 1989), postcranial adaptation (Ruff and Larsen 1989), and bone chemistry (Schoeninger et al. 1989).

The results from previous biological studies of the Guale suggest an overall reduction in health and quality of life as they changed from a hunting and gathering mode of subsistence to an agricultural one. Although the data is more problematic for the postcontact Guale, the evidence indicates a further overall decline in health after European contact. Hutchinson (1986) concludes that the population at Santa Catalina de Guale was under a greater amount of stress than the earlier, precontact Guale. This stress very likely resulted from (1) an increase in aggregation of the population, precipitating the rapid spread of European introduced diseases; and (2) the increased focus on maize as a primary constituent of the diet after the arrival of Europeans, and the concomitant decline in nutrition. Evidence from the analysis of the frequency of carious lesions and the patterns of osteoarthritis indicates that the Guale were under even more stress at Santa Maria (Shavit 1988, Griffin and Larsen 1989). Further studies will help to shed light on the European impact on the native populations of coastal Georgia and Florida.

Chapter III

NONMETRIC VARIATION AND POPULATION DISTANCE

Population distance is an expression of morphological similarity between two or more populations, based on a statistical treatment of the selected variables. In choosing these variables, one assumes that they are (1) largely under genetic control and (2) minimally affected by environmental or nutritional conditions (Corruccini 1974). Furthermore, the sample must represent the population and be of adequate size (Rosing 1982, 1984). Distance measures between populations are useful in anthropology for inferring residence patterns, patterns of diffusion and migration, and microevolutionary changes through time (Ubelaker 1984).

Traditionally, researchers have used metric variables, in particular cranial indices, to estimate population distance (Cybulski 1972, Howells 1966, 1973, Jantz 1970, 1974). Recently, nonmetric variables have been more frequently used for population distance studies

(Bennett 1965, Berry 1974, Birkby 1973, Blakely 1973, Buikstra 1972, 1980, Corruccini 1974, Finnegan 1978, Finnegan and Faust 1974, Kennedy 1981, Korey 1970, Ossenberg 1969, Saunders 1978, Sjovold 1973). Although nonmetric traits have been recognized and described since the early part of this century (Akabori 1934, Bolk 1931, Hooton 1930, Hrdlicka 1920, Wood Jones 1930), their population specificity was held in question until investigations into the genetic nature of nonmetric variation was undertaken in the 1950s and 1960s (Deol et al. 1957, Truslove 1954, Gruneberg 1952, Searle 1954, Howe and Parsons 1967, Berry and Berry 1967). In particular, Berry and Berry (1967) proposed that nonmetric variables offered a more reliable estimation of population similarity than metric variables, and researchers began employing these traits for human population distance studies (Balakrishan and Sanghvi 1968, Ossenberg 1976, Sjovold 1973, Kellock and Parsons 1970a and b, Konigsberg 1987, Sjovold 1984, Suchey 1975).

Because metric variables are typically linear measurements or indices derived from linear measurements, they are considered to be continuous variations. In contrast to this type of continuous variation, nonmetric variation is typically discrete (present or absent) in expression. Nonmetric variables take the form of accessory ridges, tubercles, extra-sutural bones, accessory foramina, differing positions of foramina, and in the case of teeth, cusps expressed on the lingual, buccal, or occlusal surface. Often, nonmetric variation can exhibit a range of expression from slight to pronounced. This type of expression has been termed "quasi-continous" rather than discontinuous (Gruneberg 1952). Although "quasi-continuous" is a better descriptive term for most nonmetric variation, the term "nonmetric" will be used here because it is the most commonly used term in the literature.

Dental nonmetric variables have been found to be particularly sensitive for determining population affinities and genetic relationships between groups and have been used extensively (Axelsson and Kirveskari 1977, 1982, Dahlberg 1963a and b, 1965a and b, 1986, Greene 1982, Haeussler 1985, Lukacs 1983, 1986, Richards and Telfer 1979, Sofaer et al. 1986, Turner 1987a and b, Yamada and Kawamoto 1988). The human dentition is genetically conservative and changes little over many generations (Scott and Turner 1988). Teeth are also extremely durable and are often the only intact remains recovered from human burials. This is certainly the case for the St. Catherines Island sample used in this study. For these two reasons, dental nonmetric traits were chosen to estimate population distances in this study.

Genetic Basis of Nonmetric Variation

Nonmetric traits have been recognized and cited as descriptive features in human populations since the early twentieth century (Gregory 1916, Hellman 1929, Hrdlicka 1920, 1921, 1924, Hooton 1930). However, not until the 1950s did researchers began investigating the genetic nature of nonmetric variables (Deol et al. 1957, Truslove 1954, Gruneberg 1952, Searle 1954, Howe and Parsons 1967, and Berry and Berry 1967). This early research initiated the wide-spread use of nonmetric traits for estimation of population distance between skeletal populations (Balakrishan and Sanghvi 1968, Berry 1974, Greene 1982, Kennedy 1981, Laughlin and Jorgensen 1957, Lundy 1980, Ossenberg 1976, Spence 1974).

Animal Research

In 1952, Hans Gruneberg initiated a series of studies using laboratory mice. This series, entitled: "Genetical Studies on the Skeleton of the Mouse," was concerned with finding to what extent skeletal morphology is genetically controlled. Gruneberg (1952) crossbred two strains of laboratory mice to assess the genetic behavior of each. His conclusions, from the study of vertebral and pelvic variations, were that these variations were multifactorally inherited and that they were sensitive to environmental influences.

One of the most important principles enumerated by Gruneberg was the principle of quasi-continuity. This tenet, based on a model by Sewall Wright (1934a and b), proposed that inheritance of a nearly discontinuous character was due to the segregation of multiple genes in conjunction with a threshold of manifestation. As an illustration of this, Gruneberg cited the expression of the third molar in mice. In mice, "additive" genes affected the size of the tooth germ, bringing it to a "threshold of manifestation"; falling below this threshold meant no expression of the third molar.

The importance of this finding lies in its implications for the study of nonmetric variables. Indeed, nonmetric varables are not discrete, but rather are of a continuous nature, even beyond their threshold of manifestation (Reich et al. 1972). Therefore, scoring techniques should reflect not only the variable's presence or absence, but also the degree of expression (number, size, shape).

Other studies in the mouse series focused on the environmental impact on trait expression. Searle (1954) found that non-genetic factors (maternal and postnatal) accounted for 80% of the variance in 75% of vertebral nonmetric traits. In an extension of this study, Deol and Truslove (1957) found that maternal physiology (in particular, factors related to malnutrition) affected the litter size and the size of the offspring. This later affect greatly influenced the expression of nonmetric traits.

In a later study by Richtsmeier and McGrath (1986), postnatal effects were considered in a crossfostering experiment using laboratory mice. Although the results were largely inconclusive, Richtsmeier and McGrath found that there is a distinct correlation between the functional type of trait being scored and its heritability. They separated nonmetric traits into three types: foraminal, hyperstotic/hypostotic, and fusion. Of 35 traits examined, four showed significant heritability values. Three of the four traits were hyperstotic/hypostotic, and one trait was foraminal. From these results, Richtsmeier and McGrath concluded that nonmetric traits follow the principles of the Functional Matrix Hypothesis: that is, as the number of developmental sources of trait variation increase, heritability values decrease. In the case of foraminal traits, factors such as the number of bundles of nerves or blood vessels and their position in relation to the bone exert additional influence over the expression of a trait (Richtsmeier and McGrath 1986).

Studies of nonmetric traits in non-primate species have provided some useful guidelines for the selection and use of traits for population distance studies. Perhaps the most important among these contributions are the quasi-continuous nature of nonmetric traits (Gruneberg 1952) and the significant influence of environmental factors in the expression of these traits

(Searle 1954, Deol and Truslove 1957, Richtsmeier and McGrath 1986). Other researchers have confirmed these early findings and have further emphasized the significant effect of environmental conditions (Berry 1968, Berry and Searle 1963, Deol et al. 1957, Grewal 1962, Gruneberg 1963, 1965, Rees 1969, Searle 1954, Self and Leamy 1978, Truslove 1954).

Primate Studies

Most research on the genetic basis of nonmetric variation has been done with nonprimates. However, some recent researchers have begun looking at primates to test the reliability of nonmetric traits for population distance studies (Berry and Berry 1971, Cheverud and Buikstra 1978, 1981, 1982, Chiarelli 1971, McGrath et al. 1984, and others).

Berry and Berry (1971) examined four species of primates (*Hylobates lar*, *Pan troglodytes*, *Pongo pymaeus*, and *Gorilla gorilla*) from the skeletal collections at the British Museum of Natural History. Thirty variants were recorded and the C.A.B. Smith mean measure of divergence was used to assess biological distance. The authors found that subspecies within each species differed systematically. This systematic difference was attributed to geographic and spatial reproductive barriers. In the case of <u>Gorilla gorilla</u>, subspecies separated by a mountain range exhibited a higher measure of divergence than those separated by a greater geographical distance along a river drainage basin. The Berrys' used this finding to further bolster their claims of the reliability of nonmetric variants for estimation of population distance. Later studies by Cheverud and Buikstra (1981, 1982) appear to support this contention.

In 1981, Cheverud and Buikstra initiated a series of studies using a skeletal collection of rhesus macaques from Cayo Santiago. This population was collected over a 25-year period (1956-1981) and was comprised of 297 individuals, representing both sexes and all ages. Using 24 cranial nonmetric traits, Cheverud and Buikstra examined the genetic nature of these variables. Their results reflected much of the earlier nonprimate research in nonmetric variation. They found that heritability values for all of the variations fell in the significant range and that hyperstotic/hypostotic variables tended to have higher values. This was again attributed to the funtional differences of traits (i.e., the Functional Matrix Model).

In an examination of relative heritability values by Cheverud and Buikstra (1982) between foraminal and hyperstotic traits, it was found that hyperstotic values were significantly higher (.798) than those for foraminal traits (.352). It was also found that, overall, nonmetric traits tended to have higher heritability values (.528) than metric variables (.317). This last finding should be accepted cautiously because of the significantly different number of traits in each category (56 metric traits and 14 nonmetric traits). Richtsmeier et al. (1984) extended this study, again using the rhesus macaques of Cayo Santiago, to look at the correlations between metric and nonmetric variations. Correlations ranging between 0.80 and 0.95 were obtained, indicating a very close relationship between the two sets of variables. Richtsmeier and co-workers interpreted this finding to reflect a common developmental pathway shared by cranial size and shape characteristics and nonmetric traits.

Overall, studies of nonhuman primates have given a slightly different picture of the reliability of nonmetric traits for population distance studies. Genetic factors seem to be somewhat more important than nongenetic factors in the expression of nonmetric traits (Cheverud and Buikstra 1981) and all of the nonmetric traits examined showed significant heritability values. A common developmental pathway for metric and nonmetric variants has also been proposed (Richtsmeier et al. 1984).

Nonmetric Traits in Humans

Nonmetric traits were used primarily as descriptive features in physical anthropology in the early 20th century (Akabori 1934, Bolk 1931, Hooton 1930, Hrdlicka 1920, Wood Jones 1930). However, later authors began to examine the genetic nature, heritability, and the usefulness of nonmetric traits for population studies (Bennett 1965, Berry 1974, 1975, Birkby 1973, Blakely 1973, Buikstra 1972a, 1980, Corruccini 1974, Finnegan 1978, Finnegan and Faust 1974, Kennedy 1981, Korey 1970, Ossenberg 1969, Rightmire 1972, Saunders 1978, Sjovold 1973). These later works have helped to clarify the place of nonmetric variation in the analysis of skeletal populations and have also raised some important questions about their use in population distance studies.

Cranial Variation

Berry and Berry (1967) examined a total of 585 adult crania using 30 nonmetric cranial variants recognized for human populations. The sample consisted of crania from North and South America, Burma, India, Nigeria, Palestine, and Egypt. The researchers found several good correlations between populations but also some "odd likenesses" such as those found between Egyptians and the Ashanti of Nigeria. No distinction could be made between West Africans and North American Indians. The Berrys dismissed these later findings as mere aberrations, and contended that cranial nonmetrics were still a reliable measure of population divergence.

Later authors have criticized the Berrys for their methodology and their easy dismissal of apparent flaws in technique. Perhaps the most comprehensive and useful of these critiques is by Robert Corruccini (1974). Corruccini argues that the Berrys did not consider a variety of parameters which can greatly influence the outcome of population distance studies using nonmetric traits. The first of these is their examination of sex differences. The Berrys have proposed that there are no significant differences between sexes in the expression of nonmetric traits. Corruccini counters that they did not separate populations to look for sexual dimorphism and that the intermingling of populations can have a "cancelling effect" on populations with differential sexual dimorphism. Corruccini also points out that the Berrys did not consider age differences of side asymmetry in their study, and that these factors could very well bias their results.

Although there are some problems with this early study, it does offer a clear and fairly precise description of cranial nonmetric traits. This type of standardization is crucial for the correct interpretation of other researchers work (see Dahlberg 1956). The Berrys work represents a landmark in the study of human nonmetric variation. Later studies have offered both support and challenges to the use of nonmetric traits in population distance research.

Postcranial Variation

Although the postcranial skeleton has been subject to less scrutiny than the cranium for nonmetric variation, many good descriptive assays are available (Finnegan 1978, Finnegan and Faust 1974, Saunders 1978, Saunders and Popovich 1978, Sawyer et al. 1978, Sjovold 1973). Of these, Finnegan (1978) offers clear descriptions and the best evaluations of nonmetric postcranial variables and their suitability for population studies.

Finnegan (1978) examined 196 skeletons from the Terry Collection using 30 nonmetric postcranial traits. His results included the following: (1) that side dimorphism was present but not important in the final biological distance equation; (2) sexual dimorphism was present, but could be overcome by statistical methods; and (3) age dependency of traits is not a concern for postcranial nonmetric variations. Finnegan lauds postcranial nonmetrics as reliable research tools which are present in larger numbers in skeletal samples (due to lower rates of breakage) but cautions that one must pay close attention to trait descriptions in research reports.

Dental Variation in Humans

The use of dental morphology to study the relationships of populations dates to the first half of this century (Dahlberg 1945, Gregory 1916, Hellman 1929, Hrdlicka 1920, 1921). Early researchers found that characteristics of the tooth crown could be useful to discriminate between different geographic groups (Dahlberg 1945, 1951, Hellman 1929, Hrdlicka 1920, 1921, Lasker 1950). The first relationships delineated by these early studies were a distinct affinity between native Americans and Asians and the dissimilarity of both groups to Europeans.

Genetic Nature of Dental Variation

Since the 1950s, much research has been done on the description and genetic basis of nonmetric dental characteristics (Baume and Lapin 1983, Berry 1976, Brothwell et al. 1963, Carbonell 1963, Corruccini et al. 1986, Dahlberg 1960, 1961, Goose and Lee 1971, Harris and Bailit 1980, Potter et al. 1968, Rosenzweig 1970). Most of these works have concentrated on the description of dental features and have dealt in a minor way with the genetic basis of these variations. Later research from the provides some evidence for the reliability of dental characteristics for population distance studies (Dahlberg 1963a, Garn et al. 1966b, Christensen 1967, Hase and Elston 1970, Lundstrom 1973, Zoubov 1973, Staley and Green 1974, Potter and Nance 1976, Harris and Bailet 1980, Butler 1982, Dahlberg et al. 1982, Corruccini et al. 1986).

In an attempt to establish the systematic nature of the human molar crown, Zoubov (1973) reported on the findings of an area of research that he called "odontoglyphics." Zoubov found that the pattern of the masticatory surface of human molars varies systematically as to the number, position, and shape of the grooves. He ascertained that these patterns were population specific and could be used, with some degree of accuracy, to identify certain populations. Dahlberg (1963) had come to similar conclusions in his study of the presence and arrangement of cusps in American Indians.

Harris and Bailit (1980), in an effort to establish the genetic nature of dental variation, recorded the incidence and size variability of the metaconule in a series of 1217 living Melanesians. The results of their study were the following: (1) the incidence decreased along a gradient from M1 to M3; (2) when the metaconule occurred on distal molars it tended to be larger; (3) the additive genetic component for M1 was 65%; and (4) the additive genetic component for M2 was 15% and almost negligible for M3. They interpreted this to mean that the M1 is under more complex genetic control than distal molars and once the initial threshold of expression is reached, the increments between subsequent thresholds are smaller (see Reich et al. 1972).

In a series of studies with monozygotic and dizygotic twins, Lundstrom (1973) found that variances in tooth morphology compared between twins and the general population suggested a good genetic basis for tooth morphology. In fact, the correlations were strong enough to determine whether two individuals were twins and what type of twins. Corruccini et al. (1986) found, upon initial analysis, that about 50% simple heritability was suggested for dental occlusal variables in mono- and dizygotic twins. However, upon reexamination, it was found that environmental factors heavily biased these estimates. Corruccini cautions that this is a twin study and observations of the general population in controlled circumstances should be made. Haseman and Elston (1970) tout twin data as a very useful means of estimating the genetic basis of characters, but they caution that the results do not always apply to the general population. Other researchers have also voiced this concern (Potter and Nance 1976, Staley and Green 1974).

It should be clear, from this sampling of the literature, that the genetic basis for dental characteristics has not yet been fully demonstrated. However, its position as a more reliable indicator of genetic relatedness should be defended. Although the twin studies may not be entirely tenable, they indicate a better reliability (in relation to the influence of environmental stress) for dental nonmetric variation. Sofaer et al. (1986) have also shown the genetic stability over space and time of dental morphology. Other researchers have explored the genetic stability and population specificity of dental characters and come to similar conclusions (Dahlberg 1945, Garn et al. 1963, 1966a, Kirveskari 1973, Saunders and Mayhall 1982, Scott 1980, Scott and Dahlberg 1982, Smith 1973, Snyder et al.

1969). Although this evidence is not proof positive, it does point to dental charateristics as a stable and reliable means of population distance estimation.

Population Specificity

As Scott and Turner point out, "a biological trait can be useful in historical-evolutionary analyses only if a significant component of its variation is genetic" (1988:100). Research has shown that although dental morphology does not adhere to a simple mode of inheritence, there is a sufficiently strong genetic component to make dental nonmetric traits useful for assessing biological relationships and microevolutionary trends (Biggerstaff 1975, Corruccini et al. 1986, Garn 1977, Goose and Lee 1971, Lundstrom 1973). The distances obtained from the frequencies of many of these traits reflect phenotypic rather genotypic affinity because of their probable polygenic mode of inheritance. However, many of the other variables studied by physical anthropologists are also polygenically inherited (that is, more than one gene controls their expression).

Morphological traits of the tooth crown have been successfully used to discriminate between major geographic "races" (Dahlberg 1945, 1951, Hellman 1929, Hrdlicka 1920, Lasker 1950). Some traits are population specific to the degree that one trait alone can be used to distinguish between groups (e.g., shovel-shaped incisors, Carabelli's trait, and cusp 6). Although ethnic affililiation is useful for many areas of inquiry, nonmetric dental traits should not be limited strictly to "racial diagnosis." Distance statistics derived from tooth morphology can be used to estimate relative degrees of similarity among groups that "diverged from common ancestors many hundreds or thousands of years in the past" (Scott and Turner 1988:103).

There is some question as to the utility of dental nonmetric traits in studies of human microdifferentiation. However, most researchers concede that these dental traits are useful in discriminating among tribal groups and local "races." Most recent dental morphologic studies have focused on this level of differentiation (Greene 1982, Haeussler 1985, Lukacs 1983, Richards and Telfer 1979, Sofaer et al. 1986, Turner 1985, 1987a and b). The bulk of this research has concentrated on the delineation of dental variation in Asian and Asian-derived groups. Groups of Asian descent are easily differentiated, in part, because of their morphologically complex dentitions.

Microevolutionary Perspectives

Most mammals rely on an intact dentition for their survival. "When the teeth fail to function through extreme wear or loss ... death soon follows" (Scott and Turner 1988:105). This has been true for much of our distant past as evolving hominids. Somewhere in our past, however, humans began to utilize culture as a buffer against the environment, thereby reducing the absolute dependency on the dentition. Although natural selection has been demonstrated to be the directing factor in some dental traits (e.g., shovel-shaped incisors), genetic drift may be a more plausible explanation for much of the dental variation observed in modern humans (Smith 1982, Taylor 1982).

Aberrant maxillary third molars have been described by Taylor (1982) as molars having the normal number of cusps but having a "compressed" shape. In most situations, the cusps are simply modified with respect to their relative locations to one another, and to a lesser degree, their size and shape. This condition is believed to be the result of a number of factors. The ontological development of the surrounding supporting structures may be the most influential factor. A shift in cusp location has been observed to occur as a result of the "invasion" of supporting or adjoining structures, reducing or modifying the space in which the tooth bud can grow. A similar process has been suggested for the groove pattern of the lower molars (Taylor 1982).

The dominant groove pattern for the hominoid lower molar in primate evolution has been the "Y-5" pattern. This pattern is characterized by the presence of a well developed hypoconulid and a distinct contact between the second and third cusps (metaconid and hypoconid). Until fully modern *Homo* appears, this pattern is highly stable, becoming a criterion for designation as "truely" hominoid. With the appearance of modern *Homo sapiens sapiens*, the groove pattern of the lower molar becomes considerably less stable. Although the lower M1 typically retains the "Y-5" pattern, the M2 and M3 began to exhibit significant variation. The predominant types of variation include contact between cusps one and four (protoconid and entoconid, respectively) and contact between all four cusps (desrcibed as a "+" pattern). The former is much more common than the latter. This shift may be due to the same type of process observed for aberrant maxillary third molars.

It may also be the case that these are simply the secondary results of a relative relaxation of selective pressures. It has been proposed that an increase in dental variation may occur when it is no longer neccessary for the teeth to be absolutely genetically stable (Scott and Turner 1988). This condition seems to characterize an evolutionary trend in Homo in general. In this sense, it appears that the wide range of dental variation in humans may simply be the effect of non-selective factors. It should be emphasized here that although the human dentition is highly variable in a macroevolutionary sense, it tends to be conservative in a microevolutionary perspective. Thus, characteristics of the teeth are useful for the estimation of population distances and group affiliation.

In summary, it should be clear that although nonmetric variation may offer a promising field for population studies, it is not the infallible tool that the Berrys and others propose. From the preponderance of evidence, it would seem likely that there is a very significant environmental influence on the expression of certain traits. Perhaps when dealing with populations under the same environmental conditions, the problem can be overcome, but this situation is rare. The most promising area of research seems to lie with the consideration of nonmetric dental variables. These variables, being the most genetically stable, appear to have a minimum of environmental factors affecting them. Partially for this reason, nonmetric dental traits were chosen for this study.

Another factor which led to the selection of nonmetric dental traits for this study was the state of preservation of the Santa Catalina sample. As Konigsberg (1987) advises, "whenever skeletal preservation is less than optimal, nonmetric traits are a viable alternative to metric traits, which usually require excellent preservation." Following this guideline, the deciding factor in choosing nonmetric dental traits for this study was not that nonmetric traits are more "meaningful" than metric traits for biological studies. Indeed, it has been demonstrated that metric and nonmetric variables are closely interrelated (Chevrud et al. 1979, Corruccini 1974) and neither is more biologically informative than the other. Rather, the deciding factor for choosing nonmetric dental traits for this study was the state of preservation of the samples. That is, the Santa Catalina sample consists largely of teeth in some areas of the cemetery. Therefore, teeth represent the best source of data for the purposes of this investigation.

Chapter IV

METHODS

Age and gender are important considerations in the analysis of nonmetric variation. Researchers have demonstrated that there are significant inter- and intrapopulation gender and age variation in nonmetric traits (Buikstra 1972b, Corruccini 1974, Garn et al. 1966b, Konigsberg 1987, Scott 1977). Because of this relationship, gender and age were estimated for each individual in the samples.

Age Determination

The ages for the Santa Maria sample were determined by K.F. Russell (Larsen and Russell 1989). Ages for the Santa Catalina sample were provided by Russell and coworkers (n.d.). For the the Santa Maria sample, preadult ages were estimated based on epiphyseal union, dental calcification, and dental eruption. The standards used for epiphyseal union were those described by Krogman

(1962:32-33), and the standards for dental calcification and dental eruption were those set by Ubelaker (1984:46-47). Due to the overall poor bone preservation of the Santa Catalina sample, only dental remains could be used to systematically estimate the ages-at-death. Therefore, dental eruption and dental wear were the primary criteria for estimation of age-at-death.

The adults from the Santa Maria sample were assigned ages-at-death based on a number of criteria. The primary criteria were dental functional wear (Miles 1978) and the metamorphosis of the auricular surface of the innominate (Lovejoy et al. 1985b). The Miles method utilizes preadult erupted dentitions to approximate the number of years an individual's teeth have been in functional occlusion. The advantage of this method is that it is specifically suited for each population to which it is applied. Using the above criteria and a number of other independent indicators of age, the ages-at-death for the Santa Maria sample were calculated using a multifactorial aging technique (see Lovejoy et al. 1985a).

Gender Determination

A number of criteria were used to estimate the gender of individuals from each sample (Russell and et al. n.d., Larsen and Russell 1989). Gender was estimated for the adults only, because there is no accurate method for gender determination in preadults. The primary criteria for gender estimation involved gender-specific characteristics of the os pubis (Phenice 1969) and overall pelvic morphology, including characteristics of the sciatic notch, subpubic angle, size of the obturator foramen and acetabulum, the type and morphology of the preauricular sulcus, and the presence or absence of pubic parturition scars (Bass 1981). The pubic ventral arc and subpubic concavity are present in females and absent in males. The ishio-pubic ramus consists of a sharp ridge in females, although it is flat in males. The sciatic notch, subpubic angle, and pubic symphysis are wide in females and narrow in males. With regard to cranial features, females tend to have smaller mastoid processes and supraorbital tori and a smooth nuchal area compared to males. If the innominate was fragmented or missing for an individual, then robusticity or gracility and size of the cranial and postcranial skeleton were considered. Generally females are more gracile than are males.

For the Santa Catalina sample, only 66 of the 223 adults could be assigned a gender (39 females, 27 males). The preservation of those individuals permitted accurate estimation of gender. As many of the above-mentioned methods were used for these estimations. Because of better preservation, 84 of 85 adult individuals from the Santa Maria sample could be assigned a gender (43 females, 41 males). Again, as many as possible of the above-mentioned methods of gender estimation were used for each individual.

Dental Trait Selection and Scoring

The dental traits used in this study were selected from a battery of traits described in the Arizona State University Dental Anthropology System (Turner n.d.). A pilot study was conducted in April 1988 by the author to determine which traits would be most applicable to the two study populations. Forty-one traits were examined from the ASU system using the Santa Maria population (see Table 2). The traits were examined for intra-observer reliability, wear sensitivity (i.e., is the trait easily modified or obliterated by age-related wear), and observability (i.e., could the trait be easily seen without destruction of the alveolus). None of the traits were deleted because of low intraobserver reliability (see below). One trait (radical number) was deleted because of low numbers of observations (i.e., it normally cannot be seen without full exposure of the root). Three of the traits were deleted due to excessive wear sensitivity (in most cases, they could not be observed after the age of 27). Traits deleted due to wear sensitivity included the premolar mesial and distal accessory cusps, the tri-cusped premolar, and the distosaggital ridge. The resulting battery of traits consists of thirty-five dental nonmetric traits and two cranial nonmetric traits along with observations on the presence/absence of teeth, periodontal disease and overall dental wear.

The computer coding form is contained in Appendix A. The coding forms record information on age, sex, tooth presence and condition, and dental trait observations

Table 2
Nonmetric Dental Traits from 1988 Pilot Study

Trait	**Teeth Observed**	**References**
winging	upper central incisors	Enoki and Dahlberg 1958
shoveling	upper incisors	Scott 1973
curvature	upper central incisors	Nichol et al. 1984
double-shoveling	upper central incisors	Dahlberg 1956
interruption groove	upper lateral incisors	Turner 1967
tuberculum dentale	upper lateral incisors	Scott 1973
canine mesial ridge	upper canines	Morris 1975
canine distal accessory ridge	upper canines	Scott 1973
premolar mesial and distal accessory cusps	upper premolars	Turner 1967
tri-cusped premolars	upper premolars	Turner 1967
distosaggital ridge	upper premolars	Morris 1978
metacone	upper 3rd molars	Turner n.d.
hypocone	upper 1st and 2nd molars	Turner n.d.
metaconule	upper 1st and 2nd molars	Harris 1977

Table 2 cont.
Nonmetric Dental Traits from 1988 Pilot Study

Trait	**Teeth Observed**	**References**
Carabelli's trait	upper 1st and 2nd molars	Dahlberg 1956
parastyle	upper 3rd molar	Turner n.d.
enamel extensions	upper 1st and 2nd molars	Pedersen 1949
premolar root number	upper premolar 3	Turner 1967
molar root number	upper 2nd molars	Turner 1967
radical number	all teeth	Turner 1967
peg-shaped incisor	upper lateral incisor	Turner n.d.
peg-shaped molar	upper 3rd molar	Turner n.d.
odontome	premolars	Pedersen 1949
first lower premolar lingual cusp variation	lower 1st premolars	Scott 1973
second lower premolar lingual cusp variation	lower 2nd premolars	Scott 1973
anterior fovea	lower 1st molar	Hrdlicka 1924
groove pattern	lower 1st and 2nd molars	Jorgensen 1955
cusp number	lower 1st and 2nd molars	Turner 1967

Table 2 cont.
Nonmetric Dental Traits from 1988 Pilot Study

Trait	Teeth Observed	References
deflecting wrinkle	lower 1st molars	Weidenreich 1937
distal trigonid crest	lower 1st molars	Hrdlicka 1924
protostylid	lower 1st and 2nd molars	Dahlberg 1956
cusp 5	lower 1st and 2nd molars	Turner n.d.
cusp 6	lower 1st and 2nd molars	Turner n.d.
cusp 7	lower 1st and 2nd molars	Turner n.d.
canine root number	lower canines	Turner 1967
Tomes' root	lower 1st premolar	Tomes 1923
first molar root number	lower 1st molar	Turner n.d.
second molar root number	lower 2nd molar	Turner 1967
torsomolar angle	lower 3rd molar	Turner n.d.
palatine torus	palate	Turner n.d.
mandibular torus	mandible	Morris 1970

from both left and right sides (the later to facilitate side asymmetry analysis). Some of the traits used in this study are observable in one population but not in the other. This is mainly due to the differential preservation at each of the sites. Although these traits are not particularly useful for the present analysis, they may be important for future comparative studies.

At the outset, dental trait frequencies were calculated for all traits and for each sample. Eighteen traits were eliminated from this part of the study due to low numbers of observations in either of the samples (N<30). Because the computation of Chi-square statistics is particularly sensitive to low cell values, it seemed prudent to simply remove these traits from the analysis. The traits eliminated were: winging, canine mesial ridge, canine distal accessory ridge, metaconule (molar 2), Carabelli's trait (molar 2), enamel extentions, premolar root number, molar root number, odontome (upper and lower), lower premolar 3 variation, lower premolar 4 variation, protostylid (molar 2), canine root number, Tomes' root, first molar root number, second molar root number, and torsomolar angle.

Inter- and Intra-Observer Error

In any line of research involving somewhat subjective measures, the degree of inter- and intra-observer error should be considered (see Landis and Koch 1975a, b for appropriate methodology). Studies by Page (1976) and Jamison and Zegura (1974) have concluded that interobserver error is significant in the scoring of nonmetric traits. With this conclusion, they caution that population studies can be biased by inter- and intraobserver, and that corrective statistics should be applied. Molto (1979) has found that intraobserver error is relatively low (on the order of 20%) and occurs randomly among measurements. With these studies in mind, it should occur to the researcher that great care must be taken when using other investigators' data.

Because all of the traits were scored by one individual, the contribution of interobserver error is nil. However, there remains the question of intraobserver reliability. The aforementioned pilot study was conducted in April 1988 by the author, using the skeletal sample from Santa Maria (N=119). One month following the completion of the pilot study, the same series was again scored by the author. The scores from the right sides only were then compared and percentages calculated for the number of responses in agreement for each trait (see Table 3). The scoring of each trait in the ASU system generally consists of from five to ten grades or classes. None of the responses in this examination of intraobserver error differed by more than one grade. As can be seen in Table 3, the level of intraobserver error is perfectly acceptable and consistent with similar studies (Konigsberg 1987, Molto 1979).

Side Asymmetry

Early researchers often recorded the presence of bilateral asymmetry but did not record the incidence of unilateral trait expression. Trinkaus (1978) examined skeletal samples of African, European, and Amerindian descent, to study this problem. His finding was that unilateral frequencies of over 10% occurred for over 50% of nonmetric traits. Trinkaus believes (although he

TABLE 3

Results of Intraobserver Reliability Analysis

Trait	N	% in agreement
winging	34	100
shoveling UI1	43	97.7
shoveling UI2	42	95.2
curvature	49	91.8
double-shoveling	48	93.7
interruption groove	44	100
tuberculum dentale	42	90.5
canine mesial ridge	8	75.0
canine distal accessory ridge	6	83.3
metacone	34	97.1
hypocone UM1	51	78.4
hypocone UM2	38	88.2
metaconule UM1	34	88.2
metaconule UM2	24	91.7
Carabelli's trait UM1	31	90.3
Carabelli's trait UM2	24	91.7
parastyle	37	100
enamel extensions UM1	40	100
enamel extensions UM2	40	100

(continued)

TABLE 3 cont.

Results of Intraobserver Reliability Analysis

Trait	N	% in agreement
premolar root number	16	100
molar root number	11	100
peg-shaped incisor	50	100
peg-shaped molar	41	100
odontome (all PM's)	91	100
first lower premolar lingual cusp variation	18	72.2
second lower premolar lingual cusp variation	16	62.5
anterior fovea	27	88.9
groove pattern LM1	31	100
groove pattern LM2	24	100
cusp pattern LM1	35	100
cusp pattern LM2	23	100
deflecting wrinkle	22	100
distal trigonid crest	22	100
protostylid LM1	21	100
protostylid LM2	9	100

(continued)

TABLE 3 cont.

Results of Intraobserver Reliability Analysis

Trait	N	% in agreement
cusp 5 LM1	35	94.3
cusp 5 LM2	24	100
cusp 6 LM1	30	96.7
cusp 6 LM2	21	100
cusp 7 LM1	31	100
cusp 7 LM2	23	100
canine root number	30	100
Tomes' root	9	100
first molar root number	11	100
second molar root number	8	100
torsomolar angle	9	100
palatine torus	74	94.6
mandibular torus	90	100

gives no direct evidence) that unilateral expression is the result of environmental stress, resulting in physiological stresses on individual tissues. Earlier research provides some support for this assertion (see Chamay 1972 and Hoyte and Enlow 1966).

Research using nonhuman species also lends some evidence for environmental influence on bilateral asymmetry (Bader 1965, Howe and Parsons 1967, Nass 1982, Siegal and Doyle 1975a, b, Siegal et al. 1977). Korey (1980) echoes the opinion of Trinkaus that unilateral expression is possibly stress related and also proposes that this type of asymmetry could be related to age. Ossenberg (1981) presents another explanation for this phenomenon by proposing a theory of multiple thresholds (see Reich et al. 1972). She proposes that the difference between unilateral and bilateral expression for a trait depends on ones relationship to a second additive genetic threshold (the first assumed to determine expression/nonexpression).

Studies with human subjects have come to two disparate conclusions regarding the cause of bilateral asymmetry. Sellevold (1980) and Axelesson and Hegegard

(1981) studied mandibular tori in prehistoric Norse and historic Eskimo, and Icelandic school children, respectively. Both studies concluded that unilateral expression was primarily the result of environmental stress. On the other side of the issue, Noss et al. (1983) and Mayhall and Saunders (1986) (in studies with the Pima Indians and Eskimos) found that there was no conclusive evidence for environmental stress as the causal agent in bilateral trait expression in molar teeth. The differences in these studies may simply reflect the relative genetic stability of the human dentition (see Sofaer et al. 1986). However, in a study of fluctuating dental asymmetry, Bailit et al. (1970) found that environmental stress plays an important role in this condition. Other researchers have obtained similar results for dental asymmetry (Baume and Crawford 1979, 1980, DiBennardo and Bailit 1978, Doyle and Johnston 1977, Garn et al. 1966c, 1970, Harris and Nweeia 1980). Concerns have also been voiced as to sampling techniques and statistical treatments in this research (Black 1980, Garn and Bailey 1977, Garn et al. 1979).

In another aspect of the same issue, Green et al. (1979) propose that a new approach in the study of bilateral asymmetry is necessary. They contend that to test for independence between sides, one cannot base an opinion on whether the frequencies are the same on both sides. This would be analogous to saying: "if the frequency of right blue eyes and the frequency of left blue eyes is the same then the traits are independent" (Green et al. 1979:630). Nor can one say that if the frequencies are different, then the traits are independent. In fact, Green et al. (1979) suggest that independence has nothing to do with bilateral trait expression and the appropriate way to study bilateral traits is to consider both sides and use the total number of times the trait occurs divided by the total number of sides observed. The latter approach is used in the present study. Unilateral expression of traits is also examined to infer levels of environmental stress.

Statistical Procedures

The purpose of this study is to determine if the population samples from Santa Catalina and Santa Maria are derived from the same population. A number of different statistical procedures are employed for this determination. Among these procedures are comparisons of frequencies, discriminant function analysis, principal component analysis, estimations of mean measure of divergence, and multidimensional scaling. Using these statistics, relationships between and among the two samples are explored.

The assumption made when calculating population distance is that one is dealing with large, panmictic populations with little or no in- or out-migration (i.e., an essentially static gene pool). A change in this gene pool will directly affect the frequency of genotypes in the populations and will be reflected in the expression of morphological characteristics (Turner 1969). Therefore, if the difference in gene pools is small, the population distance will be correspondingly small. Because the two population samples being examined should be closely genetically affiliated (being derived from essentially the same population), a great disparity in dental morphology may indicate a change in the genetic composition of the population. This change could stem from in- or out-migration, selection against certain members (as in epidemic disease), or artificial selective pressures (e.g. warfare, circumscription). Any or all of these factors could significantly change the gene pool of the Guale from that observed at Santa Catalina de Guale to the gene pool reflected by the population sample from Santa Maria. A second possibility for a significant change in dental morphology could be a change in environmental conditions (especially pre-natal environment).

Chapter V

RESULTS AND DISCUSSION

Intersite Variations

In order to assess the similarities and differences between the two population samples, dental trait frequencies were calculated for each group. The trait frequencies for the samples were then compared via two-dimensional contingency tables and a Chi-square statistic computed for each trait. The dental trait frequencies are reported in Table 4 and the Chi-square statistics for each trait are reported in Table 5 (the raw data for this study is contained in Appendix B).

Examination of the results of the contingency table analysis (Table 5) reveals that the similarities between the two population samples far outweigh the differences. Out of 27 traits examined, only seven (double-shoveling, tuberculum dentale, hypocone M1, Carabelli's trait M1, peg-shaped molar, groove pattern M2, protostylid M1) exhibited differences which were statistically

TABLE 4

Dental Trait Frequencies

Dental Trait	Grade	Frequency (%) Santa Catalina	Santa Maria
shoveling I1	0	1 (1.6)	0 (0.0)
	1	5 (8.2)	3 (7.0)
	2	34 (55.7)	20 (46.5)
	3	18 (29.5)	14 (32.6)
	4	3 (4.9)	5 (11.6)
	5	0 (0.0)	1 (2.3)
shoveling I2	0	1 (1.2)	4 (9.5)
	1	11 (12.8)	4 (9.5)
	2	32 (37.2)	16 (38.1)
	3	19 (22.1)	10 (23.8)
	4	15 (17.4)	5 (11.9)
	5	4 (4.7)	0 (0.0)
	6	2 (2.3)	0 (0.0)
	7	1 (1.2)	3 (7.1)
	8	1 (1.2)	0 (0.0)
double shoveling	0	8 (12.3)	11 (22.9)
	1	7 (10.8)	7 (14.6)
	2	16 (24.6)	11 (22.9)
	3	19 (29.2)	2 (4.2)
	4	8 (12.3)	13 (27.1)
	5	6 (9.2)	4 (8.3)
	6	1 (1.5)	0 (0.0)
interruption groove	0	24 (35.8)	8 (18.2)
	1	25 (37.3)	12 (27.3)
	2	12 (17.9)	36 (36.4)
	3	2 (3.0)	0 (0.0)
	4	4 (6.0)	8 (18.2)
tuberculum dentale	0	37 (59.7)	17 (40.5)
	1	6 (9.7)	1 (2.4)
	2	11 (17.7)	2 (4.8)
	3	5 (8.1)	12 (28.6)
	4	3 (4.8)	4 (9.5)
	5	0 (0.0)	6 (14.3)

(continued)

TABLE 4 cont.

Dental Trait Frequencies

Dental Trait	Grade	Frequency (%) Santa Catalina	 Santa Maria
metacone M3	0	2 (1.7)	0 (0.0)
	1	1 (0.9)	0 (0.0)
	2	3 (2.6)	2 (5.9)
	3	54 (46.6)	18 (52.9)
	4	51 (44.0)	10 (29.4)
	5	5 (4.3)	4 (11.8)
hypocone M1	3	12 (6.9)	5 (9.8)
	4	67 (38.7)	40 (78.4)
	5	94 (54.3)	6 (11.8)
hypocone M2	0	1 (0.7)	0 (0.0)
	1	4 (2.7)	2 (5.3)
	2	6 (4.0)	2 (5.3)
	3	104 (69.8)	19 (50.0)
	4	31 (20.8)	15 (39.5)
	5	3 (2.0)	0 (0.0)
metaconule M1	0	83 (73.5)	30 (88.2)
	1	7 (6.2)	0 (0.0)
	2	5 (4.4)	0 (0.0)
	3	9 (8.0)	3 (8.8)
	4	9 (8.0)	1 (2.9)
Carabelli's trait M1	0	22 (22.7)	17 (54.8)
	1	15 (15.5)	5 (16.1)
	2	19 (19.6)	4 (12.9)
	3	14 (14.4)	5 (16.1)
	4	12 (12.4)	0 (0.0)
	5	13 (13.5)	0 (0.0)
	6	1 (1.0)	0 (0.0)
	7	1 (1.0)	0 (0.0)

(continued)

TABLE 4 cont.

Dental Trait Frequencies

Dental Trait	Grade	Frequency (%) Santa Catalina	Santa Maria
parastyle	0	88 (92.6)	36 (97.3)
	1	2 (2.1)	0 (0.0)
	2	1 (1.1)	0 (0.0)
	3	2 (2.1)	0 (0.0)
	4	1 (1.1)	0 (0.0)
	5	1 (1.1)	1 (2.7)
peg-shaped incisor	0	79 (98.7)	50(100.0)
	2	1 (1.2)	0 (0.0)
peg-shaped molar	0	82 (81.2)	40 (97.6)
	1	19 (18.8)	1 (2.4)
anterior fovea	0	3 (3.7)	3 (11.1)
	1	4 (4.9)	2 (7.4)
	2	6 (7.3)	5 (18.5)
	3	12 (14.6)	9 (33.3)
	4	57 (69.5)	8 (29.6)
groove pattern M1	1	125 (88.0)	27 (87.1)
	2	4 (2.8)	1 (3.2)
	3	13 (9.2)	3 (9.7)
groove pattern M2	1	21 (15.0)	11 (45.8)
	2	11 (7.9)	9 (37.5)
	3	108 (77.1)	4 (16.7)
cusp number M1	5	91 (70.0)	20 (57.1)
	6	36 (27.7)	15 (42.9)
	7	3 (2.3)	0 (0.0)
cusp number M2	5	68 (62.4)	16 (69.6)
	6	41 (37.6)	7 (30.4)
deflecting wrinkle	0	5 (8.9)	6 (27.3)
	1	11 (19.6)	3 (13.6)
	2	35 (62.5)	11 (50.0)
	3	5 (8.9)	2 (9.1)

TABLE 4 cont.

Dental Trait Frequencies

Dental Trait	Grade	Frequency (%) Santa Catalina	Santa Maria
distal trigonid crest	0	54 (65.9)	19 (86.4)
	1	28 (34.1)	3 (13.6)
protostylid M1	0	6 (8.5)	3 (14.3)
	1	28 (39.4)	13 (61.9)
	2	37 (52.1)	5 (23.8)
cusp 5 M1	0	0 (0.0)	1 (2.9)
	3	16 (12.5)	1 (2.9)
	4	58 (45.3)	27 (77.1)
	5	54 (42.2)	6 (17.1)
cusp 5 M2	0	8 (7.0)	4 (16.7)
	1	2 (1.8)	0 (0.0)
	2	4 (3.5)	0 (0.0)
	3	32 (28.1)	2 (8.3)
	4	60 (52.6)	14 (58.3)
	5	8 (7.0)	4 (16.7)
cusp 6 M1	0	91 (71.1)	17 (56.7)
	1	5 (3.9)	3 (10.0)
	2	13 (10.2)	6 (20.0)
	3	7 (5.5)	4 (13.3)
	4	12 (9.4)	0 (0.0)
cusp 6 M2	0	76 (66.7)	17 (81.0)
	1	2 (1.8)	1 (4.8)
	2	10 (8.8)	1 (4.8)
	3	7 (6.1)	1 (4.8)
	4	17 (14.9)	0 (0.0)
	5	2 (1.8)	1 (4.8)
cusp 7 M1	0	123 (96.1)	30 (96.8)
	1	3 (2.3)	0 (0.0)
	2	1 (0.8)	0 (0.0)
	3	1 (0.8)	1 (3.2)
cusp 7 M2	0	114(100.0)	23(100.0)

TABLE 5

Results of Contingency Table Analysis

Dental Trait	Chi-square	D.F.	Significance
shoveling I1	1.586	2	0.452
shoveling I2	0.917	2	0.632
double-shoveling	11.660	2	0.003
interruption groove	3.213	1	0.073
tuberculum dentale	8.010	2	0.018
metacone M3	0.532	2	0.766
hypocone M1	29.414	2	0.000
hypocone M2	5.383	2	0.067
metaconule M1	3.213	1	0.073
Carabelli's trait M1	10.541	2	0.005
parastyle	1.018	1	0.313
peg-shaped incisor	0.630	1	0.427
peg-shaped molar	6.460	1	0.011
anterior fovea	5.519	2	0.063
groove pattern M1	0.021	1	0.885
groove pattern M2	12.402	1	0.000
cusp number M1	2.070	1	0.150
cusp number M2	0.423	1	0.515
deflecting wrinkle	1.104	1	0.293
distal trigonid crest	3.487	1	0.062
protostylid M1	5.233	1	0.022
cusp 5 M1	1.288	1	0.256
cusp 5 M2	1.989	1	0.158
cusp 6 M1	0.865	1	0.352
cusp 6 M2	2.583	1	0.108
cusp 7 M1	0.032	1	0.858
cusp 7 M2	-----	-	-----

significant ($p<0.05$). Normally, when computing a Chi-square statistical test, one expects to encounter a type one error roughly 20% of the time. That is to say, about 20% of the variables should be expected to appear significant due to chance alone. This figure (20%) falls close to the number of significant differences observed in Table 5 (25%). Thus, it appears that the two population samples are more similar than dissimilar and that the differences observed are likely due to chance.

To further assess the differences between the population samples, a discriminant function analysis was applied to the data (Table 4). A discriminant function analysis addresses the problem of how well it is possible to separate two or more groups of individuals given measurements for these individuals on several variables. In this case, the groups are the population samples from Santa Catalina and Santa Maria, and the measurements are the battery of dental traits. A stepwise discriminant analysis program was used (SPSSx procedure DISCRIMINANT) and all logical combinations of variables were tested for levels of discrimination.

Because this type of analysis requires that all measurements be present for at least a minimum number of cases (N>30), only a certain number of dental traits could be used. The nine dental traits included in the discriminant function analysis include the following: shoveling I1, shoveling I2, double-shoveling, interruption groove, hypocone M1, Carabelli's trait M1, cusp 5 M1, cusp 6 M1, and cusp 7 M1. Three logical groupings of these variables produced the best discriminating levels in the analysis: (1) shoveling I1, shoveling I2, double-shoveling, interruption groove, hypocone M1, Carabelli's trait M1, and cusp 5 M1; (2) Carabelli's trait M1, cusp 5 M1, cusp 6 M1, and cusp 7 M1; and (3) shoveling I1, shoveling I2, double-shoveling, interruption groove, hypocone M1, cusp 5 M1, cusp 6 M1, and cusp 7 M1. The results of these analyses are presented in Table 6.

A discriminant analysis procedure is successful if few cases are classified into the wrong groups. If a large percentage of the cases are classified correctly, one can conclude that group differences do exist and that the selected set of variables exhibits those differences. Alternatively, if a large percentage of cases fails to be

TABLE 6

Results of Discriminant Function Analysis

Classification results for variable group 1:

Actual Group	No. of Cases	Predicted Group SCDG	Predicted Group SCDG-SM
SCDG*	49	34 (69.4)	15 (30.6)
SCDG-SM**	31	7 (22.6)	24 (77.4)

Cases correctly classified: 72.50%

Classification results for variable group 2:

Actual Group	No. of Cases	Predicted Group SCDG	Predicted Group SCDG-SM
SCDG	59	44 (74.6)	15 (25.4)
SCDG-SM	19	7 (36.8)	12 (63.2)

Cases correctly classified: 71.79%

Classification results for variable group 3:

Actual Group	No. of Cases	Predicted Group SCDG	Predicted Group SCDG-SM
SCDG	79	42 (53.2)	37 (46.8)
SCDG-SM	25	1 (4.0)	24 (96.0)

Cases correctly classified: 63.46%

---

*SCDG=Santa Catalina

**SCDG-SM=Santa Maria

correctly classified, then either the selected variables do not reflect any group differences or the groups must be homogeneous. Upon examination of the results presented in Table 6, it becomes clear that the latter of these two possibilities is true for this analysis. The expression of most of the variables selected for this analysis are significantly different between the two samples ($p<0.05$). Therefore, the variables do reflect group differences. However, when combined in a discriminant function analysis, these variables do not seem to differentiate the populations very well. The classification results are marginal, at best, for the first two groupings of variables. With the inclusion of all possible variables, the results become even less satisfactory. In fact, the classification results are only slightly better than could be obtained from mere chance. It appears, then, that the two population samples are relatively homogeneous, with only minor differences between them. This homogeneity suggests a close genetic affinity between the samples.

Population Distance Estimates

Because few studies of nonmetric dental morphology have been done for native American populations of the southeastern United States, population samples from the American Southwest were chosen for comparison. The measurements for this part of the study were collected by Scott (1973). The frequencies of traits for each population are presented in Appendix C. Because Scott's data only included certain dental traits , only those reported in Appendix C were used for this analysis. Obviously, one would expect native American populations from the southwestern and southeastern United States to be different. In this type of analysis however, it is more meaningful to include more than just two population samples.

Mean measures of divergence are calculated as estimates of population distance (Sjovold 1977). Mean measures of divergence (MMD) and standardized mean measures of divergence (MMD-SD and MMD/MMD-SD (Sofaer et al. 1985)) were calculated from the dental trait frequencies. Table 7 presents the MMD, MMD-SD, and the

TABLE 7 Measures of Divergence, Guale and Southwest U.S. Dental Samples*

	SCdG	SCdG-SM	PAPAGO	NAVAJO	APACHE	HOPI	ZUNI	YUMA	A WHITE
SCdG	———	0.03416	0.11491	0.11337	0.11715	0.09913	0.12811	0.15491	0.31839
SCdG-SM	2.25256	———	0.08998	0.07520	0. 6616	0.08798	0.09690	0.12193	0.33445
PAPAGO	18.67780	6.18984	———	0.01446	0.00941	0.01526	-0.00951	0.02501	0.34688
NAVAJO	24.20938	5.75664	3.69225	———	-0.01318	0.00193	-0.01862	0.02124	0.37675
APACHE	6.99515	2.64205	0.58611	-0.89953	———	-0.00181	-0.01148	0.00707	0.41356
HOPI	18.23454	6.35563	3.19246	0.59069	-0.11762	———	-0.01594	0.04363	0.36448
ZUNI	3.80899	2.32538	-0.28508	-0.57752	-0.26302	-0.48535	———	-0.02459	0.26103
YUMA	14.05772	6.27165	2.41037	2.37477	0.33477	4.50289	-0.64187	———	0.29033
WHITE	25.34962	16.55775	27.86243	33.88556	19.36280	30.25737	7.01212	17.93135	———

---

*Mean measures of divergence above diagonal, standardized mean measures of divergence below diagonal

MMD/MMD-SD values. Both the Grewal-Smith formula, as corrected by Constandse-Westermann (1972), as well as the formula which incorporates the Freeman-Tukey transformation (Green and Suchey 1976), were included in these calculations. However, recently, use of the Grewal-Smith formula has been called into question because of its tendency to overestimate distances for small samples (Green and Suchey 1976). Therefore, only the formula suggested by Green and Suchey (1976) was used for all other analyses. In drawing conclusions from the values in Table 7, only the MMD/MMD-SD values were considered. The reason for this is that when one is contrasting populations of different sample sizes, the magnitude of variance tends to vary. As a result, the same MMD value can mean very different things depending upon the nature of the sample sizes being compared. A case in point would be the contrast between Santa Catalina and Navajo (MMD=0.1137) and Santa Catalina and Zuni (MMD=0.12811). From the MMD data alone, it would appear that Santa Catalina is more like the Navajo than it is to the Zuni. However, when the MMD values are divided by the MMD-SD (just as in Z-scores), it is clear that Santa Catalina is much more similar to the Zuni

(3.80899) than to the Navajo (24.20938). As would be expected, the Santa Catalina and Santa Maria population samples are more closely correlated with one another than to any of the other population samples (MMD/MMD-SD=2.25256).

The next procedure used to estimate population distances was multidimensional scaling (Kruskal and Wish 1978). Multidimensional scaling is a technique that is designed to construct a "map" showing the relationships between a number of objects, given a table of distances between them. The "objects" in this case are populations and the distances used were the MMD/MMD-SD values derived with the Freeman-Tukey transformation reported in Table 7. The "map" constructed from these distances is presented in Figure 5. As with the MMD/MMD-SD values discussed previously, the results of the multidimensional scaling indicate that the Santa Catalina and Santa Maria population samples are more closely related to each other than to any of the other samples.

In order to assess which dental traits were responsible for most of the variance (and hence population distance) in the population samples, a

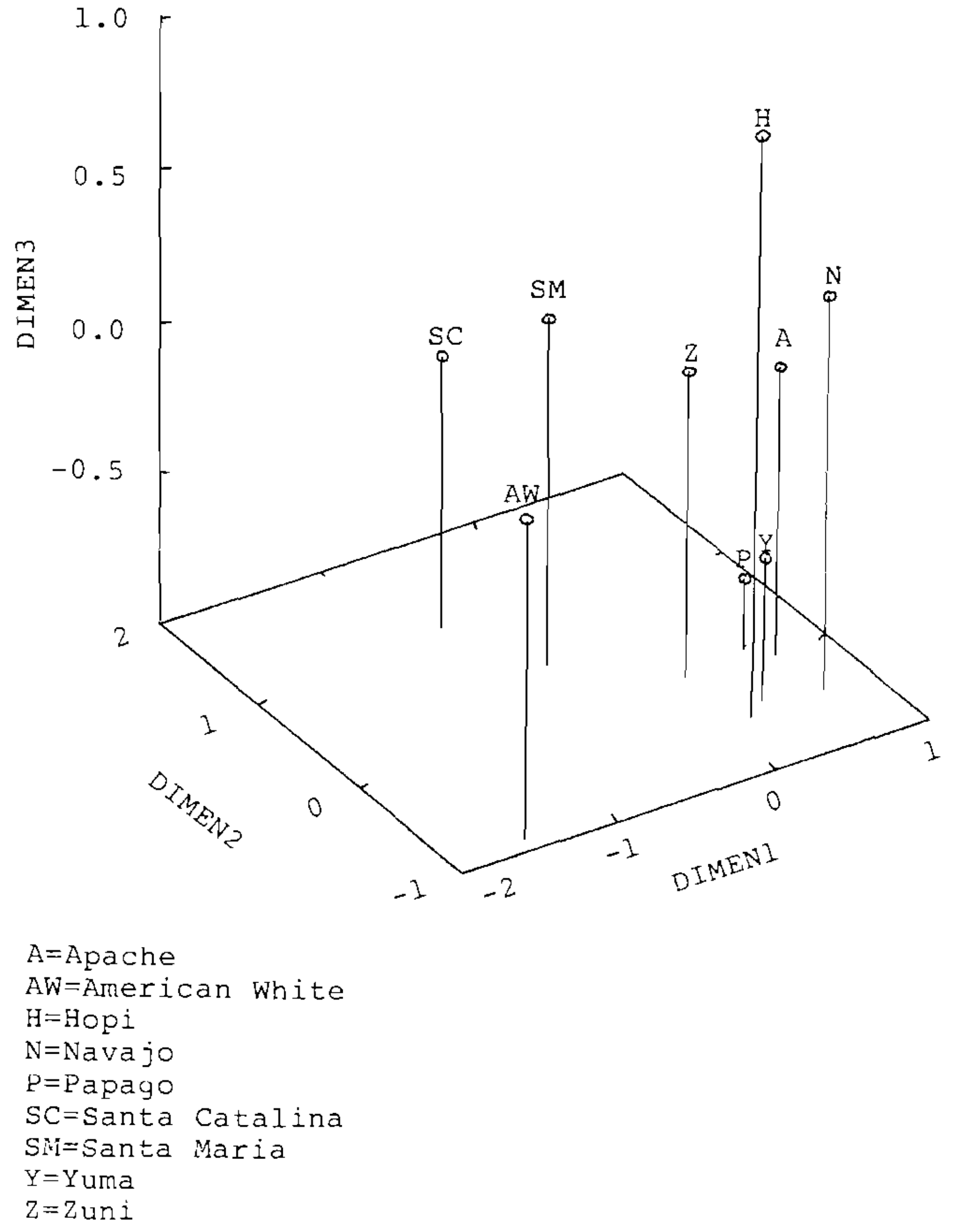

FIGURE 5. Map of Multidimensional Scaling

principle component analysis was performed (Manly 1986). Table 8 presents the unrotated component loadings and the variance explained by each of the principle components. As can be seen, the first three components explain 90.204% of the total variance. These data indicate clearly that the Santa Catalina and Santa Maria samples are quite distinct from the southwestern samples, and all of these native American samples are distinct from American Whites. It can also be observed from the results presented in Table 8 that the traits shoveling I1, shoveling I2, hypocone M1, Carabelli's trait M1, cusp number of M1 and M2, cusp 6 of M1, and cusp 7 on M2 provide valuable parameters for differentiating these three regional clusters.

Figure 6 presents a "map" of the principal component analysis. The results are the same as reported for the previous analyses of population distances. It is interesting to note, however, that the Santa Maria sample occupies a more central position with respect to the southwestern groups and the American Whites than does the Santa Catalina sample. This result cannot be fully explained by smaller sample size, for if this was simply a matter of small size, then one would

TABLE 8

Component Loadings from Principle Component Analysis

shoveling I1	0.739	0.580	-0.005	0.258
shoveling I2	0.936	0.315	-0.046	0.007
tuberculum dentale	-0.068	0.844	-0.269	-0.207
hypocone M1	0.491	-0.729	-0.033	0.225
hypocone M2	0.699	0.188	0.172	0.238
metaconule M1	0.594	-0.271	0.497	-0.300
Carabelli's trait M1	-0.819	-0.182	0.319	-0.359
groove pattern M1	0.196	-0.641	0.673	0.197
groove pattern M2	-0.097	-0.521	-0.440	0.714
cusp number M1	0.955	0.129	0.128	0.039
cusp number M2	0.899	-0.334	-0.022	-0.137
cusp 6 M1	0.798	0.328	0.146	0.190
cusp 6 M2	0.746	-0.287	0.005	-0.531
cusp 7 M1	-0.157	0.157	0.653	0.284
cusp 7 M2	-0.753	0.162	0.538	0.260

Percent of total variance explained:

1	2	3	4
44.875	21.827	12.350	9.796

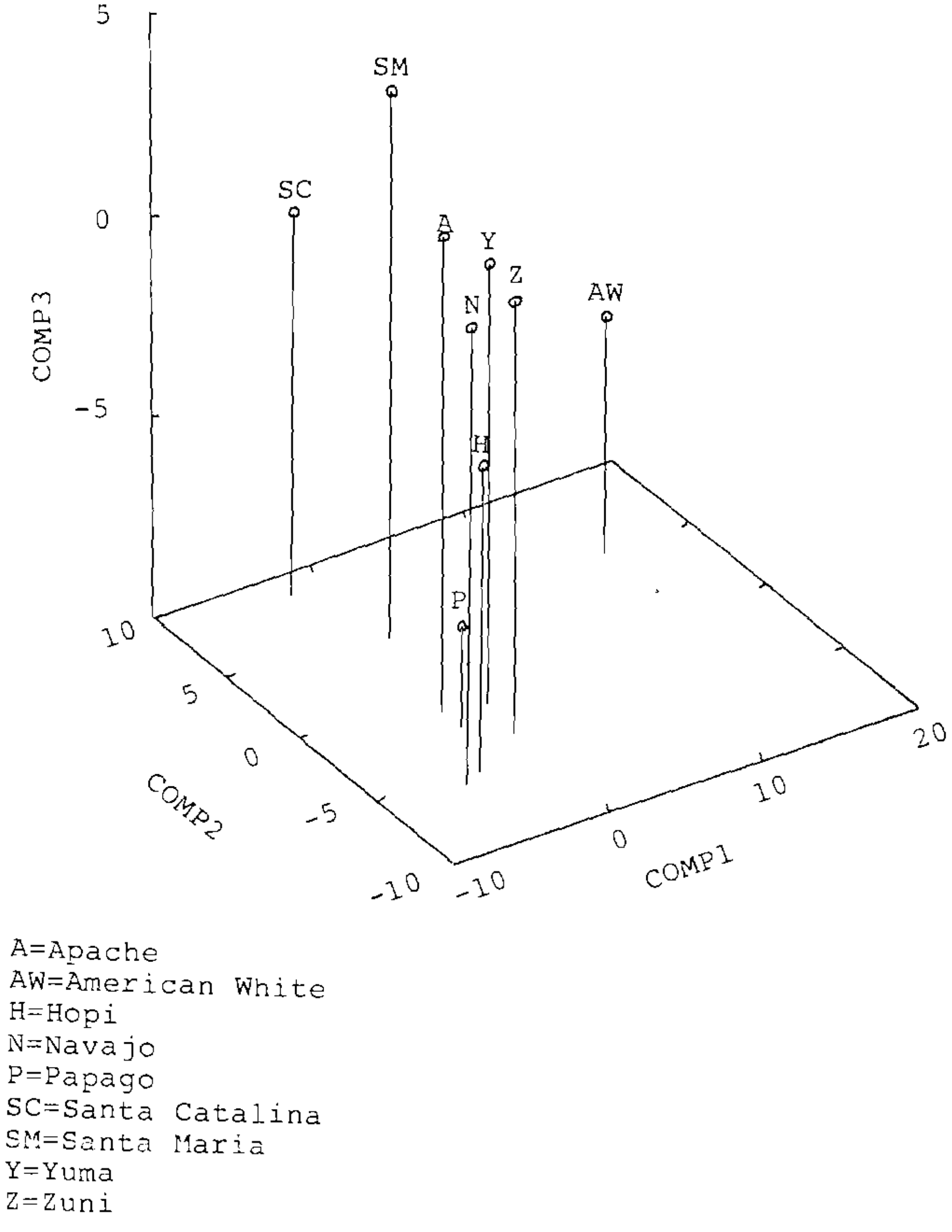

FIGURE 6. Map of Principle Components Analysis

expect the Zuni and Apache to occupy much more central positions than they do.

Assessment of Gender and Age Variations

Another consideration of this study was inter- and intra-population gender and age variations. Sexual dimorphism has been demonstrated to be significant within and between populations (Corruccini 1974, Konigsberg 1987). Up to 31% of the traits studied by Corruccini differed at $p<0.05$ between the sexes within populations and each sample exhibited a different pattern of sexual dimorphism (i.e., different traits were dimorphic for each population). The second parameter (age) also had an influence on the value obtained from the final distance equation. It was found that there is a systematic change of large magnitude for a few traits and a significant cumulative age divergence over many traits. Corruccini observed that distances between younger and older members of each gender and race group were statistically significant ($p<0.01$). This finding substantiates earlier claims of age dependence of trait expression (Akabori

1934, Ossenberg 1969, 1970, Buikstra 1972b). For this study, the age and gender variations were not great enough to be considered in the distance equations although some minor differences were present.

Intersite Gender and Age Variations

In order to assess intersite gender variations, two-dimensional contingency tables were constructed for each trait and Chi-square statistics computed. The results of this analysis are presented in Tables 9 and 10. As can be seen, when segregated into female and male cohorts, only two traits (10.5%) of those examined showed statistically significant differences ($p<0.05$) for the females between the two sites. Three traits (12.5%) for the males exhibited significant differences. As with the previous intersite comparisons (genders combined), these percentages are quite low and can be explained as simple type one errors.

As with the intersite gender comparisons, the intersite age variations were assessed by constructing two-dimensional contingency tables and the computation of Chi-square statisitics. The results of this analysis are reported in Tables 11 and 12. For the purposes of

TABLE 9

Intersite Gender Differences: Female

Dental Trait	Chi-square	D.F.	Significance
shoveling I1	3.111	2	0.211
shoveling I2	0.285	2	0.867
curvature	1.895	1	0.169
double-shoveling	0.912	2	0.634
interruption groove	3.390	1	0.066
tuberculum dentale	9.396	2	0.009
metacone M3	3.2937	2	0.193
hypocone M1	7.419	2	0.024
hypocone M2	2.379	2	0.304
metaconule M1	*	*	0.392
Carabelli's trait M1	2.286	2	0.319
parastyle	0.008	1	0.927
peg-shaped molar	2.003	1	0.157
anterior fovea	*	*	0.500
groove pattern M1	*	*	0.579
groove pattern M2	*	*	0.545
cusp number M2	*	*	0.579
cusp 5 M1	*	*	0.641
cusp 5 M2	*	*	0.646
cusp 6 M2	*	*	0.692

*probabilities calculated by Fisher's Exact Test

examining intersite age variations, the individuals were segregated into two logical groupings: preadult (ages 0-16) and adult (ages 17-60). Smaller partitions were not possible because of the large number of cells which contained zeros with such partitions.

The percentages of significant differences were particularly low (preadults, 16%; adults, 20%), and the traits with siginificant differences were the same as those for the earlier analyses. From this analysis, it appears that the differences between the two population samples are contributed almost equally by the adults and preadults. These results suggest that gender and age variations play a relatively minor role in between sample trait expression for these two samples.

Intrasite Gender and Age Variations

Intrasite gender variations were examined by constructing two-dimensional contingency tables and the computation of Chi-square statistics. The results of this analysis are presented in Tables 13 and 14. Neither sample exhibited any statistically significant gender differences for the 26 traits examined. This finding

TABLE 10

Intersite Gender Differences: Male

Dental Trait	Chi-square	D.F.	Significance
shoveling I1	3.269	2	0.195
shoveling I2	1.007	2	0.604
curvature	0.974	1	0.324
double-shoveling	7.460	2	0.024
interruption groove	5.487	1	0.019
tuberculum dentale	1.700	2	0.427
metacone M3	2.876	2	0.237
hypocone M1	6.750	1	0.009
hypocone M2	1.012	2	0.603
metaconule M1	*	*	0.444
Carabelli's trait M1	5.062	2	0.079
parastyle	1.472	1	0.225
peg-shaped molar	0.060	1	0.809
anterior fovea	*	*	0.800
groove pattern M1	*	*	0.429
groove pattern M2	*	*	0.291
cusp number M1	*	*	0.446
cusp number M2	*	*	0.108
protostylid M1	*	*	0.714
cusp 5 M1	*	*	0.692
cusp 5 M2	*	*	0.376
cusp 6 M1	*	*	0.666
cusp 6 M2	*	*	0.200
cusp 7 M1	*	*	0.385

*probabilities calculated by Fisher's Exact Test

indicates that in terms of gender, each sample is relatively homogeneous. That is, there is no significant change in trait frequency with gender.

Intrasite age variations were also examined via two-dimensional contingency tables. The results for this analysis are reported in Tables 15 and 16. As can be seen, the results are much the same as the earlier analyses. The percentages of differences are relatively low (Santa Catalina 26%, Santa Maria 16.6%) and can be easily explained statistically.

Because the Santa Catalina sample exhibited a slightly higher percentage of significant differences, discriminant function analysis was applied to the data from each sample to further explore the relationship between age and trait expression. The results of this analysis are presented in Table 17. From the data in Table 17, it can be seen that the level of discrimination for each sample is very low and that the relationship between age and trait expression must be relatively weak. From these results, it can be concluded that gender and age variations are minor for each sample with respect to trait expression. This finding differs from those of

TABLE 11

Intersite Age Differences: Preadult

Dental Trait	Chi-square	D.F.	Significance
shoveling I1	0.533	2	0.766
shoveling I2	1.403	2	0.496
curvature	1.615	1	0.204
double-shoveling	5.732	2	0.057
interruption groove	0.504	1	0.478
tuberculum dentale	4.369	2	0.113
metacone M3	0.300	2	0.861
hypocone M1	17.093	2	0.000
hypocone M2	0.706	2	0.702
metaconule M1	1.698	1	0.192
Carabelli's trait M1	2.201	2	0.333
peg-shaped molar	*	*	0.126
anterior fovea	1.461	2	0.481
groove pattern M1	0.153	1	0.696
groove pattern M2	13.139	1	0.000
cusp number M1	3.537	1	0.060
cusp number M2	0.895	1	0.344
deflecting wrinkle	1.171	1	0.279
distal trigonid crest	4.776	1	0.029
protostylid M1	3.854	1	0.049
cusp 5 M1	0.487	1	0.485
cusp 5 M2	0.870	1	0.351
cusp 6 M1	1.947	1	0.163
cusp 6 M2	3.828	1	0.050
cusp 7 M1	1.795	1	0.180

*probabilities calculated by Fisher's Exact Test

previous studies on other population samples (Corruccini 1974, Konigsberg 1987) which have found significant gender and age variation with the traits in their studies. This difference may be due to the use of cranial nonmetric traits for previous studies and the use of dental nonmetric traits for the present study.

Assessment of Stress Related Variation(s)

One of the considerations of this study was variations which may in part be caused by pre- or post-natal stress and related differences in developmental timing. The environment has a profound effect on the development and maintenance of the hard tissues and these effects can be discerned through osteological analysis (Larsen 1989, Huss-Ashmore et al. 1982). The environmental factors which affect the hard tissues can be subsumed under the general term "stress." Environmental stress comprises a number of inter-related factors. For the purposes of this study, only physiological factors are considered: disease, nutrition, and general health. The effects of stress on

TABLE 12

Intersite Age Differences: Adult

Dental Trait	Chi-square	D.F.	Significance
shoveling I1	2.365	2	0.306
shoveling I2	1.823	2	0.402
curvature	0.929	1	0.335
double-shoveling	6.043	2	0.048
interruption groove	3.819	1	0.051
tuberculum dentale	4.228	2	0.121
metacone M3	0.524	2	0.769
hypocone M1	19.004	2	0.000
hypocone M2	6.668	2	0.036
metaconule M1	1.247	1	0.264
Carabelli's trait M1	10.540	2	0.005
parastyle	0.951	1	0.329
peg-shaped incisor	0.780	1	0.377
peg-shaped molar	4.328	1	0.375
anterior fovea	11.169	2	0.004
groove pattern M1	0.929	1	0.335
groove pattern M2	0.807	1	0.369
cusp number M1	0.375	1	0.540
cusp number M2	0.057	1	0.811
protostylid M1	*	*	0.394
cusp 5 M1	0.583	1	0.445
cusp 5 M2	2.449	1	0.117
cusp 6 M1	2.021	1	0.155
cusp 6 M2	0.452	1	0.501
cusp 7 M1	1.304	1	0.253

*probabilities calculated by Fisher's Exact Test

the expression of quasi-continuous traits are well documented in mice (Bader 1965, Howe and Parsons 1967, Siegal and Doyle 1975b), laboratory rats (Siegal and Doyle 1975a, Siegal et al. 1977), primates (Lavelle and Moore 1973, Nass 1982, Chevrud and Buikstra 1981), and humans (Corruccini and Potter 1981, Garn et al. 1979, Niswander and Chung 1965, Smith et al. 1982, Trinkaus 1978, Korey 1980, Sellevold 1980).

Stress may result in morphological reduction, compression, or agenesis of teeth (Garn et al. 1963, Dahlberg 1962, Taylor 1982). Many of these variations may be the result of dental "field" effects and developmental timing. In the field model of embryological development, tissues are seen to develop in organizational fields. Influences on the tissues vary in a sense of "polarity" with the greatest effect being at a particular pole (site) within a field (Weiss 1937, Butler 1939). Variations in form and size of the individual members within the group are directly correlated with their respective distances from the pole of the field. In modern man, the first molars, first premolars, canines, upper central incisors, and lower lateral incisors are marked as "poles" of their individual fields (Dahlberg 1962).

TABLE 13

Intrasite Gender Differences: Santa Catalina

Dental Trait	Chi-square	D.F.	Significance
shoveling I1	1.295	2	0.523
shoveling I2	0.134	2	0.935
curvature	*	*	0.272
double-shoveling	4.442	2	0.108
interruption groove	*	*	0.671
tuberculum dentale	3.636	2	0.162
metacone M3	4.443	2	0.108
hypocone M1	1.909	2	0.385
hypocone M2	2.353	2	0.308
metaconule M1	*	*	0.646
Carabelli's trait M1	0.481	2	0.786
parastyle	0.020	1	0.887
peg-shaped molar	0.155	1	0.694
anterior fovea	*	*	0.334
groove pattern M1	0.144	1	0.704
cusp number M1	*	*	0.615
cusp number M2	*	*	0.300
cusp 5 M1	*	*	0.641
cusp 5 M2	*	*	0.563
cusp 6 M2	*	*	0.529

*probabilities calculated by Fisher's Exact Test

In conjunction with this field effect, there is a factor of developmental timing. It has been observed that if developmental timing (i.e. the onset of structural development) is delayed, the structures involved are reduced in size (Garn et al. 1963, Sofaer et al. 1971, Anderson et al. 1977, 1978). As such, if an individual is genetically predisposed to having an overall reduction of the dentition and experiences a delay in development, then certain teeth may be markedly reduced or entirely missing (e.g., upper lateral incisors, second premolars, third molars).

Side Asymmetry

One of the results of "field" effects or disturbances in developmental timing is side asymmetry. That is, the size or shape of teeth on left and right sides of the mouth may differ noticably due to stress. In order to assess the frequency of side asymmetry for the dental traits in this study, differences in trait expression for each individual were tabulated and recorded as presence or absence of side asymmetry for

TABLE 14

Intrasite Gender Differences: Santa Maria

Dental Trait	Chi-square	D.F.	Significance
shoveling I1	1.098	2	0.577
shoveling I2	0.911	2	0.364
curvature	1.642	1	0.200
double-shoveling	0.186	2	0.911
interruption groove	0.133	1	0.715
tuberculum dentale	1.494	2	0.474
metacone M3	1.900	2	0.386
hypocone M1	0.607	1	0.435
hypocone M2	0.078	2	0.962
metaconule M1	*	*	0.583
Carabelli's trait M1	2.282	2	0.319
parastyle	1.372	1	0.241
peg-shaped molar	0.879	1	0.348
anterior fovea	2.625	2	0.269
groove pattern M1	*	*	0.600
groove pattern M2	*	*	0.689
cusp number M1	*	*	0.231
cusp number M2	*	*	0.329
protostylid M1	*	*	0.536
cusp 5 M1	*	*	0.692
cusp 5 M2	*	*	0.476
cusp 6 M1	*	*	0.389
cusp 7 M1	*	*	0.500

*probabilities calculated by Fisher's Exact Test

TABLE 15

Intrasite Age Differences: Santa Catalina

Dental Trait	Chi-square	D.F.	Significance
shoveling I1	2.413	2	0.299
shoveling I2	0.707	2	0.702
curvature	3.478	1	0.062
double-shoveling	0.462	2	0.793
interruption groove	0.253	1	0.615
tuberculum dentale	9.353	2	0.009
metacone M3	3.598	2	0.165
hypocone M1	1.396	2	0.497
hypocone M2	10.826	2	0.004
metaconule M1	0.260	1	0.609
Carabelli's trait M1	5.569	2	0.061
parastyle	0.889	1	0.345
peg-shaped incisor	0.675	1	0.411
peg-shaped molar	4.250	1	0.039
anterior fovea	2.218	2	0.329
groove pattern M1	0.925	1	0.336
groove pattern M2	0.002	1	0.959
cusp number M1	4.432	1	0.035
cusp number M2	6.349	1	0.011
deflecting wrinkle	0.074	1	0.785
distal trigonid crest	3.536	1	0.060
protostylid M1	1.294	1	0.255
cusp 5 M1	1.290	1	0.256
cusp 5 M2	8.073	1	0.004
cusp 6 M1	1.261	1	0.261
cusp 6 M2	6.385	1	0.011
cusp 7 M1	5.043	1	0.025

TABLE 16

Intrasite Age Differences: Santa Maria

Dental Trait	Chi-square	D.F.	Significance
shoveling I1	2.012	2	0.366
shoveling I2	2.696	2	0.259
curvature	1.103	1	0.293
double-shoveling	0.873	2	0.646
interruption groove	0.028	1	0.865
tuberculum dentale	2.223	2	0.329
metacone M3	2.579	2	0.262
hypocone M1	5.749	2	0.056
hypocone M2	8.685	2	0.013
metaconule M1	0.005	1	0.943
Carabelli's trait M1	0.918	2	0.631
parastyle	0.160	1	0.688
peg-shaped molar	0.142	1	0.703
anterior fovea	3.694	2	0.158
groove pattern M1	1.879	1	0.170
groove pattern M2	4.195	1	0.040
cusp number M1	7.778	1	0.005
cusp number M2	0.350	1	0.554
protostylid M1	0.236	1	0.627
cusp 5 M1	0.150	1	0.698
cusp 5 M2	3.555	1	0.059
cusp 6 M1	5.454	1	0.019
cusp 6 M2	0.033	1	0.854
cusp 7 M1	2.526	1	0.112

TABLE 17

Discriminant Function Analysis on Groups Defined by Age

Classification results: Santa Catalina

Actual Group	No. of Cases	Predicted Group Preadult	Predicted Group Adult
Preadult	17	10 (58.8)	7 (41.2)
Adult	27	18 (66.7)	9 (33.3)

Cases correctly classified: 36.36%

Classification results: Santa Maria

Actual Group	No. of Cases	Predicted Group Preadult	Predicted Group Adult
Preadult	10	5 (50.0)	5 (50.0)
Adult	9	1 (11.1)	8 (88.9)

Cases correctly classified: 68.42%

each trait. These frequencies were then compared via two-dimensional contingency tables and Chi-square statistics.

The results of the side asymmetry analysis are presented in Table 18. These results show that although the frequencies were for the most part consistently higher for the Santa Catalina sample, only one of the differences (double-shoveling) was statistically significant. The frequencies of dental asymmetry observed in the Santa Catalina and Santa Maria population samples are comparable with those of other populations experiencing high levels of stress (Baume and Crawford 1979, 1980). However, the degree of stress as reflected in the occurrence of dental asymmetry does not appear to change significantly between the two samples.

Morphological Reduction

As discussed previously, one of the dental manifestations of biological stress is the reduction in morphological complexity of the teeth. Upon examination of the trait frequencies reported in Table 4 and the results of the contingency table analysis in Table 5,

TABLE 18

Results of Side Asymmetry Analysis

	SCDG		SCDG-SM		
Dental Trait	N	% pres.	N	% pres.	p
shoveling I1	36	2.8	36	2.8	1.000
shoveling I2	44	9.1	37	5.4	0.528
double-shoveling	43	11.6	43	0.0	0.021
interruption groove	32	28.1	38	34.2	0.585
tuberculum dentale	34	11.8	37	10.8	0.899
metacone M3	45	17.8	24	8.3	0.288
hypocone M1	88	2.3	34	0.0	0.375
hypocone M2	77	10.4	29	0.0	0.071
metaconule M1	66	4.5	25	0.0	0.278
metaconule M2	60	5.0	20	5.0	1.000
Carabelli's trait M1	58	12.1	25	12.0	0.993
Carabelli's trait M2	43	0.0	21	4.8	0.149
peg-shaped molar	40	0.0	34	2.9	0.275
anterior fovea	54	1.9	22	4.5	0.506
groove pattern M1	82	4.9	26	3.8	0.827
groove pattern M2	76	13.2	17	11.9	0.877
cusp number M1	76	3.9	29	3.4	0.905
cusp number M2	62	4.8	19	0.0	0.328
protostylid M1	47	8.5	16	18.8	0.260
cusp 5 M1	76	3.9	27	3.7	0.955
cusp 5 M2	61	11.5	18	5.6	0.464
cusp 6 M1	77	9.1	24	4.2	0.435
cusp 6 M2	60	10.0	16	0.0	0.187
cusp 7 M1	77	0.0	25	4.0	0.078

there does not appear to be a consistent pattern of reduction in morphological complexity from the Santa Catalina to the Santa Maria sample. That is, the teeth for the Santa Maria sample are not morphologically less complex nor are the dental features smaller than in the Santa Catalina sample. Although the Santa Catalina sample exhibits a greater degree of variation, this is probably due to sample size and not genetic difference or stress related variation. Examination of the dental traits with statistically significant differences reveals that there is not a consistent pattern of morphological reduction for the Santa Maria sample. The significant traits are almost equally divided, with some reduced in the Santa Catalina sample and others reduced in the Santa Maria sample. From this evidence, it appears that the Guale were not experiencing enough stress to significantly change their dentition from their occupation of Santa Catalina to their occupation of Santa Maria.

Implications for Future Research

The results of this study indicate that although there are some minor differences in the expression of nonmetric dental traits between the population samples from Santa Catalina and Santa Maria the populations themselves were closely genetically affiliated. There also appears to be little or no change in the dental morphology of the Guale after their move from Santa Catalina to Santa Maria. Other studies have demonstrated that the greatest degree of change in the Guale occurred at the introduction of agriculture (Hutchinson 1986, Larsen 1989). The overall morphology of the Guale dentition may have significantly changed at this time as well.

Chapter VI

CONCLUSIONS

The primary focus of this study was to establish the genetic affinity between the two skeletal population samples and to assess the population distance between them. The results from the examination of trait frequencies, discriminant function analysis, and other multivariate procedures indicates that the population samples from Santa Catalina and Santa Maria are almost certainly derived from the same population. Although there are some differences in the expression of some of the dental traits, these are minor and can be easily explained by sampling error. As for the actual population distance between the samples, the mean measures of divergence were calculated and compared with other unrelated native American groups. However, these statistics will only become meaningful with further studies and comparisons with other local skeletal samples. Principle component analysis has elucidated a number of traits which should be particularly useful for these studies.

Having established the affinity between the population samples, patterns of inter- and intra-population gender and age variations were explored. Prior studies have indicated that these are often crucial factors to consider before calculating population distances or comparing samples. In this case, however, the gender and age variations were so slight as to be considered negligable and were included in the overall discussion of population variation, not as a prerequisite to inclusion of traits or application of corrective statistics.

Deviations which may be caused or intensified by biological stress were also considered. Earlier studies on the prehistoric and contact period Guale have indicated that these native inhabitants experienced a great deal of stress with the arrival of Europeans. However, some studies have suggested that the stress created by a shift from a hunting and gathering mode of subsistence to an agricultural one may have had a more profound impact. The examination of side asymmetry and morphological reduction indicates that at least at the level of dental genetics there was not a detectable increase in the level of stress from the occupation of Santa Catalina to the move to Santa Maria.

LITERATURE CITED

Akabori, E.
1934 The Nonmetric Variations in the Japanese Skull. Japanese Journal of Medical Science 1, Anatomy 4:61-318.

Anderson, D.L., G.W. Thompson and F. Popovich
1977 Molar Polymorphisms and the Timing of Dentition Mineralization. Growth 41:191-197.

Anderson, D.L., G.W. Thompson and F. Popovich
1978 Molar Polymorphisms and Body Growth. Growth 42:205-212.

Arana, Luis Rafael and Albert Manucy
1977 The Building of Castillo de San Marcos. St. Augustine: Eastern National Park and Monument Association.

Axelsson, Gudjon and Bjorn Hedegard
1981 Torus Mandibularis Among Icelanders. American Journal of Physical Anthropology 54:383-389.

Axelsson, Gudjon and Pentti Kirveskari
1977 The Deflecting Wrinkle on the Teeth of Icelanders and the Mongoloid Dental Complex. American Journal of Physical Anthropology 47:321-324.

Axelsson, Gudjon and Pentti Kirveskari
1982 Correlations Between Lower Molar Occlusal Traits in Icelanders. IN Teeth: Form, Function and Evolution. Bjorn Kurten, ed. Pp. 237-244. New York: Columbia University Press.

Bader, R.S.
1965 Fluctuating Asymmetry in the Dentition of the House Mouse. Growth 29:291-300.

Bailit, H.L., P.L. Workman, J.D. Niswander and C.J. Maclean
1970 Dental Asymmetry as an Indicator of Genetic and Environmental Conditions in Human Populations. Human Biology 46:626-638.

Balakrishan, V. and L.D. Sanghvi
1968 Distance Between Populations on the Basis of Attribute Data. Biometrics 24:859-865.

Bass, W.M.
1981 Human Osteology: A Laboratory and Field Manual of the Human Skeleton. Columbia: Missouri Archaeological Society.

Baume, R.M. and M.H. Crawford
1979 Discrete Dental Trait Asymmetry in Mexico and Belize. Journal of Dental Research 59:1811.

Baume, R.M. and M.H. Crawford
1980 Discrete Dental Trait Asymmetry in Mexican and Belizean Groups. American Journal of Physical Anthropology 52:315-321.

Baume, R.M. and B.A. Lapin
1983 Inbreeding Effects on Dental Morphometrics in Papio hamadryas. American Journal of Physical Anthropology 62:129-135.

Bennett, Kenneth A.
1965 The Etiology and Genetics of Wormian Bones. American Journal of Physical Anthropology 23:255-260.

Berry, A. Caroline
1974 The Use of Nonmetrical Variations of the Cranium in the Study of Scandanavian Population Movements. American Journal of Physical Anthropology 40:345-358.

Berry, A. Caroline
1976 The Anthropological Value of Minor Variants of the Dental Crown. American Journal of Physical Anthropology 45:257-267.

Berry, A. Caroline and R.J. Berry
1967 Epigenetic Variation in the Human Cranium.

Journal of Anatomy 101:361-379.

Berry A. Caroline and R.J. Berry
1971 Epigenetic Polymorphism in the Primate Skeleton. IN Comparative Genetics in Monkeys, Apes and Man. A.B. Chiarelli. Pp. 13-42. New York: Academic.

Berry, R.J.
1968 The Biology of Nonmetrical Variation in Mice and Men. IN The Skeletal Biology of Earlier Human Populations. D.R. Brothwell. Pp. 103-133. New York: Pergamon Press.

Berry, R.J. and A.G. Searle
1963 Epigenetic Polymorphism in Rodents. Proceedings of the Zoological Society of London 140:577-615.

Biggerstaff, Robert H.
1975 Cusp Size, Sexual Dimorphism, and Heritability of Cusp Size in Twins. American Journal of Physical Anthropology 42:127-140.

Birkby, E.E.
1973 Discontinuous Nonmetric Traits of the Skull as Population Markers in the Prehistoric Southwest. Ph.D. dissertation, University of Arizona.

Black, T.K.
1980 An Exception to the Apparent Relationship Between Stress and Fluctuating Asymmetry. Journal of Dental Research 59:1168-1169.

Blakely, R.
1973 Biological Variation Among and Between Two Prehistoric Indian Populations at Dickson Mounds. Ph.D. dissertation, University of Indiana.

Bolk, G.I.
1931 On Metopism. American Journal of Anatomy 22:27-47.

Bolton, Herbert E.
1917 The Mission as a Frontier Institution in the Spanish-American Colonies. American Historical Review 23:42-62.

Bolton, Herbert E. and Mary Ross
1925 The Debatable Land. Berkley: University of

California Press.

Brothwell, D.R., V.M. Carbonell and D.H. Goose
1963 Congenital Absence of Teeth in Human Populations. IN Dental Anthropology. D.R. Brothwell. Pp. 179-190. New York: Pergamon Press.

Buikstra, Jane E.
1972a Hopewell in the Lower Illinois River Valley: A Regional Approach to the Study of Biological Variability and Mortuary Activity. PhD. Dissertation, University of Chicago.

Buikstra, J.
1972b Techniques for Coping with the Age-regressive Nature of Nonmetric Traits. American Journal of Physical Anthropology 37:431-432.

Buikstra, Jane E.
1980 Epigenetic Distance: A Study of Biological Variability in the Lower Illinois River Region. IN Early Native Americans: Prehistoric Demography, Economy, and Technology. David L. Browman, ed. Pp. 271-299. New York: Mouton Publishers.

Bushnell, Amy Turner
1986 Santa Maria in the Written Record. Miscellaneous Project Report Series, No. 21, Florida State Museum, Department of Anthropology, Gainsville, Florida.

Butler, Percy M.
1939 Studies of the Mammalian Dentition. Differentiation of the Post-Canine Dentition. Proceedings of the Zoological Society of London, Series B 109:1-36.

Butler, Percy M.
1982 Some Problems of the Ontogeny of Tooth Patterns. IN Teeth: Form, Function and Evolution. Bjorn Kurten, ed. Pp. 44-51. New York: Columbia University Press.

Carbonell, Virginia M.
1963 Variations in the Frequency of Shovel-shaped Incisors in Different Populations. IN Dental Anthropology. D.R. Brothwell. Pp. 211-234. New

York: Pergamon Press.

Chamay, A. and P. Tschantz
1972 Mechanical Influences in Bone Remodeling: Expeirmental Research on Woff's Law. Journal of Biomechanics 5:173-180.

Cheverud, James M. and Jane E. Buikstra
1978 A Study of Intragruop Biological Change Induced by Social Group Fission in Macaca mulatta Using Discrete Cranial Traits. American Journal of Physical Anthropology 48:41-46.

Cheverud, James M. and Jane E. Buikstra
1981 Quantitative Genetics of Skeletal Nonmetric Traits in the Rhesus Macaques on Cayo Santiago. II. Phenotypic, Genetic and Environmental Correlations Betwwen Traits. American Journal of Physical Anthropology 54:51-58.

Cheverud, James M. and Jane E. Buikstra
1982 Quantitative Genetics of Skeletal Nonmetric Traits in the Rhesus Macaques on Cayo Santiago. III. Relative Heritability of Skeletal Nonmetric and Metric Traits. American Journal of Physical Anthropology 59:151-155.

Cheverud, James M., Jane Buikstra and Elizebeth Twichell
1979 Relationships Between Nonmetric Skeletal Traits and Cranial Size and Shape. American Journal of Physical Anthropology 50:191-198.

Chiarelli, A.B.
1971 Comparative Genetics in Monkeys, Apes and Man. London: Academic.

Christensen, G.J.
1967 Occlusal Morphology of Human Molar Tooth Buds. Archives of Oral Biology 12:141-149.

Constandse-Westermann, T.S.
1972 Coefficients of Biological Distance. Oostehout N.B. The Netherlands.

Corruccini, Robert S.
1974 An Examination of the Meaning of Cranial Discrete Traits for Human Skeletal Biological Studies. American Journal of Physical Anthropology

40:425-446.

Corruccini, Robert S., Krishan Sharma and Rosario H. Yap Potter
1986 Comparative Genetic Variance and Heritability of Dental Occlusal Variables in US and Northwest Indian Twins. American Journal of Physical Anthropology 70:293-299.

Corruccini, Robert S. and R.H.Y. Potter
1981 Developmental Correlates of Crown Component Asymmetry and Occlusal Discrepancy. American Journal of Physical Anthropology 55:21-31.

Cybulski, J.S.
1972 Skeletal Variability in British Columbia Coastal Populations. A Descriptive and Comparative Assessment of Cranial Morphology. Unpublished Ph.D. Dissertation, University of Toronto.

Dahlberg, Albert A.
1945 The Changing Dentition of Man. Journal of the American Dental Association 32:676.

Dahlberg, Albert A.
1951 The Dentition of the American Indian. IN Laughlin, W.S. (ed.), Papers on the Physical Anthropology of the American Indian. New York: Viking Fund. pp. 138-176.

Dahlberg, Albert A.
1956 Materials for the Establishment of Standards for Classification of Tooth Characters, Attributes and Techniques in Morphological Studies of the Dentition. Department of Anthropology, University of Chicago.

Dahlberg, Albert A.
1960 The Dentition of the First Agriculturists (Jarmo, Iraq). American Journal of Physical Anthropology 18:243-256.

Dahlberg, Albert A.
1961 Relationship of Tooth Size to Cusp Number and Groove Conformation of Occlusal Surface Patterns of Lower Molar Teeth. Journal of Dental Research 40:34.

Dahlberg, Albert A.
1962 On the Teeth of Early Sapiens. IN Evolution and Hominisation. Gottfried Kurth, ed. Pp. 205-211. Stuttgart, Germany: Gustav Fischer Verlag.

Dahlberg, Albert A.
1963a Analysis of the American Indian Dentition. IN Dental Anthropology. D.R. Brothwell. Pp. 149-177. New York: Pergamon Press.

Dahlberg, Albert A.
1963b Dental Evolution and Culture. Human Biology 35:237-249.

Dahlberg, Albert A.
1965a Evolutionary Background of Dental and Facial Growth. Journal of Dental Research 44:151-160.

Dahlberg, Albert A.
1965b Geographic Distribution and Origin of Dentitions. The International Dental Journal 15(3):348-355.

Dahlberg, Albert A.
1986 Ontogeny and Dental Genetics in Forensic Problems. Forensic Science International 30:163-176.

Dahlberg, Albert A., Pentti Kirveskari and Thelma Dahlberg
1982 The Pima Indian Studies of the Inheritance of Dental Morphological Traits. IN Teeth: Form, Function and Evolution. Bjorn Kurten, ed. Pp. 292-297. New York: Columbia University Press.

Deagan, Kathleen
1983 Spanish St. Augustine: The Archaeology of a Colonial Creole Community. New York: Academic Press.

Deol, M.S., H. Greensberg, A.G. Searle and G.M. Truslove
1957 Genetical Differentiation Involving Morphological Characters in an Inbred Strain of Mice. I. A British Branch of the C57BL Strain. Journal of Morphology 100:345-375.

Deol, M.S. and Gillian M. Truslove
1957 Genetical Studies on the Skeleton of the Mouse. XX. Maternal Physiology and Variation in the

Skeleton of C57BL Mice. Journal of Genetics 55: 288-312.

DePratter, C.B.
1979 Ceramics. IN David Hurst Thomas and Clark Spencer Larsen (eds.), The Anthropology of St. Catherines Island: 2. The Refuge-Deptford Mortuary Complex. Anthropological Papers of the American Museum of Natural History Vol. 56, Part 1.

DiBennardo, R. and H.L. Bailit
1978 Stress and Dental Asymmetry in a Population of Japanese Children. American Journal of Physical Anthropology 48:89-94.

Doyle, W.J. and O. Johnston
1977 On the Meaning of Increased Fluctuating Dental Asymmetry: A Cross Population Study. American Journal of Physical Anthropology 46:127-134.

Enoki, Kei and Albert A. Dahlberg
1958 Rotated Maxillary Central Incisors. Orthodontic Journal of Japan 17:157.

Finnegan, Michael
1978 Nonmetric Variation of the Infracranial Skeleton. Journal of Anatomy 125:23-37.

Finnegan, Michael and K. Cooprider
1978 Empirical Comparison of Distance Equations Using Discrete Traits. American Journal of Physical Anthropology 49:39-46.

Finnegan, Michael and M.A. Faust
1974 Bibliography of Human and Nonhuman Nonmetric Variation. Research Reports, 14. Department of Anthropology, University of Massachusetts, Amherst.

Garn, S.M.
1977 Genetics of Dental Development. IN McNamara, J.A. (ed.), The Biology of Occlusal Development. Ann Arbor: Center for Human Growth and Development. pp. 61-88.

Garn, S.M. and S.M. Bailey
1977 The Symmetrical Nature of Bilateral Asymmetry of Deciduous and Permanent Teeth. Journal of Dental

Research 56:1422.

Garn, S.M., P.E. Cole and B.H. Smith
1979 The Effect of Sample Size on Crown Size Asymmetry. Journal of Dental Research 58:2012.

Garn, S.M., M.M. Cohen and M.A. Geciavskas
1970 Increased Crown-size Asymmetry in Trisomy G. Journal of Dental Research 49:465.

Garn, Stanley M., Albert A. Dahlberg, Arthur B. Lewis and Rose S. Kerewsky
1966a Cusp Number, Occlusal Groove Pattern and Human Taxonomy. Nature 210:224-225.

Garn, S.M., R.S. Kerewsky and A.B. Lewis
1966b Extent of Sex Influence on Carabelli's Polymorphism. Journal of Dental Research 45:18-23.

Garn, S.M., A.B. Lewis and R.S. Kerewsky
1966c The Meaning of Bilateral Asymmetry in the Permanent Dentition. Angle Orthodontia 36:55-62.

Garn, S.M., A.B. Lewis and J. Vicinus
1963 Third Molar Polymorphism and Its Significance to Dental Genetics. Journal of Dental Research 42 (supplement):1344-1363.

Garn, S.M., R.H. Osborne and K.D. McCabe
1979 The Effect of Prenatal Factors on Crown Dimensions. American Journal of Physical Anthropology 51:665-678.

Geiger, Maynard J.
1940 Biogrphical Dictionary of the Franciscans in Spanish Florida and Cuba (1528-1841). Paterson, N.J.: Franciscan Studies, Vol. 21.

Goose, D.H. and G.T.R. Lee
1971 The Mode of Inheritence of Carabelli's Trait. Human Biology 43:64-69.

Green, Richard F. and Judy Myers Suchey
1976 The Use of Inverse Sign Transformations in the Analysis of Non-metric Cranial Data. American Journal of Physical Anthropology 45:61-68.

Green, Richard F., Judy Myers Suchey, and D.V. Gokhale
1979 The Statistical Analysis of Correlated Bilateral Traits in the Analysis of Cranial Material. American Journal of Physical Anthropology 50:629-634.

Greene, David Lee
1982 Discrete Dental Variations and Biological Distances of Nubian Populations. American Journal of Physical Anthropology 58:75-79.

Gregory, William K.
1916 Studies on the Evolution of the Primates. Part I. The Cope-Osborn "Theory of Trituberculy" and the Ancestral Molar Patterns of the Primates. Part II. Phylogeny of Recent and Extinct Anthropoids, with Special Reference to the Origin of Man. Bulletin of the American Museum of Natural History 35:239-355.

Grewal, M.S.
1962 The Rate of Divergence in the C57BL Strain of Mice. Genetic Research 3:226-237.

Griffin, Mark C. and Clark Spencer Larsen
1989 Patterns in Osteoarthritis: A Case Study from the Prehistoric and Historic Southeastern U.S. Atlantic Coast. American Journal of Physical Anthropology 78:232.

Gruneberg, Hans
1952 Genetical Studies on the Skeleton of the Mouse. IV. Quasi-Continuous Variations. Journal of Genetics 51:95-114.

Gruneberg, Hans
1963 The Pathology of Development. Blackwell, Oxford.

Gruneberg, Hans
1965 Genes and Genotypes Affecting the Skeleton of the Mouse. Journal of Embryology and Experimental Morphology 14:137-159.

Haeussler, A.
1985 Dental Morphology of New World, Eastern Siberia, and Soviet Central Asia Populations. M.A. Thesis. Arizona State University, Tempe.

Hann, John H.
1987 Apalachee: The Land between the Rivers. Gainsville: University Presses of Florida.

Hardin, Kenneth
1986 The Santa Maria Mission Project. Florida Anthropologist 39:75-83.

Harris, Edward F.
1977 Anthropologic and Genetic Aspects of the Dental Morphology of Solomon Islanders, Melanesia. Ph.D. dissertation, Arizona State University, Tempe.

Harris, Edward F. and Howard L. Bailit
1980 The Metaconule: A Morphologic and Familial Analysis of a Molar Cusp. American Journal of Physical Anthropology 53:349-358.

Harris, Edward F. and M.T. Nweeia
1980 Dental Asymmetry as a Measure of Environmental Stress in the Ticuna Indians of Columbia. American Journal of Physical Anthropology 53:133-142.

Haseman, J.K. and R.C. Elston
1970 The Estimation of Genetic Variance from Twin Data. Behavior Genetics 1:11-19.

Hellman, Milo
1929 Racial Characters in Human Dentition. Part I. A Racial Distribution of the Dryopithecus Pattern and Its Modifications in the Lower Molar Teeth of Man. Proceedings of the American Philosophical Society 67:157-174.

Hooton, E.
1930 The Indians of Pecos Pueblo: A Study of Their Skeletal Remains. New Haven, Connecticut: Yale University Press.

Howe, H.L. and P.A. Parsons
1967 Genotype and Environment in the Determination of Minor Variants and Body Weight in Mice. Journal of Embryology and Experimental Morphology 17:283-292.

Howells, W.W.
1966 Craniometry and Multivariate Analysis: The Jomon

Population of Japan. Papers of the Peabody Museum of Archaeology and Ethnology, Havard University, Vol. 57, No. 1.

Howells, W.W.
1973 Cranial Variation in Man: A Study by Multivariate Analysis of Patterns of Difference Among Recent Human Populations. Papers of the Peabody Museum of Archaeology and Ethnology, Harvard University, Vol. 67.

Hoyte, D.A.N. and D.H. Enlow
1966 Wolff's Law and the Problem of Muscle Attachment on Resorptive Surfaces of Bone. American Journal of Physical Anthropology 24:205-214.

Huss-Ashmore, R., A.H. Goodman, and G.J. Armelagos
1982 Nutritional Inference from Paleopathology. Advances in Archaeological Method and Theory 5:395-474.

Hutchinson, Dale L.
1986 Enamel Hypoplasias: Biological Stress and Lifeway on St. Catherines Island, Georgia. Master's Thesis, Department of Anthropology, Northern Illinois University.

Hutchinson, Dale L. and Clark Spencer Larsen
1988 Determination of Stress Episode Duration from Linear Enamel Hypoplasias: A Case Study from St. Catherines Island, Georgia. Human Biology 60(1):93-110.

Hrdlicka, Ales
1920 Shovel-Shaped Teeth. American Journal of Physical Anthropology 3:429-465.

Hrdlicka, Ales
1921 Further Studies of Tooth Morphology. American Journal of Physical Anthropology 4:141-176.

Hrdlicka, Ales
1924 New Data on the Teeth of Early Man and Certain Fossil European Apes. American Journal of Physical Anthropology 7(1):109-132.

Jamison, Paul L. and Stephen L. Zegura
1974 A Univariate and Multivariate Examination of

Measurement Error in Anthropometry. American Journal of Physical Anthropology 40:197-204.

Jantz, R.L.
1970 Change and Variation in Skeletal Populations of Arikara Indians. Unpublished Ph.D. Dissertation, University of Kansas, Lawrence.

Jantz, R.L.
1974 The Redbird Focus: Cranial Evidence in Tribal Identification. Plains Anthropologist 19(63):5-13.

Jones, Grant D.
1978 The Ethnohistory of the Guale Coast through 1684. IN The Anthropology of St. Catherines Island: 1. Natural and Cultural History 55:178-210. David Hurst Thomas, Grant D. Jones, Roger S. Durham, and Clark Spencer Larsen.

Jorgensen, Knud Dreyer
1955 The Dryopithecus Pattern in Recent Danes and Dutchmen. Journal of Dental Research 34(2):195-208.

Kellock, W.L. and P.A. Parsons
1970a Variations of Minor Nonmetrical Skeletal Variants in Australian Aborigines. American Journal of Physical Anthropology 32:409-421.

Kellock, W.L. and P.A. Parsons
1970b A Comparison of the Incidence of Nonmetrical Cranial Variants in Australian Aborigines with Those of Melanesia and Polynesia. American Journal of Physical Anthropology 33:235-239.

Kennedy, Brenda
1981 Marriage Patterns in an Archaic Population: A Study of Skeletal Remains from Port au Choix, Newfoundland. Archaeological Survey of Canada, Paper No. 104. National Museum of Man, Mercury Series.

Kirveskari, Pentti
1973 Uncommon Dental Traits in Population Studies. IN Orofacial Growth and Development. Albert A. Dahlberg. Pp. 251-261. Chicago: Aldine.

Konigsberg, Lyle W.
1987 Population Genetic Models for Interpreting Prehistoric Intra-Cemetery Biological Variation. Ph.D. dissertation. Northwestern University, Evanston, Illinois.

Korey, Kenneth A.
1970 Characteristics of the Distributions of Nonmetric Variants of the Skull. M.A. Thesis, University of Chicago, Illinois.

Korey, Kenneth A.
1980 The Incidence of Bilateral Nonmetric Skeletal Traits: A Reanalysis of Sampling Procedures. American Journal of Physical Anthropology 53:19-23.

Krogman, W.M.
1962 The Human Skeleton in Forensic Medicine. Springfield: C.C. Thomas.

Kruskal, J.B. and M. Wish
1978 Multidimensional Scaling. University Paper Series on Quantitative Applications in the Social Sciences, 07-011. Beverly Hills: Sage Publications.

Landis, J. Richard and Gary G. Koch
1975a A Review of Statistical Methods in the Analysis of Data Arising from Observer Reliability Studies. I. Statistica Neerlandica 29:101-123.

Landis, J. Richard and Gary G. Koch
1975b A Review of Statistical Methods in the Analysis of Data Arising from Observer Reliability Studies. II. Statistica Neerlandica 29:151-161.

Larsen, Clark Spencer
1982 The Anthropology of St. Catherines Island: 3. Prehistoric Human Biological Adaptation. Papers of the American Museum of Natural History Vol. 57, Part 3.

Larsen, Clark Spencer
1989 Biocultural Interpretation and the Context for Contact. IN Clark Spencer Larsen (ed.) The Archaeology of Mission Santa Catalina de Guale: 2. Biocultural Interpretations of a Population in

Transition. Anthropological Papers of the American Museum of Natural History.

Larsen, Clark Spencer and Katherine Ford Russell
1989 Patterns in Mortality at Contact: Paleodemography of Mission Santa Catalina de Guale de Santa Maria. American Journal of Physical Anthropology 79:258.

Larsen, Clark Spencer, Rebecca Shavit and Mark C. Griffin
n.d. Dental Caries Evidence for Dietary Change: An Archaeological Context. IN Advances in Dental Anthropology. Marc Kelley and Clark Spencer Larsen, eds. New York: Alan R. Liss, Inc. In press.

Larsen, Clark Spencer, Margaret J. Schoeninger, Dale L. Hutchinson, Katherine Ford Russell, and Christopher B. Ruff
n.d. Beyond Demographic Collapse: Biological Adaptation and Change in Native Populations of La Florida. IN David Hurst Thomas (ed.), Columbian Consequences, Volume II: Archaeological and Historical Perspectives on the Spanish Borderlands East. Washington: Smithsonian Institution Press.

Larson, Lewis
1978 Historic Guale Indians of the Georgia Coast and the Impact of the Spanish Mission Effort IN Jerald Milanich and S. Proctor, Tacachale: Essays on the Indians of Florida and Southeastern Georgia During the Historic Period. Gainsville: University Presses of Florida. pp. 120-140.

Lasker, G.W.
1950 Genetic Analysis of Racial Traits of the Teeth. Cold Spring Harbor Symposium on Quantitative Biology 15:191-203.

Laughlin, W.S. and J.B. Jorgensen
1957 Variation in Discrete Traits Between Greenlandic Eskimo Cranial Isolates. American Journal of Physical Anthropology 15:436-437.

Lavelle, C.L.B. and W.J. Moore
1973 The Incidence of Agenesis and Polygenesis in the Primate Dentition. American Journal of Physical

Anthropology 38:671-680.

Lovejoy, C.O., R.S. Meindl, R.P. Mensforth, and T.J. Barton
1985a Multifactorial Determination of Skeletal Age at Death: A Method and Blind Tests of Its Accuracy. American Journal of Physical Anthropology 68:1-14.

Lovejoy, C.O., R.S. Meindl, T.P. Pryzbeck, and R.P. Mensforth
1985b Chronological Metamorphisis of the Auricular Surface of the Ilium: A New Method for the Determination of Adult Skeletal Age at Death. American Journal of Physical Anthropology 68:15-28.

Lukacs, J.R.
1983 Dental Anthropology and the Origins of Two Iron Age Populations from Northern Pakistan. Homo 34:1-15.

Lukacs, J.R.
1986 Dental Morphology and Odontometrics of Early Agriculturalists from Neolithic Mehrgarh, Pakistan. IN Teeth Revisited: Proceedings of the 7th International Symposium on Dental Morphology, Paris 1986. Memoires of the National Museum of Natural History, Paris (series C) 53:285-303. D.E. Russell, J.P. Santoro, and D. Sigogneau-Russell, eds.

Lundstrom, A.
1973 Dental Genetics IN Orofacial Growth and Development. Albert A. Dahlberg. Pp. 91-107. Chicago: Aldine.

Lundy, J.K.
1980 The Mylohyoid Bridge in the Khoisan of Southern Africa and Its Suitability as a Mongoloid Genetic Marker. American Journal of Physical Anthropology 53:43-48.

Manly, Bryan F.J.
1986 Multivariate Statistical Methods. New York: Chapman and Hall.

Mayhall, John T. and Shelley R. Saunders
1986 Dimensional and Discrete Dental Trait Asymmetry Relationships. American Journal of Physical Anthropology 69:403-411.

McGrath, Janet W., James M. Cheverud and Jane E. Buikstra
1984 Genetic Correlations Between Sides and Heritability of Asymmetry for Nonmetric Traits in Rhesus Macaques on Cayo Santiago. American Journal of Physical Anthropology 64:401-411.

Milanich, Jerald T.
1978 The Western Timucua: Patterns of Acculturation and Change. IN Jerald Milanich and Samuel Proctor, Tacachale: Essays on the Indians of Florida and Southestern Georgia During the Historic Period. Gainsville: University Presses of Florida. pp. 59-88.

Milanich, Jerald T. and Rebecca Saunders
1986 The Spanish Castillo and the Franciscan Doctrina of Santa Catalina, at Santa Maria, Amelia Island, Florida (8Na41). Unpublished Manuscript.

Miles, A.E.W.
1963 The Dentition in the Assessment of Individual Age in Skeletal Material. IN Brothwell, D.R. (ed.) Dental Anthropology. Oxford: Pergamon Press.

Molto, J.E.
1979 The Assessment and Meaning of Intraobserver Error in Population Studies Based on Discontinuous Cranial Traits. American Journal of Physical Anthropology 51:333-344.

Morris, Nancy T.
1970 The Occurrence of Mandibular Torus at Gran Quivara. M.A. thesis, Arizona State University, Tempe.

Nass, G.G.
1982 Dental Asymmetry as an Indicator of Developmental Stress in a Free-ranging Troop of <u>Macaca</u> <u>fuscata</u>. IN <u>Teeth: Form, Function and Evolution</u>. Bjorn Kurten, ed. Pp. 207-227. New York: Columbia University Press.

Nichol, Christian R., Christy G. Turner and Albert A. Dahlberg
1984 Variation in the Convexity of the Human Maxillary Incisor Labial Surface. American Journal of Physical Anthropology 361-370.

Niswander, J.D. and C.S. Chung
1965 The Effects of Inbreeding on Tooth Size in Japanese Children. American Journal of Human Genetics 17:390-398.

Noss, John F., G. Richard Scott, Rosario H. Yap Potter and Albert A. Dahlberg
1983 Fluctuating Asymmetry in Molar Dimensions and Discrete Morphological Traits in Pima Indians. American Journal of Physical Anthropology 61:437-445.

Ossenberg, Nancy S.
1969 Discontinuous Morphological Variation in the Human Cranium. PhD. Thesis, University of Toronto.

Ossenberg, Nancy S.
1970 The Influence of Artificial Deformation on Discontinuous Morphological Traits. American Journal of Physical Anthropology 33:357-372.

Ossenberg, Nancy S.
1976 Within and Between Race Distances in Population Studies Based on Discrete Traits of the Human Skull. American Journal of Physical Anthropology 45:701-716.

Ossenberg, Nancy s.
1981 An Argument for the Use of Total Side Frequencies of Bilateral Nonmetric Skeletal Traits in Population Distance Analysis: The Regression of Symmetry on Incidence. American Journal of Physical Anthropology 54:471-479.

Page, John William
1976 A Note on Interobserver Error in Multivariate Analyses of Populations. American Journal of Physical Anthropology 44:521-526.

Pedersen, P. O.
1949 The East Greenland Eskimo Dentition. Meddelelser om Gronland 142:1-256.

Phenice, T.W.
1969 A Newly Developed Visual Method of Sexing the Os Pubis. American Journal of Physical Anthropology 30:297-302.

Potter, R.H. and W.E. Nance
1976 A Twin Study of Dental Dimension. I. Discordance, Asymmetry and Mirror Imagery. American Journal of Physical Anthropology 44: 391-396.

Potter, R.H.Y., P.L. Yu, A.A. Dahlberg, A.D. Merritt and P.M. Conneally
1968 Genetic Studies of Tooth Size Factors in Pima Indian Families. American Journal of Human Genetics 20:89-100.

Rees, John W.
1969 Morphologic Variation in the Cranium and Mandible of the White Tailed Deer (Odocoileous virginianus): A Comparative Study of Geographical and Four Biological Distances. Journal of Morphology 128:95-112.

Reich, T., J. James and C. Morris
1972 The Use of Multiple Thresholds in Determining the Mode of Transmission of Semi-Continuous Traits. Annals of Human Genetics 36:163-184.

Reitz, E.J.
1983 A Comparison of Spanish and Aboriginal Subsistence on the Atlantic Coastal Plain. Paper Presented at the 40th Annual Meeting of the Southeastern Archaeological Conference, Columbia South Carolina.

Reitz, E.J. and C.M. Scarry
1985 Reconstructing Historic Subsistence with an Example from 16th Century Spanish Florida. Special Publication Series, Number 3. Society for Historical Archaeology. Ann Arbor: Braun-Brumfield, Inc.

Richards, Lindsay C. and Peter J. Telfer
1979 The Use of Dental Characters in the Assessment of Genetic Distance in Australia. Archaeology and Physical Anthropology in Oceania 14(3):184-194.

Richtsmeier, Joan T., James M. Cheverud and Jane E. Buikstra
1984 The Relationship Between Cranial Metric and Nonmetric Traits in Rhesus Macaques from Cayo Santiago. American Journal of Physical Anthropology 61:213-222.

Richtsmeier, Joan T. and Janet W. McGrath
1986 Quantitative Genetics of Cranial Nonmetric Traits in Randombred Mice: Heritability and Etiology. American Journal of Physical Anthropology 69:51-58.

Rightmire, G.P.
1972 Cranial Measurements and Discrete Traits Compared in Distance Studies of African Negro Skulls. Human Biology 44:263-276.

Rosenzweig, K.A.
1970 Tooth Form as a Distinguishing Trait Between Sexes and Human Populations. Journal of Dental Research 49:1423-1426.

Rosing, F. W.
1982 A Critical Review of Quasi-continuous Variation of the Human Skeleton. Translation of Discreta des Menschlichen Skeletts - ein Kritischer Uberlick. Homo 33:100-125.

Rosing, F. W.
1984 Discreta of the Human Skeleton: A Critical Review. Journal of Human Evolution 13:319-323.

Ross, Mary
1926 The Restoration of the Spanish Missions in Georgia, 1598-1606. Georgia Historical Quarterly 10(3):171-199.

Ruff, Christopher B. and Clark Spencer Larsen
1989 Postcranial Biomechanical Adaptations to Subsistence Strategy Changes on the Georgia Coast. IN Clark Spencer Larsen (ed.) The Arcaeology of Mission Santa Catalina de Guale: 2.

Biocultural Interpretations of a Population in Transition. Anthropological Papers of the American Museum of Natural History.

Russell, Katherine F.
1987 The Demographic Implications of European Contact in Northern Spanish Florida. Master's Thesis. Department of Anthropology. Northern Illinois University.

Russell, K.F., I. Choi, and C.S. Larsen
n.d. The Paleodemography of Santa Catalina de Guale. IN C.S. Larsen (ed.) The Archaeology of Mission Santa Catalina de Guale: 2. Biocultural Interpretations of a Population in Transition. Anthropological Papers of the American Museum of Natural History. In press.

Saunders, Rebecca
1988 Excavations at 8NA41: Two Mission Period Sites on Amelia Island, Florida. Miscellaneous Project Report Series No. 35. Florida State Museum, Department of Anthropology, Gainsville, Florida.

Saunders, Shelley Rae
1978 The Development and Distribution of Discontinuous Morphological Variation of the Human Infracranial Skeleton. Archaeological Survey of Canada, Paper No. 81. National Museum of Man, Mercury Series.

Saunders, Shelley Rae and J.T. Mayhall
1982 Developmental Patterns of Human Dental Morphological Traits. Archives of Oral Biology 29:45-49.

Saunders, Shelley Rae and F. Popovich
1978 A Family Study of Two Skeletal Variants: Atlas Bridging and Clinoid Bridging. American Journal of Physical Anthropology 49:193-204.

Sawyer, D.R., M.J. Allison, R.P. Elzay and A. Pezzia
1978 The Mylohyoid Bridge of Pre-Columbia Peruvians. American Journal of Physical Anthropology 48:9-16.

Schoeninger, M.J., N.J. van der Merwe, K. Moore, J. Lee-Thorp, and C.S. Larsen
1989 Decrease in Diet Quality between the Prehistoric

and Contact Periods on St. Catherines Island, Georgia. IN Clark Spencer Larsen (ed.) The Archaeology of Mission Santa Catalina de Guale: 2. Biocultural Interpretations of a Population in Transition. Anthropological Papers of the American Museum of Natural History.

Scott, G. Richard
1973 Dental Morphology: A Genetic Study of American White Families and Variation in Living Southwest Indians. Unpublished Ph.D. dissertation, Arizona State University, Tempe.

Scott, G. Richard
1977 Classification, Sex Dimorphism, Association, and Population Variation of the Canine Distal Accessory Ridge. Human Biology 49(3):453-469.

Scott, G. Richard
1980 Population Variation of Carabelli's Trait. Human Biology 52:63-78.

Scott, G. Richard and Albert A. Dahlberg
1982 Microdifferentiation in Tooth Morphology Among Indians of the American Southwest. IN Teeth: Form, Function and Evolution. Bjorn Kurten, ed. Pp. 259-291. New York: Columbia University Press.

Scott, G. Richard and Christy G. Turner II
1988 Dental Anthropology. Annual Reviews in Anthropology. 17:99-126.

Searle, A.G.
1954 Genetical Studies on the Skeleton of the Mouse. IX. Causes of Skeletal Variation Within Pure Lines. Journal of Genetics 52:68:102.

Self, S. and L. Leamy
1978 Heritability of Quasi-continuous Skeletal Traits in a Randombred Population of House Mice. Genetics 88:109-120.

Sellevold, Berit J.
1980 Mandibular Torus Morphology. American Journal of Physical Anthropology 53:569-572.

Shavit, Rebecca

1988 Temporal Variation in Dental Pathology of Native Populations from Northern Spanish Florida. M.A. Thesis. Department of Anthropology, Northern Illinois University.

Siebert, Wilbur H.
1940 The Departure of the Spaniards and Other Groups from East Florida, 1763-1764. The Florida Historical Quarterly 19(2):145-154.

Siegal, M.I. and W.J. Doyle
1975a The Differential Effects of Prenatal and Postnatal Audiogenic Stress on Fluctuating Dental Asymmetry. Journal of Experimental Zoology 191:211-214.

Siegal, M.I. and W.J. Doyle
1975b The Effects of Cold Stress on Fluctuating Asymmetry in the Dentition of the Mouse. Journal of Experimental Zoology 193:385-389.

Siegal, M.I., W.J. Doyle and C. Kelley
1977 Heat Stress, Fluctuating Asymmetry and Prenatal Selection in the Laboratory Rat. American Journal of Physical Anthropology 46:121-126.

Sjovold, Torstein
1973 The Occurrence of Minor Nonmetrical Variants in the Skeleton and Their Quantitative Treatment for Population Comparisons. Homo 24:204-233.

Sjovold, Torstein
1977 Non-metrical Divergence Between Skeletal Populations: The Theoretical Foundation and Biological Importance of C.A.B. Smith's Mean Measuee of Divergence. Ossa 4(supplement 1):1-133.

Sjovold, Torstein
1984 A report on the Heritability of Some Cranial Measurements and Non-metric Traits. IN G.N. Van Vark and W.W. Howells (eds.), Multivariate Statistical Methods in Physical Anthropology. Boston: D. Reidel, pp. 23-246.

Smith, B.H., S.M. Garn and P.E. Cole
1982 Problems of Sampling and Inference in the Study of Fluctuating Dental Asymmetry. American

Journal of Physical Anthropology 58:281-290.

Smith, Patricia
1973 Variations in Dental Traits Within Populations. IN Orofacial Growth and Development. Albert A. Dahlberg, Pp. 172-181. Chicago: Aldine.

Smith, Patricia
1982 Dental Reduction: Selection or Drift? IN Teeth: Form, Function and Evolution. Bjorn Kurten, ed. Pp. 366-379. New York: Columbia University Press.

Snyder, R.G., Albert A. Dahlberg, C.C. Snow and T. Dahlberg
1969 Trait Analysis of the Dentition of the Tarahumara Indians and Mestizos of the Sierra Madre Occidental, Mexico. American Journal of Physical Anthropology 31:65-76.

Sofaer, J.A., H.L. Bailit and C.J. Maclean
1971 A Developmental Basis for Differential Tooth Reduction During Hominid Evolution. Evolution 25: 509-517.

Sofaer, Jeffrey A., Patricia Smith and Edith Kaye
1986 Affinities Between Contemporary and Skeletal Jewish and Non-Jewish Groups Based on Tooth Morphology. American Journal of Physical Anthropology 70:265-275.

Spence, M.W.
1974 Residence Practices and the Distribution of Skeletal Traits in Teotihuacan, Mexico. Man 9:262-273.

Staley, Robert N. and Larry J. Green
1974 Types of Tooth Cusp Occurrence Asymmetry in Human Monozygotic and Dyzygotic Twins. American Journal of Physical Anthropology 40:187-196.

Suchey, J.M.
1975 Biological Distance of Prehistoric Central California Populations Derived from Nonmetric Traits of the Cranium. Unpublished Ph.D. Dissertation, University of California, Riverside.

Taylor, R.M.S.
1982 Aberrant Maxillary Third Molars: Morphology and Developmental Relations. IN Teeth: Form, Function and Evolution. Bjorn Kurten, ed. Pp. 64-74. New York: Columbia University Press.

Thomas, David Hurst
1987 The Archaeology of Mission Santa Catalina de Guale: 1. Search and Discovery. Anthropological Papers of The American Museum of Natural History, Vol. 63, Part 2.

Thomas, David Hurst
1988 Saints and Sinners at Santa Catalina: Hispanic Designs for Colonial America. IN The Recovery and Meaning in Historical Archaeology. Mark P. Leone and Parker B. Potter, Jr., eds. Pp.73-140. Washington: Smithsonian Institution Press.

Thomas, D.H., G.D. Jones, R.S. Durham, and C.S. Larsen
1978 The Anthropology of St. Catherines Island: 1. Natural and Cultural History. Anthropological Papers of the American Museum of Natural History 55, Part 2.

Thornbury, W.D.
1965 Regional Geomorphology of the United States. New York: John Wiley and Sons, Inc.

Tomes, C.S.
1923 A Manual of Dental Anatomy, Human and Comparative. 8th edition. London: J. and A. Churchill.

Trinkaus, Erik
1978 Bilateral Asymmetry of Human Skeletal Nonmetric Traits. American Journal of Physical Anthropology 49:315-318.

Truslove, G.M.
1954 Genetical Studies on the Skeleton of the Mouse. XIII. Variations in the Presphenoid. Journal of Genetics 52:589-602.

Turner, Christy G.
n.d. Arizona State University Dental Anthropology System: Scoring Procedures for Key Mophological Traits of the Permanent Dentition. Department of

Anthropology, Arizona State University, Tempe, Arizona.

Turner, Christy G.
1967 The Dentition of Arctic Peoples. Ph.D. dissertation, University of Wisconsin, Madison.

Turner, Christy G.
1969 Microevolutionary Interpretations from the Dentition. American Journal of Physical Anthropology 30:421-426.

Turner, Christy G.
1985 The Dental Search for Native American Origins. IN Out of Asia: Peopling the Americas and the Pacific. Robert Kirk and Emoke Szathmary, eds. Pp. 31-78. Canberra, Australia: Journal of Pacific History, Australian National University.

Turner, Christy G.
1987a Late Pleistocene and Holocene Population History of East Asia Based on Dental Variation. American Journal of Physical Anthropology 73:305-321.

Turner, Christy G.
1987b Telltale Teeth. Natural History 96(1):6-10.

Ubelaker, Douglas H.
1984 Human Skeletal Remains: Excavation, Analysis, Interpretation. Washington: Taraxacum. 119p.

Weidenreich, F.
1937 The Dentition of Sinanthropus pekinensis: A Comparative Odontography of the Hominids. Paleontogia Sinca, N.S.D., No. 1.

Weiss, P.
1937 Gradual Determination and the Field Concept. IN Principles of Development. P. Weiss. Pp. 289-437. New York: Holt and Co.

Wood Jones, F.
1930 The Nonmetrical Morphological Characters of the Skull as Criteria for Racial Diagnosis. I,II,II. Journal of Anatomy 65:179-195,368-378,438-445.

Wright, Sewall
1934a An Analysis of Variability in Number of Digits in

an Inbred Strain of Guinea Pigs. Genetics 19:506-536.

Wright, Sewall
1934b The Results of Crosses between Inbred Strains of Guinea Pigs, Differing in Number of Digits. Genetics 19:537-551.

Yamada, Hiroyuki and Keiichi Kawamoto
1988 The Dentition of Cook Islanders. IN Kazumichi Katayama and Akira Tagaya, eds. Pp. 143-209 People of the Cook Islands - Past and Present: A Report of the Physical Anthropological and Linguistic Research in the Cook Islands 1985-1987. Cook Islands Library and Museum Society Bulletin No. 5. Osaka, Japan: Second Department of Anatomy, Osaka City University Medical School.

Zoubov, A.A.
1973 Odontoglyphics: The Laws of Variation of the Human Molar Crown Microrelief. IN Orofacial Growth and Development. Albert A. Dahlberg. Pp. 269-282. Chicago: Aldine.

APPENDIX A

NONMETRIC DENTAL TRAIT CODING FORM AND FORMAT

NON-METRIC DENTAL TRAITS (ASU SYSTEM)

locality____
site____(1-3)
burial____(4-6)
individual_______________________________________(7-8)
unit____(9-11)
collection_____________________________________(12-13)

sex_____________(14) criteria________________________

____

____(15-21)

age__________(22-24) criteria________________________

____

____(25-31)

age category______________________________________(32)

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	26	27	28	29	30	31	32

END CARD 1 | 0 | 1 | 79-80

comments____

ADULT DENTITION

Left maxilla								Right maxilla							
14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
M3	M2	M1	P4	P3	C	I2	I1	I1	I2	C	P3	P4	M1	M2	M3
M3	M2	M1	P4	P3	C	I2	I1	I1	I2	C	P3	P4	M1	M2	M3
30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Left mandible								Right mandible							

DECIDUOUS DENTITION

Left maxilla					Right maxilla				
46	47	48	49	50	51	52	53	54	55
dM2	dM1	dC	dI2	dI1	dI1	dI2	dC	dM1	dM2
dM2	dM1	dC	dI2	dI1	dI1	dI2	dC	dM1	dM2
56	57	58	59	60	61	62	63	64	65
Left mandible					Right mandible				

END CARD 2 | 0 | 2 | 79-80

winging	______________	☐	14
shoveling	______________	☐☐ ☐☐	15-18
curvature	______________	☐	19
double-shoveling	______________	☐☐	20-21
interruption groove	______________	☐☐	22-23
tuberculum dentale	______________	☐☐	24-25
Canine mesial ridge	______________	☐☐	26-27
Canine d.a.r.	______________	☐☐	28-29
metacone	______________	☐☐☐☐	30-33
hypocone M1	______________	☐☐☐☐	34-37
hypocone M2	______________	☐☐☐☐	38-41
cusp 5 (metaconule)	______________	☐☐ ☐☐	42-45
Carabelli's trait	______________	☐☐ ☐☐	46-49
parastyle	______________	☐	50
enamel extensions	______________	☐☐ ☐☐	51-54
premolar root number	______________	☐☐	55-56
molar root number	______________	☐☐	57-58
peg-shaped incisor	______________	☐☐	59-60
peg-shaped molar	______________	☐☐	61-62
odontome - upper	______________	☐☐ ☐☐	63-66
odontome - lower	______________	☐☐ ☐☐	67-70
lower P3 variation	______________	☐☐	71-72
lower P4 variation	______________	☐☐	73-74

END CARD 3	0 3		79-80
anterior fovea			14-15
groove pattern			16-19
cusp number			20-23
deflecting wrinkle			24-25
distal trigonid crest			26-27
protostylid			28-31
cusp 5			32-35
cusp 6			36-39
cusp 7			40-43
Canine root number			44-45
Tomes' root			46-47
first molar root number			48-49
second molar root number			50-51
torsomolar angle			52-53
palatine torus			54
mandibular torus			55
dental wear			56-57
abcessing and periodontal disease			58-59
END CARD 4	0 4		79-80

IDENTIFICATION

The individual identification comprises columns 1-32 of the first card for each form (Card 1). For each subsequent card of each form, the individual identification consists of only columns 1-13. The codes for each component of the individual identification are found on the following pages. The locations for each component are as follows:

Site	1-3
Burial Number	4-6
Individual Number	7-8
Unit Identification	9-11
Collection	12-13
Sex	14
Sex Criteria	15-21
Age (specific)	22-24
Age Criteria	25-31
Age Category	32

IDENTIFICATION CODES

SITE

(301) Santa Catalina de Guale - Quad IV, Structure 1 (St. Catherines Island)
(303) Santa Catalina de Guale de Santa Maria (Amelia Island)
(304) Mission Santa Maria (Amelia Island)

BURIAL AND INDIVIDUAL

The burial number corresponds to the actual burial number assigned in the field (i.e. 1,2,3 etc.). The individual number indicates which individual within the burial. For example Burial 4B would be Burial 4, Individual 2.

UNIT IDENTIFICATION

This is a 3 digit number systematically assigned to the field unit in which each burial was found. Each site will have different unit codes assigned to it at the time of analysis.

COLLECTION

(1) The American Museum of Natural History
(8) Northern Illinois University
(9) Savannah Science Museum
(10) Garrow and Associates, Inc.

SEX

(1) Indeterminate
(2) Female
(3) Male

AGE

Records the actual number in years (with one decimal place).

AGE CATEGORY

(1) Infant (0-2)
(2) Child (2.1-12.0)
(3) Adolescent (12.1-16.0)
(4) Adult (16.1-43.0)
(5) Senile Adult (43.1+)
(6) Unknown

SEX CRITERIA

(1) Phenice (1969)
(2) overall pelvic morphology (sciatic notch, subpubic angle, symphysis orientation, size of obturator foramen and acetabulum, preauricular sulcus, parturition scars) (Bass 1981)
(3) gracile skull (small mastoids, supraorbitals, nuchal area) (Bass 1981)
(4) gracile mandible (Bass 1981)
(5) gracile postcranial (small skeletal elements, reduced size of muscle markings) (Bass 1981)
(6) robust skull (large mastoids, supraorbitals, nuchal area) (Bass 1981)
(7) robust mandible (Bass 1981)
(8) robust postcranial (large skeletal elements, markedly roughened areas of muscle attachment) (Bass 1981)

AGE CRITERIA

(1) epiphyseal union (Krogman 1962)
(2) dental calcification and eruption (Ubelaker 1984)
(3) general thickness of cortical bone and overall size of skeletal elements
(4) tooth wear -- functional age (Choi 1986, Miles 1963, Russell and Choi 1987)
(5) pubic symphyseal face metamorphosis (Todd 1920, Meindl et al. 1985)
(6) ossified spheno-occipital synchrondrosis (Bass 1987)

(7) auricular surface (Lovejoy et al. 1985)

DENTITION CODING FORMAT

This is a 1 (one) character format, each character corresponding to one of the deciduous or permanent teeth. If there is no information on a tooth (ie. maxilla or mandible is missing or partially missing), the space should be left blank indicating 'missing data'. For both deciduous and permanent dentitions:

0 = absent antemortem
1 = present

2 = absent postmortem
3 = present but not articulated
4 = tooth missing, alveolus not fully resorbed
5 = present but unerupted
6 = not erupted (no information on presence)
8 = crown destroyed by caries
9 = congenital absence

Example:

The following dentition was recorded for SCI-SCDG Individual 71.

Mandibular Left I2,C,PM3,PM4,M1,M2
Mandibular Right I2,PM4,M1,M2
Maxillary Left I1,C,PM3,M1
Mandibular Right PM3

This has been properly encoded on the following page.

Note:

Because this individual is an adult, it is assumed that the deciduous dentition erupted properly and the teeth were lost antemortem. Therefore, '0's were recorded for the deciduous dentition, not blanks (which would indicate missing data).

ADULT DENTITION

Left maxilla								Right maxilla							
14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
M3	M2	M1	P4	P3	C	I2	I1	I1	I2	C	P3	P4	M1	M2	M3
M3	M2	M1	P4	P3	C	I2	I1	I1	I2	C	P3	P4	M1	M2	M3
30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Left mandible								Right mandible							

DECIDUOUS DENTITION

Left maxilla					Right maxilla				
46	47	48	49	50	51	52	53	54	55
dM2	dM1	dC	dI2	dI1	dI1	dI2	dC	dM1	dM2
dM2	dM1	dC	dI2	dI1	dI1	dI2	dC	dM1	dM2
56	57	58	59	60	61	62	63	64	65
Left mandible					Right mandible				

DENTAL TRAIT CODING FORMAT

This is generally a one character format, except in the cases where a half-interval grade is suggested by Turner (n.d.). Each trait is scored for the left and right sides and for each tooth listed in Table 2. All scoring conforms to the grades suggested by Turner (n.d.).

APPENDIX B

NONMETRIC DENTAL TRAIT OBSERVATIONS

The dental trait observations follow the format described in Appendix A. All card column assignments are indicated beside each variable on the coding form.

```
30100200---013000000827000340004----------------------------------------------01
30100200---011111111111111111111111111111111000000000000000000000-------------02
30100200---0142222033003300--404040403535--11330000022----0000000000007722----03
30100200---010011335555----1111441100000000----------104400-------------------04
30100600---011000000030000040004----------------------------------------------01
30100600---01----------------3--333--------3-00000000000000000000-------------02
30100600---01-----------------------------------------------------------------03
30100600---01-----3---5-----------3---0---0-------------4---------------------04
30100700---011000000027000040004----------------------------------------------01
30100700---0133--33----33-33----3333-3--33-3300000000000000000000-------------02
30100700---01----------------35----503535-000----0----------1-----------------03
30100700---01-----1------------------------------------33---------------------04
30100800---011000000016002000003----------------------------------------------01
30100800---01333333-3333-333333333333333-3333---------------------------------02
30100800---01-22-2055---00040303040403535000000000---------0110-000-001-11----03
30100800---0144-133-555---1-111-544-000-000------------22---------------------04
30100900---012003050044000040005----------------------------------------------01
30100900---019111111112181119000111111111111000000000000000000000-------------02
30100900---01--------------------404035350000---------------------------------03
30100900---01----------------------------------------106633-------------------04
30101000---013020000841000340004----------------------------------------------01
30101000---011111111111118011000011111111000000000000000000000000-------------02
30101000---01422220220000----203550--4040--------0--------0000----------------03
30101000---01----------------------------------------005533-------------------04
30101100---013000000826000340004----------------------------------------------01
30101100---0133-33333--33--3-3---333-33--3-3300000000000000000000-------------02
30101100---01-1-1-03-2-0-----20------4040-----------------0-0-----------------03
30101100---01------------------------------------------44---------------------04
30101200---011000000021000040004----------------------------------------------01
30101200---01-333333-333333-3---333-333333---00000000000000000000-------------02
30101200---01--3440-4-100------35505030--001-----4--------00-0----------------03
30101200---01------------------------------------------3----------------------04
30101400---013000000829000340004----------------------------------------------01
30101400---011111111111111111111111111111111000000000000000000000-------------02
30101400---01-22221000000----353540403535--------03333----0000--------0000----03
30101400---01--11335555--------44440000000011--2222--104422-------------------04
30101500---011000000020000040004----------------------------------------------01
30101500---01-333--------33------------------00000000000000000000-------------02
30101500---01--------------------505040--000----------------------------------03
30101500---01------------------------------------------3----------------------04
30101800---013020000843000340005----------------------------------------------01
30101800---011101111122118111111111111111111000000000000000000000-------------02
30101800---01---3-10-0-0-----3535--504040--------0--------0-00--------0000----03
30101800---01----------------------------------------106655-------------------04
30102400---011000000020000040004----------------------------------------------01
30102400---0133------------3333333------3333-00000000000000000000-------------02
```

```
30102400---01----------------4030----3010--00--000----------------00000000----03
30102400---01--11335555--00----554400000000------------22---------------------04
30102500---011000000016002000003----------------------------------------------01
30102500---0133333333333--333333333333333333300000000000000000000-------------02
30102500---01-2233022200000443535505035354444000003333-13300110-0-00000000----03
30102500---014411335566--11111144440022000011332222----22---------------------04
30102600---011000000007002000002----------------------------------------------01
30102600---01-33-33-----3-33-----33-----3333--3-------3-----------------------02
30102600---01------------0-0-----4040001000002200-------------00--00-000-0----03
30102600---01-2-1-3-5-6-0-0-2-1-5-3-4-0-0-0------------11---------------------04
30102700---011000000005002000002----------------------------------------------01
30102700---01--33-333333333---33-333-333333------------33------33-------------02
30102700---01-434406511000020----5050---------------------00----------77-0----03
30102700---0144111-556-221011--554-002-000-------------11---------------------04
30103000---011000000028000040004----------------------------------------------01
30103000---0133-----------------3-3----333---00000000000000000000-------------02
30103000---01----------------35------35----2---0------------------------------03
30103000---01------------------------------------------44---------------------04
30103200---012023050040000345004----------------------------------------------01
30103200---0111011111112001113000-3----31100100000000000000000000-------------02
30103200---010---------------30303535------------0--------0000----------------03
30103200---01----------------------------------------105555-------------------04
30103300---011000000002002000001----------------------------------------------01
30103300---016656656252256566----------------111333-33333------33-------------02
30103300---01--------------------3535----00-----------------------------------03
30103300---01------------------------------------------11---------------------04
30103400---011000000003002000002----------------------------------------------01
30103400---01--3--333333--3---------------------------------------------------02
30103400---01--311022------------4040----33--11-----------00------------------03
30103400---01------------------------------------------1----------------------04
30103500---011000000005002000002----------------------------------------------01
30103500---01-----33333-3-3--6556666666666556--------331112332311-------------02
30103500---01-2222033--------------50-----0---5-----------00------------------03
30103500---014422--55--3300----55--00--00-------------011-0-------------------04
30103600---011000000001002000001----------------------------------------------01
30103600---01----------------6666666666666566-----3-3331151111511-------------02
30103600---01-----------------------------------------------------------------03
30103600---01-0-1---6---2-0-----4---1---0--------------11---------------------04
30103700---011000000004002000002----------------------------------------------01
30103700---016656665555666566665666555566656611222111111112222211-------------02
30103700---01--------------------4040----00--22-------------------------------03
30103700---014411--55--2200----44--00--00-------------01100-------------------04
30103800---011000000003002000002----------------------------------------------01
30103800---01------------------3----33-3--3--3-------33333----333-------------02
30103800---01-----------------------------------------------------------------03
30103800---013311--55--220011--44--00--00--------------11---------------------04
```

```
30103900---013020000839000040004----------------------------------------------01
30103900---0133-33--33--33-333-333-----33---300000000000000000000-------------02
30103900---01-22--033---------------------------------------------------------03
30103900---01------------------------------------------66---------------------04
30104100---013000000837000040004----------------------------------------------01
30104100---011188111111110811111111111111111100000000000000000000-------------02
30104100---01422440441100----3535----3535--------0--------0000--------7722----03
30104100---01--11115555--------554400000000----222200005522-------------------04
30104300---011000000029000040004----------------------------------------------01
30104300---01---3333333333-------33-3-111011-00000000000000000000-------------02
30104300---01-22661000000---------------------------------00------------------03
30104300---01-----------------------------------------055---------------------04
30104400---011000000014002000003----------------------------------------------01
30104400---015111111111111115511111111111111500000000000000000000-------------02
30104400---0101133033010000003535404020200000000002222----0000000000003311----03
30104400---01--2122-666--00--00-433-122-000----------002200-------------------04
30104500---011000000004002000002----------------------------------------------01
30104500---01--3--3-------3----3333---3---3-----------------------------------02
30104500---01--------------------4040----00--22-----------------------3-------03
30104500---013311--55--220022--44--00--00--------------11---------------------04
30104600---013000000829000040004----------------------------------------------01
30104600---019111111111111111011111111111110100000000000000000000-------------02
30104600---01433330331233----101050503535----330001111----0011000000000000----03
30104600---01--113-665---------334-330-000-----------004433-------------------04
30104800---011000000032000040004----------------------------------------------01
30104800---01---33-----333333---333----333---00000000000000000000-------------02
30104800---01------------------40--50--40--------0-----------0----------------03
30104800---01------------------------------------------44---------------------04
30105000---012000050033000040004----------------------------------------------01
30105000---011111112111111011111111111111111100000000000000000000-------------02
30105000---01-22-2044-0------400050--3535--------0---------000--------0000----03
30105000---01-----------------------------------------055-4-------------------04
30105100---011000000020000040004----------------------------------------------01
30105100---01-----------------3-333----333---00000000000000000000-------------02
30105100---01---------------------------------------------------------0000----03
30105100---01----3---5-------1---4---0---0--------------2---------------------04
30105300---012030500028000040004----------------------------------------------01
30105300---011111112222211113111112221111111100000000000000000000-------------02
30105300---01----------------404050503535220022000----------00--------0000----03
30105300---01--11315555--------444400000000--------00004433-------------------04
30105400---011000000014002000003----------------------------------------------01
30105400---013-333------333--3-3-33----333333---------------------------------02
30105400---01----------------35--4040----00--04--0----------0-000000-000-0----03
30105400---014411-355-5110022-055-400-000-0------------22---------------------04
30105500---011000000007002000002----------------------------------------------01
30105500---01----33---333-33------3333333-33--------3-33-------33-------------02
```

```
30105500---01----2----2-10044------40--00-0-0-4-0----------0--10---0---3------03
30105500---01-4-1-3-6-6-1-1-1-1-4-2-0-4-2-0------------11---------------------04
30105600---011000000008002000002----------------------------------------------01
30105600---01-333333--333333--51665666656615-3--------3111-1--111-------------02
30105600---01---11---11000000----4040101000000000---------00--1100------------03
30105600---013311135555110011--554000000000-----------011---------------------04
30105700---011000000004002000002----------------------------------------------01
30105700---01-------3333--------3---------------------3-----------------------02
30105700---01-22-2023--------------------------------------0------------------03
30105700---01-----------------------------------------------------------------04
30105800---012000050020000040004----------------------------------------------01
30105800---012111111111111112111111111111111100000000000000000000-------------02
30105800---01-664404402000044----4040201000003300-0033--3300--000000000000----03
30105800---01--11335544--00----330000000000011332222--103333-------------------04
30105900---013000000830000040004----------------------------------------------01
30105900---013----------333---333----3--33--300000000000000000000-------------02
30105900---01----------------30----40-----0------0-0--------0-----------------03
30105900---01--1-3-5-5---------4-4-0-0-0-0-------------44---------------------04
30106000---012000050043000040005----------------------------------------------01
30106000---0100011111121811001101111111111000000000000000000000000-------------02
30106000---01----------------------35-----------------------------------------03
30106000---01----------------------------------------106655-------------------04
30106100---013000006020000040004----------------------------------------------01
30106100---01-33-33333----31133-33------3-33300000000000000000000-------------02
30106100---01-2-2-022------2---40404035350000--000--------0--00---000-3-00----03
30106100---01------------------------------------------33---------------------04
30106200---013000000083200040004----------------------------------------------01
30106200---011111111111181111111111111111111100000000000000000000-------------02
30106200---01444550440000----404050504040--------00033----0000--------0000----03
30106200---01--11335555--------554400000000--------00004433-------------------04
30106300---011000000033000040004----------------------------------------------01
30106300---01---3-------333---1------------3-00000000000000000000-------------02
30106300---01-----------------------------------------------------------------03
30106300---01------------------------------------------55---------------------04
30106400---012000050035000040004----------------------------------------------01
30106400---0133000000000111--000100000000000000000000000000000000-------------02
30106400---01----------------40----5040----------0----------0-----------------03
30106400---01----------------------------------------004455-------------------04
30106800---012020050025000040004----------------------------------------------01
30106800---01333333333-33333310111333331110110000000000000000000-------------02
30106800---01-222-1004-1-----3535404035350000-50002222--330-00--------0000----03
30106800---01--1--35--5--------4--40--00--0-----------033---------------------04
30107000---012000050035000040004----------------------------------------------01
30107000---01--------------33118222-------01100000000000000000000-------------02
30107000---01-----------------------------------------------------------------03
30107000---01----33-----------------------------------055-4-------------------04
```

```
30107100---011000000009002000002----------------------------------------------01
30107100---01--33------33-----333333--3--333----------------------------------02
30107100---01-------------0-4----35------0---0-----------------00-0-01--11----03
30107100---014411115555--001111553300000000------------22---------------------04
30107200---011000000023000040004----------------------------------------------01
30107200---01----3------3-333-3-33-----------00000000000000000000-------------02
30107200---01------------------30--50--35-4-4----0-----------1----------------03
30107200---01----3---5-----------4---0---0-------------33---------------------04
30107400---013000000836000040004----------------------------------------------01
30107400---01-33---------3-33100111----22200000000000000000000000-------------02
30107400---01------------------3550--35350-002---02-22-------0----------------03
30107400---01-----------------------------------------033---------------------04
30107600---011000000020000040004----------------------------------------------01
30107600---01333--------3--333-3-33333---3-3300000000000000000000-------------02
30107600---01----------------404040--30300-44---------------11--------1--1----03
30107600---01--1---5-----------------------------------22---------------------04
30107700---011000000035000040004----------------------------------------------01
30107700---0131112133-333--33011111322231111000000000000000000000-------------02
30107700---01-2-55-----------504050--3535--------0--------0000--------0000----03
30107700---01---3-------------------------------------066-3-------------------04
30107800---011000000008002000002----------------------------------------------01
30107800---01---3-3----3-33----3--3----33-33----------------------------------02
30107800---01------------0033------50-----3---5-----------------00-0---3------03
30107800---011111-266-5000011-144-321-000-0------------11---------------------04
30107900---011000000005002000002----------------------------------------------01
30107900---01------3-------------------3333-----------------------------------02
30107900---01-------------------------------------------------------00-3-0----03
30107900---01-4-1---5---1-0-1---5---0---0---------------1---------------------04
30108000---011000000033000040004----------------------------------------------01
30108000---013---3-----33-3--333333-------33300000000000000000000-------------02
30108000---01----------------40----50------------0--------------------7-0-----03
30108000---01--3-33--55----------33--00--00------------55---------------------04
30108200---012003050033000040004----------------------------------------------01
30108200---013---------333---3-3-3-----3-333300000000000000000000-------------02
30108200---01----------------00------------------0----------0-----------------03
30108200---01---------6--------------------------------55---------------------04
30108600---011000000033000040004----------------------------------------------01
30108600---01-33-33----3333-3-333-3-----333--00000000000000000000-------------02
30108600---01------------------40505035----------------------0----------------03
30108600---01--11---5-----------3---0---0--------------55---------------------04
30108900---011000000019000040004----------------------------------------------01
30108900---01333333-----33333111333-33333333300000000000000000000-------------02
30108900---01--------------4-353550503535005544001----------11000000000000----03
30108900---01--11335555--------444400000000----22------33---------------------04
30109100---013000006037000040004----------------------------------------------01
30109100---013---33----3----3--333-3-----333-00000000000000000000-------------02
```

```
30109100---01----------------4050----------------5----------00----------------03
30109100---01-------------------------------------------5---------------------04
30109200---011000000006002000002----------------------------------------------01
30109200---01-333333---33333--33-333333-3333-33-------3-3-------3-------------02
30109200---01---2----0-----------5050303000001100---------0---000000-001-1----03
30109200---01111133556633001111553300440000------------11---------------------04
30109300---011000000011002000002----------------------------------------------01
30109300---01--333-33333-333--1155333-333333-3-3------313---------------------02
30109300---01-22220220000-0-0----4040--3500-010-0---------00--0-0000-000-2----03
30109300---014411225555---10000554400000000------------22---------------------04
30109600---011000000031000040004----------------------------------------------01
30109600---0133--------------333333----333---00000000000000000000-------------02
30109600---01----------------40------30----------0----------0-----------------03
30109600---01--1-3-5-----------5---0---0---------------55---------------------04
30109700---012000050033000040004----------------------------------------------01
30109700---01--33333-333-3333110111123-3333--00000000000000000000-------------02
30109700---01------------------3050----35--------022------00-0----------------03
30109700---01----3---5-----------4---0---0-------------55---------------------04
30109800---013000000828000040004----------------------------------------------01
30109800---01----3------3333-111113-----3111100000000000000000000-------------02
30109800---01----------------------50--50-------------------------------------03
30109800---01--11335544--------440000000000--33----00-044---------------------04
30109900---012003000036000040004----------------------------------------------01
30109900---013---3----3-3333--3333------3---300000000000000000000-------------02
30109900---01----6----0-0----40----40--35--------0-2-2-----00-----------------03
30109900---01------------------------------------------55---------------------04
30110000---013020060835000040004----------------------------------------------01
30110000---011001110111100011181111111111111100000000000000000000-------------02
30110000---01--2220032233----2020----------------0--------0000----00000000----03
30110000---01----------------------------------------005544-------------------04
30110100---012000050020000040004----------------------------------------------01
30110100---01-333333333333333333333-3--33333300000000000000000000-------------02
30110100---01-22330220000------4050503530000044000------3300-0000000000000----03
30110100---01----33--55-------1--44--00--0011-42-22----33---------------------04
30110200---012000050037000040004----------------------------------------------01
30110200---013---3---------3--111------------00000000000000000000-------------02
30110200---01----------------30--------40--------0----------0-----------------03
30110200---01-------------------------------------------6---------------------04
30110700---013000000825000040004----------------------------------------------01
30110700---01--33333----3333311011133--31103300000000000000000000-------------02
30110700---01---1--------------354040----33--00--0-----------0----------------03
30110700---01----3------------------------------------044---------------------04
30110800---011000000030000040004----------------------------------------------01
30110800---0133-333----33333-3-0332222233301100000000000000000000-------------02
30110800---01----------------35----504040--00----0----------0---------0000----03
30110800---01-----3---5-----------3---0---0------------44---------------------04
```

```
30110900---011000000026000040004----------------------------------------------01
30110900---013333------3--333333333--333--33300000000000000000000-------------02
30110900---01----------------404050503535--4411-------------00--------7-0-----03
30110900---01--11115555-------1555500000000------------44---------------------04
30111000---011000000020000040004----------------------------------------------01
30111000---01-33333333333-33333333333-333333300000000000000000000-------------02
30111000---01-33440330133------4050501010000044000------3300-0000-00003333----03
30111000---014411236666--00----4433444-000011--3322----33---------------------04
30111100---011000000023000040004----------------------------------------------01
30111100---01-3-333-33333---33333-----333----00000000000000000000-------------02
30111100---01-33-30-1-1--------35----30----0---0-----------------------10-----03
30111100---01--1-1-5-5---------5-4-0-0-0-0-------------33---------------------04
30111200---011000000020000040004----------------------------------------------01
30111200---0133333----333333-3-3333-----3-33-00000000000000000000-------------02
30111200---01----1----0-0----35--50504040000045--3---------00---------770-----03
30111200---01--11--55----------44--00--00--1-1-22------33---------------------04
30111400---012000050024000040004----------------------------------------------01
30111400---01-3-----------3-311111-----------00000000000000000000-------------02
30111400---01------------------35--5035----0-----------------0----------------03
30111400---01--1-2-5-5---------5-4-0-0-0-0-------------44---------------------04
30112000---011000000008002000002----------------------------------------------01
30112000---01-3---------3-----33333----33-33----------------------------------02
30112000---01------------------------35----0---0---------------0--100-330-----03
30112000---01331133665511110000334332000000-------------2---------------------04
30112300---012000050026000040004----------------------------------------------01
30112300---01----------------3-3-------3333-300000000000000000000-------------02
30112300---01----------------------------------------------------------0-0----03
30112300---01-------------------------------------------4---------------------04
30112500---011000000025000040004----------------------------------------------01
30112500---01-33--3---------33---3---3--3333300000000000000000000-------------02
30112500---01------------------4050--35----------0-----------1--------93-2----03
30112500---01---1-3------------------------------------33---------------------04
30112600---011000000029000040004----------------------------------------------01
30112600---01-33----------33-3333333--333333300000000000000000000-------------02
30112600---01----------------40403030---------------------------------7711----03
30112600---01------6666--------------------------------54---------------------04
30112700---012020050040000040004----------------------------------------------01
30112700---013--3-1113333--3----111113133----00000000000000000000-------------02
30112700---01-----100--------50--------35---0---00----------0-----------------03
30112700---01------------------------------------------55---------------------04
30112800---012000050035000040004----------------------------------------------01
30112800---01333-3-----333333110011222111111100000000000000000000-------------02
30112800---01----------------354050--3535--------0--------------------00-0----03
30112800---01----11--55------00--44--00--00-----------055-3-------------------04
30112900---011000000032000040004----------------------------------------------01
30112900---01-33-33-----33-33----------------00000000000000000000-------------02
```

```
30112900---01------------------4050--3535--------0--221133---0------------------03
30112900---01------------------------------------------4------------------------04
30113000---011000000009002000002------------------------------------------------01
30113000---016515551111555156-3155533115551551110000-01---0000111---------------02
30113000---01-22230220011--------50503030000044---11------00---0--0-0-5-2-------03
30113000---01443333555622002222554200040000----------101100---------------------04
30113100---011000000003002000002------------------------------------------------01
30113100---016656666666666566665666666666656611122211111111221111---------------02
30113100---01--------------------4040----33-------------------------------------03
30113100---012223--55--2200----33--00--00------------101100---------------------04
30113200---011000000018002040004------------------------------------------------01
30113200---01------------------3333----------00000000000000000000---------------02
30113200---01-----------------------------------------------------0-0-7-2-------03
30113200---014-1---6---2-0-----3---4---0----------------3-----------------------04
30113400---012000050019002040004------------------------------------------------01
30113400---01-33-33333333--331101113-33333-3-00000000000000000000---------------02
30113400---01-222220010002230303040--3030-0050-000----------00-100--00000000----03
30113400---01-3---3---6-------2---3---4---0-----------022-----------------------04
30113500---011000000009002000002------------------------------------------------01
30113500---01-3333333333-333--31663333333-33-33------331100----33---------------02
30113500---01-221105500000022----4040353500221100-----------00--0-00-0---1------03
30113500---01221233556622111111442200440000-----------22------------------------04
30113900---011000000021000040004------------------------------------------------01
30113900---01-33----------333----------------00000000000000000000---------------02
30113900---01------------------5050503030004555000-----------0------------------03
30113900---01------------------------------------------3------------------------04
30114300---013000000820000040004------------------------------------------------01
30114300---01-----------------1-13------11---00000000000000000000---------------02
30114300---01-----------------------------------------------------------0000----03
30114300---01----3------------------------------------0-3-----------------------04
30114400---011000000039000040004------------------------------------------------01
30114400---01---------------------------5-11100000000000000000000---------------02
30114400---01------------------------------------------------------------7------03
30114400---01-------------------------------------------6-----------------------04
30114500---011000000028000040004------------------------------------------------01
30114500---01-----------------33-3-----3--33300000000000000000000---------------02
30114500---01-------------------------------------------------------------------03
30114500---01--1313555---------444-000-000--------------5-----------------------04
30115000---012000050025000040004------------------------------------------------01
30115000---013---333------3------------------00000000000000000000---------------02
30115000---01---3-------------35----40----------------------0-0-----------------03
30115000---01------------------------------------------4------------------------04
30115200---011000000035000040004------------------------------------------------01
30115200---013-33-------3--------------------00000000000000000000---------------02
30115200---01-----------------30--50-------------0-----------0------------------03
30115200---01------------------------------------------5------------------------04
```

```
30115300---011000000021000340004----------------------------------------------01
30115300---013311113-33-33333111111122211111100000000000000000000-------------02
30115300---01--2220-41000----404040403535-311----0--22----0000000000000011----03
30115300---01--1133--------------------------------00-033-0-------------------04
30115600---011000000024000040004----------------------------------------------01
30115600---01-333333333---33-----------------00000000000000000000-------------02
30115600---01-22330211122--------3540202022002200---------00------------------03
30115600---01------------------------------------------3----------------------04
30115700---011000000009002000002----------------------------------------------01
30115700---01--33333----3-33--3333----3-3333----------------------------------02
30115700---01---4----2---0-3-----5040--1000-025-0-------------000-00000000----03
30115700---014411235566--010111553300330000------------22---------------------04
30116000---011000000025000040004----------------------------------------------01
30116000---01-----3-333333-33-333333--333333300000000000000000000-------------02
30116000---01--2-2011-1-2------40--40--30--------0---------0-0--------0000----03
30116000---01--11115555--------554400000000------------33---------------------04
30116100---011000000031000040004----------------------------------------------01
30116100---01----3---------33----------------00000000000000000000-------------02
30116100---01------------------40------35--------------------0----------------03
30116100---01------------------------------------------4----------------------04
30116700---011000000024000040004----------------------------------------------01
30116700---011111113---333-3-----------------00000000000000000000-------------02
30116700---01---2----1-2---4440--50--40------3---2--------0-0-----------------03
30116700---01------------------------------------------3----------------------04
30116800---011000000036000040004----------------------------------------------01
30116800---01-----3-333333333010111221111100000000000000000000000-------------02
30116800---01-11-2011-1-0------30--50--40--------0-------3-0-0----------------03
30116800---01----3------------------------------------044---------------------04
30116900---011000000039000040004----------------------------------------------01
30116900---01-33--3--3-3---------------333-1100000000000000000000-------------02
30116900---01-----------------------------------------------------------------03
30116900---01------------------------------------------77---------------------04
30117000---011000000039000040004----------------------------------------------01
30117000---01-------------------333----33--3-00000000000000000000-------------02
30117000---01-----------------------------------------------------------------03
30117000---01----3--------------------------------------5---------------------04
30117200---011000000006002000002----------------------------------------------01
30117200---01--3-33-----3-33---333333333333--3--------------------------------02
30117200---01--------------------5050--3500-042-0-------------00--00003322----03
30117200---014411--55--110022--33--00--00--------------11---------------------04
30117500---011000000006002000002----------------------------------------------01
30117500---01-333333-3333333--3333333333333--3-3----3-333------33-------------02
30117500---01--2220-30011--------5050353500003300---------00--000000001100----03
30117500---0144112-565-2200111-544-020-000-------------11---------------------04
30117700---011000000026000040004----------------------------------------------01
30117700---01--333---------------------------00000000000000000000-------------02
```

```
30117700---01---------------------35----------3--------------------------------03
30117700---01-------------------------------------------4----------------------04
30118400---011000000010000040004-----------------------------------------------01
30118400---01-33---------------3333---333333------------3----------------------02
30118400---01---------------------40--35--0-0-1-0------------------------------03
30118400---0133113-555---00001-444-000-000--------------22---------------------04
30118500---011000000002002000001-----------------------------------------------01
30118500---01------------------------333----------------3-------33-------------02
30118500---01------------------------------------------------------------------03
30118500---01------------------------------------------------------------------04
30118600---012000050019002040004-----------------------------------------------01
30118600---01333333----3333331111132111111111100000000000000000000-------------02
30118600---01--------------22404050503535333344000-----------11000000000000----03
30118600---01441133------------------------------------033---------------------04
30118700---011000000007002000002-----------------------------------------------01
30118700---01-3333333-333333--33-333-3333333-3---------33--------3-------------02
30118700---01-3-5505-11000022----4040404011003300----------00--110011-000-1----03
30118700---01341122665522002222333344000000-------------11---------------------04
30118800---013000000824000040004-----------------------------------------------01
30118800---01333333----3333331111122111111111100000000000000000000-------------02
30118800---01-----------------303050503535--------0----------00--------0000----03
30118800---01--11335555--------554400000000------------054---------------------04
30118900---011000000023000040004-----------------------------------------------01
30118900---013333---------333-----------------00000000000000000000-------------02
30118900---01-----------------35--404035304433----0----------0-----------------03
30118900---01-------------------------------------------3----------------------04
30119600---011000000008002000002-----------------------------------------------01
30119600---01--------------------333---333333-----------3--------3-------------02
30119600---01------------------------------------------------------00001101----03
30119600---01-4-1-3-5-6-0-0-2-2-5-1-0-5-0-0--------------1---------------------04
30119700---011000000005002000002-----------------------------------------------01
30119700---01-5565553335565---33-3-555566633-11--33--333333---311--------------02
30119700---01-3344023-------------404035--000------1-------00----------3-------03
30119700---01441113555622002220555400020000-----------0011---------------------04
30119900---011000000017000040004-----------------------------------------------01
30119900---01-----------------511112222211112200000000000000000000-------------02
30119900---01------------------------------------------------------00000000----03
30119900---01-4-12--65-----------34--40--00------------0-2-2-------------------04
30120000---011000000004002000002-----------------------------------------------01
30120000---01--3-33-3333333---33-333333333333-33-333-333333-----33-------------02
30120000---01-33-3033-2-----------5050----44--22------------0--00-000-077-7----03
30120000---0144111166-52211222244-422-000-0-------------11---------------------04
30120100---011000000003002000002-----------------------------------------------01
30120100---016656366666636366--3---3333---3--111111111113333333333-------------02
30120100---01---------------------5050----12--11-------------------------------03
30120100---010011--65--330011--44--10--00----------------1---------------------04
```

```
30120200---012003000036000040004----------------------------------------------01
30120200---013--3111-111111130101111111110000000000000000000000000-------------02
30120200---01--1110-1--------4030--40--40-----5-00-------30000----------------03
30120200---01----------------------------------------005533-------------------04
30120300---011000000019002040004----------------------------------------------01
30120300---01---------------------------333--00000000000000000000-------------02
30120300---01------------------------------------------------------0-0-0-0----03
30120300---01-4-1---------0-1---------------------------2---------------------04
30120400---011000000021000040004----------------------------------------------01
30120400---0133-33------33333----------------00000000000000000000-------------02
30120400---01----------------4040--504040-000----0----------11----------------03
30120400---01------------------------------------------3----------------------04
30120500---011000000028000040004----------------------------------------------01
30120500---01----------------33-------33333--00000000000000000000-------------02
30120500---01----------------------------------------------------------0-0----03
30120500---01----1---5-----------3---0---0--------------4---------------------04
30120600---011000000029000040004----------------------------------------------01
30120600---01----------33-33-3333-------3333300000000000000000000-------------02
30120600---01----------------------50--35-0-0---------------------------------03
30120600---01----33------------------------------------44---------------------04
30120700---011000000017002000004----------------------------------------------01
30120700---01311111111111111-511111111111111500000000000000000000-------------02
30120700---01422220110002110030--505040350000000000022----001-000000000000----03
30120700---0144111355----0021--44--00--00------------003300-------------------04
30120800---011000000020000040004----------------------------------------------01
30120800---0133333-3-33333-33----333-3-33-33300000000000000000000-------------02
30120800---01--0001002200-0--404050--35350-005-000----11330000000000--00------03
30120800---01---1-3-5-5---1-----5-4-0-0-0-011---2------22---------------------04
30120900---011000000017002040004----------------------------------------------01
30120900---01-3333-----333-33----------------00000000000000000000-------------02
30120900---01---------------4--4050--35350-00--000-----------00000------------03
30120900---01------------------------------------------3----------------------04
30121000---011000000026000040004----------------------------------------------01
30121000---01----------------33---------3333300000000000000000000-------------02
30121000---01----------------------------------------------------------7-0----03
30121000---01---133-555---------444-000-000-------------4---------------------04
30121100---011000000007002000002----------------------------------------------01
30121100---01--------------------33-3--3333-----------------------------------02
30121100---01-----------------------------------------------------00-011-1----03
30121100---01-3-1---6---2-1-2---5---0---1---------------1---------------------04
30121200---012000050031000040004----------------------------------------------01
30121200---01333---------33--3--333--------3300000000000000000000-------------02
30121200---01----------------40--404035----------0----------0---------0-0-----03
30121200---01-----1---4-----------0---0---0------------55---------------------04
30121300---011000000019000040004----------------------------------------------01
30121300---01----------------333333-----33---00000000000000000000-------------02
```

```
30121300---01-----------------------------------------------------00000000----03
30121300---01--1-3-5-5---------5-4-0-0-0-0--------------3---------------------04
30121400---0110000000140020000003---------------------------------------------01
30121400---01----------------33333-----3--333---------------------------------02
30121400---01-----------------------------------------------------0-0-1-1-----03
30121400---014411335555--000000553300000000-------------2---------------------04
30121600---0110000000210000040004---------------------------------------------01
30121600---01----------------111-3-333-3--11100000000000000000000-------------02
30121600---01-----------------------------------------------------------------03
30121600---0144112355----------44--00--00---------------3---------------------04
30122100---0110000000190000040004---------------------------------------------01
30122100---01333---3-3333333-111111231121111100000000000000000000-------------02
30122100---01--1330-24-03---435--40403030000000003-----133000--0-000000000----03
30122100---01--1133------------------------11--22-----033-0-------------------04
30122200---0110000000330000040004---------------------------------------------01
30122200---013333333--333--------------------00000000000000000000-------------02
30122200---01---33---11-2----35--50--30----------0--------000-----------------03
30122200---01------------------------------------------5----------------------04
30122600---0110000000220000040004---------------------------------------------01
30122600---01-3333-------33------------------00000000000000000000-------------02
30122600---01--------------------353530--000-000------------------------------03
30122600---01------------------------------------------3----------------------04
30122700---0110000000200000040004---------------------------------------------01
30122700---01-----------------33-3-----33----00000000000000000000-------------02
30122700---01-----------------------------------------------------------------03
30122700---01----3---5-----------4---0---0--------------2---------------------04
30122800---0110000000250000040004---------------------------------------------01
30122800---01----------------333-------333-3300000000000000000000-------------02
30122800---01-----------------------------------------------------------------03
30122800---01----33-------------------------------------4---------------------04
30122900---0110000000350000040004---------------------------------------------01
30122900---013--33------33-3-33-333-----3--3300000000000000000000-------------02
30122900---01----------------40------------------0----------0---------0-------03
30122900---01----33--44----------00--00--00------------44---------------------04
30123000---0110000000280000040004---------------------------------------------01
30123000---01------------------3----------33-00000000000000000000-------------02
30123000---01-----------------------------------------------------------------03
30123000---01---133-666---------444-333-000-------------4---------------------04
30123100---0120030000300000040004---------------------------------------------01
30123100---013333-------333-3-3113----------100000000000000000000-------------02
30123100---01----------------4040----3535-------------------00--------0-0-----03
30123100---01--1-3-5-----------4---0---0--------------055---------------------04
30123300---0110000000240000040004---------------------------------------------01
30123300---01-----------333------------------00000000000000000000-------------02
30123300---01----------------------35---------2-------------------------------03
30123300---01------------------------------------------3----------------------04
```

```
30123400---011000000010002000002----------------------------------------------01
30123400---01--3-------3-33---3--3------3-33----------------------------------02
30123400---01-------------0-2----5050----00--22------------------000--77------03
30123400---01----33--44------00--00--00---------------------------------------04
30123500---011000000008002000002----------------------------------------------01
30123500---01--333-------33---3333-----33333----------------------------------02
30123500---01--------------------5050----00--00---------------0-000000--11----03
30123500---01331133555522001211553400000000------------11---------------------04
30123700---011000000019000040004----------------------------------------------01
30123700---01-3------------3----3------3---3-00000000000000000000-------------02
30123700---01------------------------3010--00--00-----------------------1-----03
30123700---01-----3---6-------2---4---3---0------------22---------------------04
30123800---011000000021000040004----------------------------------------------01
30123800---01333---------33333333----------3300000000000000000000-------------02
30123800---01----------------3030404030300000----0----------00----------------03
30123800---01--1-335-55--------5-440-000-00------------33---------------------04
30123900---011000000007002000002----------------------------------------------01
30123900---01-----------------------------33----------------------------------02
30123900---01-----------------------------------------------------------------03
30123900---01-4-1-3-5-4-2-0-2-1-5-0-0-0-0-0-------------1---------------------04
30124000---011000000021000040004----------------------------------------------01
30124000---01--3--33----33-------------------00000000000000000000-------------02
30124000---01---2----0-0---------40------3---0--------------------------------03
30124000---01------------------------------------------3----------------------04
30124100---011000000026000040004----------------------------------------------01
30124100---0133--33333333-3--3333333---333-3300000000000000000000-------------02
30124100---01-----033--------35----5030---00-----0--------000-----------------03
30124100---01--1-335-55--------4-5500000000------------44---------------------04
30124200---011000000034000040004----------------------------------------------01
30124200---01-3--33---33-3----33-33---3-33-3300000000000000000000-------------02
30124200---01----2----0-0------------35-------------------------------00-0----03
30124200---01------------------------------------------55---------------------04
30124300---011000000020000040004----------------------------------------------01
30124300---01333333----33333311113-------331100000000000000000000-------------02
30124300---01----------------202040403535000033000------33--11--------0000----03
30124300---01--11-355-6--00----55-300-400-0--------00--33---------------------04
30124400---011000000015002000003----------------------------------------------01
30124400---01-3-33--------33-33-33--------------------------------------------02
30124400---01----------------------403535--00-000-------------0-0-0-0-2-1-----03
30124400---01----3---5-------2---4---0---0-------------22---------------------04
30124600---011000000017002000004----------------------------------------------01
30124600---01-----------------33333----3--33-00000000000000000000-------------02
30124600---01-----------------------------------------------------0-0-0-0-----03
30124600---01441111555522001111442200000000-------------2---------------------04
30124700---011000000020000040004----------------------------------------------01
30124700---01----3--3-----3--3---------33-3-300000000000000000000-------------02
```

```
30124700---01----------------------40-----3--3--------------------------------03
30124700---01-4-1---6---1-0-----3---4---0--------------22---------------------04
30124900---011000000020000040004----------------------------------------------01
30124900---01-333--333-33----33333---3-33311100000000000000000000-------------02
30124900---01-334-0334-0---------40--30--0-0--------------0----00-----0022----03
30124900---01--11335555--00----444400000000---------0--23---------------------04
30125000---011000000037000040004----------------------------------------------01
30125000---013-3--3-------3--000001----11100100000000000000000000-------------02
30125000---01-----------------------------------------------------------------03
30125000---01-----------------------------------------055-5-------------------04
30125200---011000000016002000004----------------------------------------------01
30125200---01-333333--33333333-33333333333-3300000000000000000000-------------02
30125200---01---32---10210044--3540403535445511000--------00-1000000000000----03
30125200---014-1--35--52-0-2--15--40--00--011--2-------33---------------------04
30125400---011000000026000040004----------------------------------------------01
30125400---013333---------3--3----------3----00000000000000000000-------------02
30125400---01----------------35--505035---0------0----------0-----------------03
30125400---01------------------------------------------44---------------------04
30125500---011000000007002000002----------------------------------------------01
30125500---01-----------333--------3---33-33-----------3----------------------02
30125500---01----------------------50-----1---1----------------0-0-0---0------03
30125500---01-4-1-3-5-6-2-1-2-2-5-2-0-5-0-0------------11---------------------04
30125800---011000000024000040004----------------------------------------------01
30125800---013333--------3---33333333-3333---00000000000000000000-------------02
30125800---01----------------30--404030--0-0--------------------------0000----03
30125800---01----3-5-4---------4-0-0-0-0-0-------------33---------------------04
30125900---011000000006002000002----------------------------------------------01
30125900---01------------------3--3--33-333------------3--------3-------------02
30125900---01------------------------------------------------------0-0-3-7----03
30125900---014411--77--331122--33--33--11---------------1---------------------04
30126000---011000000033000040004----------------------------------------------01
30126000---01----------------33-333---1113-3-00000000000000000000-------------02
30126000---01-----------------------------------------------------------------03
30126000---01----33-------------------------------------5---------------------04
30126300---011000000010002000002----------------------------------------------01
30126300---01-33333333333333-3333333333333333---------------------------------02
30126300---01-222203313001133----5050505000447700-0011--3300--000000000000----03
30126300---014411336666--111111333333330000----2222----22---------------------04
30126900---011000000001002000001----------------------------------------------01
30126900---01--------3----3--------------------------33-----------------------02
30126900---01----------------------50-----0-----------------------------------03
30126900---01------------------------------------------11---------------------04
30127000---011000000011002000002----------------------------------------------01
30127000---01-3333333----333--33333333-33333----------------------------------02
30127000---01-2-2-02-0-1-0-5-----4040353500002200---------0---0-0000007722----03
30127000---014411335666--111121533303440000------------22---------------------04
```

```
30127100---011000000029000040004----------------------------------------------01
30127100---01-------3----------3333----33333-00000000000000000000-------------02
30127100---01-2---------------------------------------------------------------03
30127100---01--11--55----------44--00--00--------------55---------------------04
30127200---011000000037000040004----------------------------------------------01
30127200---01----------------333333---------300000000000000000000-------------02
30127200---01-----------------------------------------------------------------03
30127200---01--1---5-----------4---0---0----------------5---------------------04
30127500---011000000018002040004----------------------------------------------01
30127500---0133-333-----333333-3333---333333300000000000000000000-------------02
30127500---01----------------3030--403530--00----0----------00000000000000----03
30127500---01--11--------------------------------------33---------------------04
30127600---012000050020000040004----------------------------------------------01
30127600---01-333-3---3-3-----1-333-333113---00000000000000000000-------------02
30127600---01----1----0-0--0-----35--30--0-0-0-0-----------0---00-00000000----03
30127600---01-----------------------------------------022---------------------04
30127700---011000000029000040004----------------------------------------------01
30127700---01--33--------33------------------00000000000000000000-------------02
30127700---01--------------------4040---------3-------------------------------03
30127700---01------------------------------------------4----------------------04
30127900---011000000013002000003----------------------------------------------01
30127900---01--3333--333-333--333333--333333----------------------------------02
30127900---01--2-20-3-3-20044----5050--3500-022-0----------0--0-0000007722----03
30127900---014411336656--112212444422020000------------22---------------------04
30128000---011000000003002000002----------------------------------------------01
30128000---01--3--3-3----------3----------3--3--------33----------------------02
30128000---01--------------------50------0------------------------------------03
30128000---011111--66--221122--44--21--00--------------11---------------------04
30128100---011000000032000040004----------------------------------------------01
30128100---01-----------------33---33--3---3300000000000000000000-------------02
30128100---01-----------------------------------------------------------------03
30128100---01--1-336-66--------4-444-440-00-------------5---------------------04
30128200---011000000021000040004----------------------------------------------01
30128200---0133-3---333-33-3333333----3-3333300000000000000000000-------------02
30128200---01-33-5022-2-0----3535----4040--00----0---------000--------0000----03
30128200---01--1-335-55--------444400000000------------33---------------------04
30128300---011000000007002000002----------------------------------------------01
30128300---01--3---33-3-------33-33-3-3---33----------------------------------02
30128300---01-2-2302-0000--------40------0---0------------00----------0-------03
30128300---011111--55--220022--44--00--00--------------11---------------------04
30128400---011000000025000040004----------------------------------------------01
30128400---01----------------3333-333-3--33-300000000000000000000-------------02
30128400---01-----------------------------------------------------------------03
30128400---01-------------------------------------------4---------------------04
30128500---011000000021000040004----------------------------------------------01
30128500---01-----------------333---3-333333300000000000000000000-------------02
```

```
30128500---01----------------------------------------------------------023----03
30128500---01--11335555--11----555500000000-------------3---------------------04
30128600---011000000008002000002----------------------------------------------01
30128600---01-----------------33--33333--3------------------------------------02
30128600---01--------------------------------------------------------0---0----03
30128600---012-1-2-5-5-2-0-1-1-5-5-0-0-0-0-------------11---------------------04
30128700---011000000008002000002----------------------------------------------01
30128700---01--3-33----3-3----------------------------------------------------02
30128700---01------------0033----40------0---0----------------0--0------------03
30128700---01------------------------------------------11---------------------04
30128900---011000000007002000002----------------------------------------------01
30128900---01-3333------------------------------------------------------------02
30128900---01--------------------40--30--0-0-2-0--------------0-0-------------03
30128900---01------------------------------------------1----------------------04
30129100---012000050027000040004----------------------------------------------01
30129100---01-333333---3333333333333-33333---00000000000000000000-------------02
30129100---01------------------4050503535--------1------3-0-0---------0000----03
30129100---01----3-------------------------------------44---------------------04
30129200---011000000030000040004----------------------------------------------01
30129200---01----------------------------333300000000000000000000-------------02
30129200---01-----------------------------------------------------------------03
30129200---01---3-3-5-----------5---0---0---------------5---------------------04
30129300---011000000007002000002----------------------------------------------01
30129300---01-33333---333333---3333-----3333-3--------3-----------------------02
30129300---01----2----1--0022----4040353500001300----------0--000000003300----03
30129300---013311-366-5110012-044-311-000-0------------11---------------------04
30129400---013000000838000040004----------------------------------------------01
30129400---010000000000000000188111822221100100000000000000000000-------------02
30129400---01-----------------------------------------------------------------03
30129400---01-----------------------------------------0-5-3-------------------04
30129600---011000000004002000002----------------------------------------------01
30129600---01------------------3-3-333333-3------------33-----333-------------02
30129600---01---------------------------------------------------------77------03
30129600---014411--77--220022--44--22--11---------------1---------------------04
30129900---011000000026000040004----------------------------------------------01
30129900---01----------------1133333----1111100000000000000000000-------------02
30129900---01---------------------------------------------------------7777----03
30129900---01--11335555--------444400000000-----------0-4---------------------04
30130000---011000000015002000003----------------------------------------------01
30130000---01333333-----3-----------------------------------------------------02
30130000---01------------0-0-00--50--20--0-0-0-0-0----------1-000-------------03
30130000---01------------------------------------------3----------------------04
30130100---011000000032000040004----------------------------------------------01
30130100---01333-----------------------------00000000000000000000-------------02
30130100---01----------------35--50--40----------0----------------------------03
30130100---01------------------------------------------4----------------------04
```

```
30130200---011000000004002000002----------------------------------------------01
30130200---01--3--33-333--3----3---33333--3--3---------3--------3-------------02
30130200---01--3330-2------------5050----00--66-------------------------------03
30130200---014411--55--220000--44--00--00--------------11---------------------04
30130300---011000000040000040004----------------------------------------------01
30130300---01-------------------33------3--3-00000000000000000000-------------02
30130300---01-----------------------------------------------------------------03
30130300---01-------------------------------------------6---------------------04
30130400---011000000038000040004----------------------------------------------01
30130400---01-----------------3--3-----3-3--300000000000000000000-------------02
30130400---01-----------------------------------------------------------------03
30130400---01----1---4-----------0---0---0--------------5---------------------04
30130500---011000000018000040004----------------------------------------------01
30130500---01333333--------3333333-------333300000000000000000000-------------02
30130500---01--------------3-404050--35350-000-000----------110-0-0-000-00----03
30130500---014411116666----1111333344440000------------33---------------------04
30130600---011000000007002000002----------------------------------------------01
30130600---01-33333333333333--33-333---33333-3-------33-----------------------02
30130600---01-222202211210022----5050404001102200---------00--0000000000-1----03
30130600---01441133556622112222443300240000------------11---------------------04
30130700---011000000025000040004----------------------------------------------01
30130700---013---3---------3-3----------3---300000000000000000000-------------02
30130700---01----------------40----40-----------------------0-----------------03
30130700---01------------------------------------------3----------------------04
30130800---011000000019002040004----------------------------------------------01
30130800---01-------------------33-3-3--333--00000000000000000000-------------02
30130800---01-----------------------------------------------------00100000----03
30130800---01-4-1-------1-------------------------------2---------------------04
30130900---011000000008002000002----------------------------------------------01
30130900---01-333333---33333--3333------3333----------------------------------02
30130900---01---4----1-0-0033----4040353500002200---------0---000010002211----03
30130900---0133--115566111-2222553300140000------------11---------------------04
30131000---011000000008002000002----------------------------------------------01
30131000---01--3-3-------33-----33-------3------------------------------------02
30131000---01--------------------4040----22--11---------------0--00-000-00----03
30131000---01------------------------------------------11---------------------04
30131100---011000000020000040004----------------------------------------------01
30131100---01------------------333-------33--00000000000000000000-------------02
30131100---01---------------------------------------------------------0-00----03
30131100---01--33--66----------33--44--00---------------3---------------------04
30131300---011000000014002000003----------------------------------------------01
30131300---01----3-----3-3-33------------3333---------------------------------02
30131300---01---------------2--30------35---0---00-----------00--0---0---2----03
30131300---01---1-3-5-5-0-0-1-0-5-3-0-0-0-0------------22---------------------04
30131400---011000000031000040004----------------------------------------------01
30131400---013333-3-------------333-----33--300000000000000000000-------------02
```

```
30131400---01----------------40--50--40------4---0-----------0---------7733----03
30131400---01------------------------------------------44----------------------04
30131500---011000000033000040004-----------------------------------------------01
30131500---01-------------------33------33-33000000000000000000000-------------02
30131500---01----------------------------------------------------------009-----03
30131500---01-----3-------------------------------------4----------------------04
30131600---011000000024000040004-----------------------------------------------01
30131600---01-----------------3-3-------3--3-000000000000000000000-------------02
30131600---01------------------------------------------------------------------03
30131600---01----33-------------------------------------3----------------------04
30131800---011000000015002000003-----------------------------------------------01
30131800---01-33-------33333-333---3---333333----------------------------------02
30131800---01-------------0-3----505035350000-400---------------0-0-0-0-7-1----03
30131800---014411-366----0122-244--22--00--------------22----------------------04
30132200---011000000001002000001-----------------------------------------------01
30132200---01---------------------33-33------3-3------333-------33-------------02
30132200---01------------------------------------------------------------------03
30132200---01------------------------------------------11----------------------04
30132500---011000000020000040004-----------------------------------------------01
30132500---01---333----333-3-----------------000000000000000000000-------------02
30132500---01--------------44----------30---0---0--------------0000------------03
30132500---01------------------------------------------2-----------------------04
30132900---011000000030000040004-----------------------------------------------01
30132900---01----33--------33--3333-----3333-000000000000000000000-------------02
30132900---01------------------35------40------------------------------7700----03
30132900---01--1---5-----------4---0---0---------------55----------------------04
30133000---011000000009002000002-----------------------------------------------01
30133000---01-33333------------------------------------------------------------02
30133000---01-------------0-3------50--40-0-0-1-0------------------------------03
30133000---01------------------------------------------11----------------------04
30133100---011000000037000040004-----------------------------------------------01
30133100---01--3-----------33-333333-------33000000000000000000000-------------02
30133100---01------------------3040----40--------0------------0--------0-0-----03
30133100---01--1---------------------------------------66----------------------04
30133400---011000000006002000002-----------------------------------------------01
30133400---01-------------------333333333-33-----------------------------------02
30133400---01----------------------------------------------------------000-----03
30133400---01-4-1-3-6-5-2-0-0-0-4-4-2-0-0-0-------------1----------------------04
30133500---011000000014002000003-----------------------------------------------01
30133500---01333333--33333333333333----333333----------------------------------02
30133500---01--4-41-0----0000303040402020000022000--------00110000000000000----03
30133500---01441111555522112222444400000000------------22----------------------04
30133600---011000000029000040004-----------------------------------------------01
30133600---01333333----333333-33333----33333-000000000000000000000-------------02
30133600---01----------------303050503535--------0----------11-----------------03
30133600---01--1-1-5-6---------4-4-0-2-0-0-------------55----------------------04
```

```
30133900---011000000005002000002----------------------------------------------01
30133900---01--3-3-3333---3----3-3-333333-3--3---------33---------------------02
30133900---01-2244011------------5050----00--23-----------00------------------03
30133900---014411--55--220122--55--00--00--------------11---------------------04
30134100---011000000035000040004----------------------------------------------01
30134100---01--3-3----------3-3--3---------3-00000000000000000000-------------02
30134100---01------------------3040----------0---0-----------0----------------03
30134100---01----33--55----------33--00--00------------44---------------------04
30134200---011000000006002000002----------------------------------------------01
30134200---01--3-33333333-3----3-33333333-3--3--------33--------3-------------02
30134200---01-33440111-----------5050----0---55-----------00--00--00--01------03
30134200---014433--66--220022--55--22--00--------------11---------------------04
30134400---011000000030000040004----------------------------------------------01
30134400---01333--33--3-3-3-3----3-3---3333-300000000000000000000-------------02
30134400---01---44----100----4040--35------------0--------0000--------00-0----03
30134400---01---1---5-----------5---0---0--------------44---------------------04
30134700---011000000011002000002----------------------------------------------01
30134700---01---3-------------3333-------333----------------------------------02
30134700---01---------------------------------------------------0-0-107-11----03
30134700---01441133556622001122554400110000-------------2---------------------04
30134800---011000000003002000002----------------------------------------------01
30134800---01--------------------------------3---------3--------3-------------02
30134800---01-----------------------------------------------------------------03
30134800---01------------------------------------------11---------------------04
30134900---011000000002002000001----------------------------------------------01
30134900---01------------------3---3333-------------------------3-------------02
30134900---01-----------------------------------------------------------------03
30134900---014-2---6---1-0-2---4---2---0----------------1---------------------04
30135000---011000000002002000001----------------------------------------------01
30135000---01--3-----3----3----3---3-33---3--3-3------33--------3-------------02
30135000---01--3--0-5------------4040----1---00-------------------------------03
30135000---013311--55--220022--55--00--00--------------11---------------------04
30135200---011000000006002000002----------------------------------------------01
30135200---01--3----33-3------------------3-----------------------------------02
30135200---01-33--033------------50------0---1--------------------------------03
30135200---01-4-1---5---3-0-2---4---0---0--------------11---------------------04
30135300---011000000015002000003----------------------------------------------01
30135300---01333-33----3---33333---3333333-3300000000000000000000-------------02
30135300---01------------0054404050--40400-000-000----------000----0-0-0-0----03
30135300---014-1-33--66----1-22--33--44--00------------33---------------------04
30135500---011000000040000040004----------------------------------------------01
30135500---01-----------------33333----33-33-00000000000000000000-------------02
30135500---01-----------------------------------------------------------------03
30135500---01-------------------------------------------7---------------------04
30135600---011000000027000040004----------------------------------------------01
30135600---01-----------------3333-3---33333000000000000000000000-------------02
```

```
30135600---01---------------------------------------------------------0000----03
30135600---01----336666--------333344440000-------------5---------------------04
30135700---012000050025000040004----------------------------------------------01
30135700---01----------------33-------------300000000000000000000-------------02
30135700---01-----------------------------------------------------------------03
30135700---01--------5----------------------------------4---------------------04
30136000---011000000040000040004----------------------------------------------01
30136000---01----------------333333-----3333300000000000000000000-------------02
30136000---01-----------------------------------------------------------------03
30136000---01-------------------------------------------7---------------------04
30136100---012000050024000040004----------------------------------------------01
30136100---01----3--------33-----------------00000000000000000000-------------02
30136100---01----------------------50--40-4-4-5-0-----------------------------03
30136100---01------------------------------------------3----------------------04
30136200---011000000024000040004----------------------------------------------01
30136200---01-33333-----3333-3---33----33-33300000000000000000000-------------02
30136200---01--------------------5050353500003300---------------------77------03
30136200---01---1-3-5-5---------5-5-0-0-0-0------------33---------------------04
30136300---011000000014002000003----------------------------------------------01
30136300---01-3---3----3---3--------------------------------------------------02
30136300---01------------0033--------3535--00--00-----------------------------03
30136300---01------------------------------------------2----------------------04
30136400---011000000031000040004----------------------------------------------01
30136400---01-3-33-3-------3-----------------00000000000000000000-------------02
30136400---01---8--------------------3030-----------------2-------------------03
30136400---01------------------------------------------4----------------------04
30136500---011000000030000040004----------------------------------------------01
30136500---01------------3-33----------------00000000000000000000-------------02
30136500---01------------------35------35-------------------------------------03
30136500---01------------------------------------------4----------------------04
30136600---011000000002002000001----------------------------------------------01
30136600---01---------3---3---------------------------3-----------------------02
30136600---01----1-----------------50-----------------------------------------03
30136600---01-------------------------------------------1---------------------04
30136700---011000000024000040004----------------------------------------------01
30136700---013---33-----33-------------------00000000000000000000-------------02
30136700---01----------------40------------------0----------0-----------------03
30136700---01------------------------------------------4----------------------04
30136800---011000000002002000001----------------------------------------------01
30136800---01------------------3-------------------------3--------------------02
30136800---01-----------------------------------------------------------------03
30136800---014-3---6---2-0-----4---1---0----------------1---------------------04
30136900---011000000018002040004----------------------------------------------01
30136900---01-----------333-3----------------00000000000000000000-------------02
30136900---01------------------40--40-----1------0-----------0-0-0------------03
30136900---01------------------------------------------3----------------------04
```

```
30137000---011000000025000040004----------------------------------------------01
30137000---01-----------------33-3-----3-----00000000000000000000-------------02
30137000---01-----------------------------------------------------------------03
30137000---014-3-3-5-5-----1---5-5-0-0-0-0--------------3---------------------04
30137100---011000000016002000003----------------------------------------------01
30137100---01----------------------------333300000000000000000000-------------02
30137100---01--------------------------------------------------------0---0----03
30137100---01---1-3-7-5---1-2-2-4-4-2-0-3-0-------------2---------------------04
30137200---011000000022000040004----------------------------------------------01
30137200---0133333--3-3-33333-3333--3-3-3311-00000000000000000000-------------02
30137200---01-2--205----4----404050504040--00----0---------000----------------03
30137200---014433336666--------444444440000-----------033---------------------04
30137300---011000000020000040004----------------------------------------------01
30137300---01-----------------3-3-3----------00000000000000000000-------------02
30137300---01-----------------------------------------------------------0-----03
30137300---01----1---6-------2---4---2---0--------------2---------------------04
30137400---011000000000702000001----------------------------------------------01
30137400---01-------------------------------------------33--------------------02
30137400---01-----------------------------------------------------------------03
30137400---01-------------------------------------------1---------------------04
30137500---011000000020000040004----------------------------------------------01
30137500---0133-3-3-----3---3----------------00000000000000000000-------------02
30137500---01----------------4040----30----0---0-0----------------------------03
30137500---01------------------------------------------2----------------------04
30137600---011000000033000040004----------------------------------------------01
30137600---0133333------33-----33-3------3-3300000000000000000000-------------02
30137600---01----------------40--505035----------0----------0-----------------03
30137600---01------------------------------------------55---------------------04
30137700---011000000015002000003----------------------------------------------01
30137700---01-----------------333---------33-000000000000000000-------------02
30137700---01-------------------------------------------------------0---0-----03
30137700---01--1133------11-----------------------------3---------------------04
30137800---011000000027000040004----------------------------------------------01
30137800---01-3----------33---3------------3300000000000000000000-------------02
30137800---01----------------------5030---------------------------------------03
30137800---01----11--55----------44--00--00------------44---------------------04
30137900---011000000027000040004----------------------------------------------01
30137900---0133----------33-----33-------33--00000000000000000000-------------02
30137900---01----------------30----5035----------0----------------------------03
30137900---01--------------------------------4---------44---------------------04
30138000---011000000029000040004----------------------------------------------01
30138000---01---3-------3--33----------------00000000000000000000-------------02
30138000---01------------------30------40---0---00-----------1----------------03
30138000---01------------------------------------------3----------------------04
30138100---011000000015002000003----------------------------------------------01
30138100---01--3----------33---3----------------------------------------------02
```

```
30138100---01--------------------5050--3534-522-0-----------------------------03
30138100---01--1---6-----1-1---4---2---0---------------33---------------------04
30138200---011000000032000040004----------------------------------------------01
30138200---013--3333---333---3---333-----333-00000000000000000000-------------02
30138200---01---4------4----------------------------------0-------------------03
30138200---01------------------------------------------55---------------------04
30138300---011000000028000040004----------------------------------------------01
30138300---0133-3333----3-333----------------00000000000000000000-------------02
30138300---01---4----0-0-----4035--503030--22----0--------0-00----------------03
30138300---01------------------------------------------4----------------------04
30138400---011000000022000040004----------------------------------------------01
30138400---01----3------33-33----------------00000000000000000000-------------02
30138400---01------------------35------40---3---------------------------------03
30138400---01------------------------------------------3----------------------04
30138500---011000000036000040004----------------------------------------------01
30138500---01--3----------3-3-3--------------00000000000000000000-------------02
30138500---01------------------35--50------------0-----------0----------------03
30138500---01----3---6-----------4---3---0-------------55---------------------04
30138600---011000000032000040004----------------------------------------------01
30138600---01-33-3-----------33--33----333---00000000000000000000-------------02
30138600---01--------------------40--35----------0----------0-----------------03
30138600---01----3-------------------------------------44---------------------04
30138700---011000000017002040004----------------------------------------------01
30138700---01----------------3-333---------3-00000000000000000000-------------02
30138700---01-----------------------------------------------------0-0-0-0-----03
30138700---01--1--35--5----1--05--40--00--0-------------4---------------------04
30138800---011000000037000040004----------------------------------------------01
30138800---01--------------------11222111101100000000000000000000-------------02
30138800---01-----------------------------------------------------------------03
30138800---01-----3-----------------------------------0-5-3-------------------04
30138900---011000000019002040004----------------------------------------------01
30138900---01------------------3333-33-33333300000000000000000000-------------02
30138900---01-----------------------------------------------------00000000----03
30138900---01--11-3---6-----------4---2---0113322-------2---------------------04
30139000---011000000020000040004----------------------------------------------01
30139000---01---3-3-----3-3------------------00000000000000000000-------------02
30139000---01----------------------35-------0------------------00-------------03
30139000---01------------------------------------------2----------------------04
30139100---011000000016002000003----------------------------------------------01
30139100---01---------------3--3-------33----00000000000000000000-------------02
30139100---01------------------40----------------0-----------0-----0---0------03
30139100---014-3----------------------------------------2---------------------04
30139200---011000000017002040004----------------------------------------------01
30139200---01-------------333----------------00000000000000000000-------------02
30139200---01------------------40--40--30-3-0-4-0------------0----------------03
30139200---01------------------------------------------2----------------------04
```

```
30139300---0110000000022000040004---------------------------------------------01
30139300---01-----3-3--3---3-----------------00000000000000000000-------------02
30139300---01-3---03-------------------50-------------------------------------03
30139300---01------------------------------------------3----------------------04
30139400---0110000000018002040004---------------------------------------------01
30139400---013-333-3-3-3333333333-333333-333300000000000000000000-------------02
30139400---01---2-0-41-2----340404040--2044-0-2-00--------0-000010-0-0--01----03
30139400---01--11326666----2211433323330000-----2-2----33---------------------04
30139500---0110000000009002000002---------------------------------------------01
30139500---01-333-333---3333-------3--3-3-3-----------3-----------------------02
30139500---01-2-2-05-4-0-0-3-----4040353500002200---------0----000---0---0----03
30139500---01-----1---5-------0---3---0---0------------11---------------------04
30139600---0110000000022000040004---------------------------------------------01
30139600---01-----333-33------3-3--------333-00000000000000000000-------------02
30139600---01-3-3703-0000---------------------------------00------------22----03
30139600---01---133------------------------------------33---------------------04
30139700---0110000000027000040004---------------------------------------------01
30139700---0133--33--------------------------00000000000000000000-------------02
30139700---01------------------------35---------------------------------------03
30139700---01------------------------------------------4----------------------04
30139800---0110000000006002000002---------------------------------------------01
30139800---01----3-3-------------------------3--------------------------------02
30139800---01---1---------------------------------------------0---------------03
30139800---01------------------------------------------1----------------------04
30139900---0110000000023000040004---------------------------------------------01
30139900---01-3----3----33333----------------00000000000000000000-------------02
30139900---01---2----2---------40--503535--44-------------0--0----------------03
30139900---01------------------------------------------3----------------------04
30140000---0110000000011002000002---------------------------------------------01
30140000---01------3---3333---------------------------------------------------02
30140000---01---3----1-4--0-3------35-----2---1-----------0----0-0------------03
30140000---01------------------------------------------2----------------------04
30140100---0110000000011002000002---------------------------------------------01
30140100---01-3333333333333---------------3-----------------------------------02
30140100---01--33304411000055----404035--111-000----------00--0000------------03
30140100---01-4-1---5-----1-2---5---0---0--------------22---------------------04
30140200---0110000000014002000003---------------------------------------------01
30140200---01--3----------333-------------------------------------------------02
30140200---01------------------355050--4000-055-20----------------------------03
30140200---01------------------------------------------2----------------------04
30140300---0110000000022000040004---------------------------------------------01
30140300---01-3----33-----33-----------------00000000000000000000-------------02
30140300---01-3-3-02-2-2-----------504040-------------------------------------03
30140300---01------------------------------------------3----------------------04
30140400---0110000000004002000002---------------------------------------------01
30140400---01--3--3----3--3------------------3--------3-----------------------02
```

```
30140400---01--------------------4040----00--11-------------------------------03
30140400---01------------------------------------------1----------------------04
30140500---011000000014002000003----------------------------------------------01
30140500---01-----------------3--------33-3-----------------------------------02
30140500---01------------------------------------------------------0---0------03
30140500---01-2-11--56--0-0-20--43--03--00--------------2---------------------04
30140600---011000000021000040004----------------------------------------------01
30140600---01-33---------3-------------------00000000000000000000-------------02
30140600---01--------------------50--40--4-4-5-0------------------------------03
30140600---01------------------------------------------3----------------------04
30140700---011000000020000040004----------------------------------------------01
30140700---01----------------------------333300000000000000000000-------------02
30140700---01------------------------------------------------------------0----03
30140700---01---1-3-5-5---------5-4-0-0-0-0-------------3---------------------04
30140800---011000000008002000002----------------------------------------------01
30140800---01-----------------333333----3333----------------------------------02
30140800---01-----------------------------------------------------00001100----03
30140800---012211235566--002222553200240000-------------1---------------------04
30140900---011000000023000040004----------------------------------------------01
30140900---01------3---3---3-----------------00000000000000000000-------------02
30140900---01---3----1-2---------------30---0---------------------------------03
30140900---01------------------------------------------3----------------------04
30141000---011000000026000040004----------------------------------------------01
30141000---01-33------------3----------------00000000000000000000-------------02
30141000---01------------------4050--35--0-0----------------------------------03
30141000---01------------------------------------------4----------------------04
30141100---011000000020000040004----------------------------------------------01
30141100---01-33--------3---3-------------33300000000000000000000-------------02
30141100---01------------------4040--35--0-0-4-0-------------0-0--------------03
30141100---01---1-2-5-5---------4-3-0-0-0-0------------33---------------------04
30141200---011000000038000040004----------------------------------------------01
30141200---01----------------110000000000101100000000000000000000-------------02
30141200---01-----------------------------------------------------------------03
30141200---01-----------------------------------------0-5-5-------------------04
30141300---011000000035000040004----------------------------------------------01
30141300---013----3----33333333333------3333300000000000000000000-------------02
30141300---01----------------5050------35--------0----------00--------0000----03
30141300---01--1133------------------------------------55---------------------04
30141400---011000000030000040004----------------------------------------------01
30141400---01-----------------3333-----------00000000000000000000-------------02
30141400---01---------------------------------------------------------0-0-----03
30141400---01------5-5---------5-4-0-0-0-0--------------5---------------------04
30141500---011000000022000040004----------------------------------------------01
30141500---013333-------3333-----------------00000000000000000000-------------02
30141500---01----------------40--505035350000---------------0-----------------03
30141500---01------------------------------------------3----------------------04
```

```
30141600---011000000021000040004----------------------------------------------01
30141600---01----------------131--3----33333-00000000000000000000-------------02
30141600---01----------------------------------------------------------0-0----03
30141600---01--11335566--------554400220000-------------3---------------------04
30141700---011000000001002000001----------------------------------------------01
30141700---01--3----------3-------------33---33-------------------------------02
30141700---01--------------------5050------------------------------0---0-3----03
30141700---01------------------------------------------1----------------------04
30141800---011000000014002000003----------------------------------------------01
30141800---01----3------------3-3--3333----33---------------------------------02
30141800---01-------------------------------------------------------0---0-----03
30141800---01----22--66------11--33--22--00------------11---------------------04
30141900---011000000005002000002----------------------------------------------01
30141900---01--3-333--333-3------333333333------------------------------------02
30141900---01---22---------------4040----00--11-----------00----------77-7----03
30141900---01------------------------------------------1----------------------04
30142000---011000000021000040004----------------------------------------------01
30142000---01------------333-----------------00000000000000000000-------------02
30142000---01----------------------40--35------------------------0------------03
30142000---01------------------------------------------3----------------------04
30142100---011000000003002000002----------------------------------------------01
30142100---01------------------3--3----3--3--3333----331113---311-------------02
30142100---01----------------------50-----0-----------------------------------03
30142100---013311--66--221111--44--22--00--------------11---------------------04
30142200---011000000017002040004----------------------------------------------01
30142200---01-33333------3-------------------00000000000000000000-------------02
30142200---01--------------------40--30--0-0-2-0--------------0-00------------03
30142200---01------------------------------------------2----------------------04
30142300---011000000017002040004----------------------------------------------01
30142300---01-----------------------3---3333-00000000000000000000-------------02
30142300---01------------------------------------------------------0-0-0-1----03
30142300---01-4-1-2-6-6-2-0-2-2-3-3-4-4-0-0-------------2---------------------04
30142400---011000000008002000002----------------------------------------------01
30142400---01-----------333---------------------------------------------------02
30142400---01----------------------50-----0---5----------------0-0------------03
30142400---01-------------------------------------------1---------------------04
30142500---011000000006002000002----------------------------------------------01
30142500---01--3-3333------------------------3--------------------------------02
30142500---01---1-02-0-1-0-0-----50------1---3------------0---0---------------03
30142500---01-------------------------------------------1---------------------04
30142600---011000000030000040004----------------------------------------------01
30142600---0133-3----------------------------00000000000000000000-------------02
30142600---01----------------35------35---------------------------------------03
30142600---01------------------------------------------4----------------------04
30142700---011000000028000040004----------------------------------------------01
30142700---01----------------33---------3--3300000000000000000000-------------02
```

```
30141600---011000000021000040004----------------------------------------------01
30141600---01----------------131--3----33333-00000000000000000000-------------02
30141600---01----------------------------------------------------------0-0----03
30141600---01--11335566--------554400220000-------------3---------------------04
30141700---011000000001002000001----------------------------------------------01
30141700---01--3----------3-------------33---33-------------------------------02
30141700---01--------------------5050------------------------------0---0-3----03
30141700---01------------------------------------------1----------------------04
30141800---011000000014002000003----------------------------------------------01
30141800---01----3------------3-3--3333----33---------------------------------02
30141800---01-------------------------------------------------------0---0-----03
30141800---01----22--66------11--33--22--00------------11---------------------04
30141900---011000000005002000002----------------------------------------------01
30141900---01--3-333--333-3------333333333------------------------------------02
30141900---01---22---------------4040----00--11-----------00----------77-7----03
30141900---01------------------------------------------1----------------------04
30142000---011000000021000040004----------------------------------------------01
30142000---01------------333-----------------00000000000000000000-------------02
30142000---01----------------------40--35------------------------0------------03
30142000---01------------------------------------------3----------------------04
30142100---011000000003002000002----------------------------------------------01
30142100---01------------------3--3----3--3--3333----331113---311-------------02
30142100---01----------------------50-----0-----------------------------------03
30142100---013311--66--221111--44--22--00--------------11---------------------04
30142200---011000000017002040004----------------------------------------------01
30142200---01-33333------3-------------------00000000000000000000-------------02
30142200---01--------------------40--30--0-0-2-0--------------0-00------------03
30142200---01------------------------------------------2----------------------04
30142300---011000000017002040004----------------------------------------------01
30142300---01-----------------------3---3333-00000000000000000000-------------02
30142300---01------------------------------------------------------0-0-0-1----03
30142300---01-4-1-2-6-6-2-0-2-2-3-3-4-4-0-0-------------2---------------------04
30142400---011000000008002000002----------------------------------------------01
30142400---01-----------333---------------------------------------------------02
30142400---01----------------------50-----0---5----------------0-0------------03
30142400---01-------------------------------------------1---------------------04
30142500---011000000006002000002----------------------------------------------01
30142500---01--3-3333------------------------3--------------------------------02
30142500---01---1-02-0-1-0-0-----50------1---3------------0---0---------------03
30142500---01-------------------------------------------1---------------------04
30142600---011000000030000040004----------------------------------------------01
30142600---0133-3----------------------------00000000000000000000-------------02
30142600---01----------------35------35---------------------------------------03
30142600---01------------------------------------------4----------------------04
30142700---011000000028000040004----------------------------------------------01
30142700---01----------------33---------3--3300000000000000000000-------------02
```

```
30142700---01-----------------------------------------------------------------03
30142700---01----33--66----------54--11--00-------------4---------------------04
30142800---011000000000702000001----------------------------------------------01
30142800---01------3---------------3--3---------------3-----------------------02
30142800---01-----------------------------------------------------------------03
30142800---01------------------------------------------11---------------------04
30142900---011000000015002000003----------------------------------------------01
30142900---01---3---------3-----3-------3-3-----------------------------------02
30142900---01------------------------------------------------------00--12-----03
30142900---01-4-3---------0-----------------------------3---------------------04
30143000---011000000001002000001----------------------------------------------01
30143000---01------------------------------------------333--------------------02
30143000---01-----------------------------------------------------------------03
30143000---01-------------------------------------------1---------------------04
30143100---011000000014002000003----------------------------------------------01
30143100---01----------------3-3--------3-------------------------------------02
30143100---01------------------------------------------------------0---7------03
30143100---014-1---5---2-0-2---5---0---0----------------2---------------------04
30200301---081000000025000040004----------------------------------------------01
30200301---082111211111111811----------------0000000000-----------------------02
30200301---080222204411--------4040--3535--------01111----00-0----------------03
30200301---08----------------------------------------0-3-0--------------------04
30202801---082003000021000040004----------------------------------------------01
30202801---082211211222222122----------------0000000000-----------------------02
30202801---08---3----------3-----4040----00--00---11------0-------------------03
30202801---08----------------------------------------0-4-0--------------------04
30202802---081000000021000040004----------------------------------------------01
30202802---08--311111211880------------------0000000000-----------------------02
30202802---08-1-2202-22----------35-------------------------------------------03
30202802---08----------------------------------------0-3----------------------04
30203001---082003000035000040004----------------------------------------------01
30203001---089118821112111119----------------0000000000-----------------------02
30203001---080111-2000-----------40403030---------0000----0-------------------03
30203001---08----------------------------------------1-4-3--------------------04
30203901---081000000015002000003----------------------------------------------01
30203901---08511-----22221115----------------0000000000-----------------------02
30203901---08----------------4040404030300000330002222------00----------------03
30203901---08----------------------------------------0-2-0--------------------04
30205101---082003000031000040004----------------------------------------------01
30205101---08-33222221111132-----------------0000000000-----------------------02
30205101---08--------------------404035--------------------0------------------03
30205101---08----------------------------------------0-4-0--------------------04
30205801---082003000020000040004----------------------------------------------01
30205801---08211112222221333-----------------0000000000-----------------------02
30205801---08--------------------4040353500005500-1122--------0000------------03
30205801---08------------------------------------------3-0--------------------04
```

```
30208601---081000000008000040002----------------------------------------------01
30208601---086516656666566156----------------1122222211-----------------------02
30208601---08--------------------4040303033000000-0022------------------------03
30208601---08----------------------------------------0-1-0--------------------04
30208701---083000060035000040004----------------------------------------------01
30208701---08-000111122210811----------------0000000000-----------------------02
30208701---08-2-3-03-0-----------------40------------0----0--0----------------03
30208701---08----------------------------------------1-4-4--------------------04
30209801---082003000021000040004----------------------------------------------01
30209801---082112121222222112----------------0000000000-----------------------02
30209801---08---0----0-----------5050353544553300---------0---0---------------03
30209801---08----------------------------------------0-3-0--------------------04
30210701---082003000036000040004----------------------------------------------01
30210701---089101118888111112----------------0000000000-----------------------02
30210701---08----------------------504040-000-300--122------------------------03
30210701---08----------------------------------------0-3-3--------------------04
30210901---0820030000----------4----------------------------------------------01
30210901---082111122222212112----------------0000000000-----------------------02
30210901---08--------------------4040353500000000-1122------------------------03
30210901---08----------------------------------------0-4-0--------------------04
30211101---082003000023000040004----------------------------------------------01
30211101---0821131111213--112----------------0000000000-----------------------02
30211101---08-2-2203-11----22----4040303000005500-0011----00------------------03
30211101---08----------------------------------------0-4-0--------------------04
30221301---081000000013002000003----------------------------------------------01
30221301---08-3--322222211113----------------0000000000-----------------------02
30221301---08------------------30--403535-344-3000-022-------0----------------03
30221301---08----------------------------------------0-2-0--------------------04
30221601---081000000015002000003----------------------------------------------01
30221601---085112122222222115----------------0000000000-----------------------02
30221601---08----------------404050504040333355000----------00----------------03
30221601---08----------------------------------------0-2-0--------------------04
30299902---083120067827000040004----------------------------------------------01
30299902---0810111111111111001111111111111111000000000000000000000-------------02
30299902---080223302200----4440--5050------------000--------0-----0000--------03
30299902---08--1133----------------------------------104400-------------------04
30300101---082003050034000040004----------------------------------------------01
30300101---08------------3-------------------00000000000000000000-------------02
30300101---08-----------------------------------------------------------------03
30300101---08-----------------------------------------------------------------04
30300301---082123450041500045074----------------------------------------------01
30300301---080000000000000000000000000000000000000000000000000000-------------02
30300301---08-----------------------------------------------------------------03
30300301---08-----------------------------------------------------------------04
30300302---083000067854400040005----------------------------------------------01
30300302---08--0100000004001300001122221114100000000000000000000-------------02
```

```
30300302---08-----------------------------------------------------------------03
30300302---08------------------------------------------5040-------------------04
30300401---082123050041700045074----------------------------------------------01
30300401---0800012822288811000100111111120001000000000000000000000-------------02
30300401---08----------------------50---------0----0---1--------000-----------03
30300401---08----2---4-----------0---0---0-1199--2---103433-------------------04
30300402---082123450039400040074----------------------------------------------01
30300402---08--0202000000000000000-----33330000000000000000000000-------------02
30300402---08-----------------------------------------------------------------03
30300402---08-------------------------------1-3-2----10-5---------------------04
30300611---081000000009002000003----------------------------------------------01
30300611---08-3-----3-333333--3---3-3-33---3----------------------------------02
30300611---08-3--020------0-0------404040-300-153--011-1-3-0----00------------03
30300611---08----11--55------00--54--00--0011----------22---------------------04
30300612---083000067844700040005----------------------------------------------01
30300612---089111112222111119-21223222322212-00000000000000000000-------------02
30300612---08--------------------------------0000-21101133--------------------03
30300612---082211--55------22--------------1---23----006341-------------------04
30300603---083020007845900040075----------------------------------------------01
30300603---08----------------8000881112210004---------------------------------02
30300603---08-----------------------------------------------------------------03
30300603---08-----------------------------------------0---3-------------------04
30300701---082023450060000000075----------------------------------------------01
30300701---08-----------00000000000000000000000000000000000000000-------------02
30300701---08-----------------------------------------------------------------03
30300701---08----------------------------------------00-----------------------04
30300801---082123450044800045075----------------------------------------------01
30300801---080000184004440180000010000041100000000000000000000000-------------02
30300801---08-----------------------------------------2-----------------------03
30300801---08----------------------------------------00--55-------------------04
30300901---083120067818800045074----------------------------------------------01
30300901---0851111111111111151111111111111111000000000000000000000-------------02
30300901---083222211122330000----40403535----0100-0011----00--000000000000----03
30300901---08--11116666----01005555----000011--------003300-------------------04
30301001---083120067835400045074----------------------------------------------01
30301001---08-------3------------------------00000000000000000000-------------02
30301001---08-----------------------------------------------------------------03
30301001---08-----------------------------------------------------------------04
30301101---083120067837200045074----------------------------------------------01
30301101---080001111111111000010111104041101100000000000000000000-------------02
30301101---083-------44-------------------------------11--00------------------03
30301101---08------------------------------1100--22--006635-------------------04
30301401---083120067836400045074----------------------------------------------01
30301401---081101111111111101110111111111110100000000000000000000-------------02
30301401---08333440440411----------------------00---0033330000----------------03
30301401---08------------------------------11--22----105533-------------------04
```

```
30301501---083120067839000045074----------------------------------------------01
30301501---08140131111111113133-111101111011000000000000000000000-------------02
30301501---08322000110400--------------------------1---1--0000----------------03
30301501---08------------------------------11-----2--006653-------------------04
30301601---0810000000040120000025050004400331155----1155000022----------------01
30301601---08--3--3-33333-3---53----55-33-3--33333333-31111133333-------------02
30301601---08-22-1022-1-3114440404040----00--22---22-------0---0---0---3------03
30301601---084411--556-220011--55--00--00--------------1100-------------------04
30301701---083000067850000040005----------------------------------------------01
30301701---08---2222222222-3-000040422221011000000000000000000000-------------02
30301701---08-----------------------------------------------------------------03
30301701---08-----------------------------------------277-3-------------------04
30301801---083120067840900045074----------------------------------------------01
30301801---08041111122211210-110421222212411000000000000000000000-------------02
30301801---08--------0-0--------------------------00--11------0---------------03
30301801---08----2---6---------------------11---22---004533-------------------04
30301802---081000000003002000002----------------------------------------------01
30301802---08------------------55--------5-------------1122111111-------------02
30301802---08-----------------------------------------------------------------03
30301802---084-1---5---0-0-1---4---0---0----------------1-0-------------------04
30301901---082123450052300045075----------------------------------------------01
30301901---08--3---------33--000011122111000000000000000000000000-------------02
30301901---08--------------------4040----44--22---11--------------------------03
30301901---08------------------------------11---------035---------------------04
30302001---082023450025400040074----------------------------------------------01
30302001---081111111111111110011111111111381000000000000000000000-------------02
30302001---08344770550400----3535404030300000-10002211----00000000------------03
30302001---08----------------------------------------002300-------------------04
30302101---082023450051700045075----------------------------------------------01
30302101---080000110111111001000000000000000000000000000000000000-------------02
30302101---08-----0-----------------------------------11----------------------03
30302101---08----------------------------------------005-4--------------------04
30302201---083120067837000045074----------------------------------------------01
30302201---081111111111111111010111111111101100000000000000000000-------------02
30302201---0813333200200000----50--4030300030000002222--330000000000007700----03
30302201---08----33--55------11--44--00--00----------102211-------------------04
30302301---083120067840100045074----------------------------------------------01
30302301---080001110111111001000111110111000000000000000000000000-------------02
30302301---08------------------35----------------0-----------0----------------03
30302301---08----------------------------------------007755-------------------04
30302401---082003450040000040004----------------------------------------------01
30302401---080011111111111111110111111111101100000000000000000000-------------02
30302401---081222210000000000----40---------------00-0----00-0----------------03
30302401---08----------------------------------------104433-------------------04
30302501---082123450018000005074----------------------------------------------01
30302501---08-----------------------------------------------------------------02
```

```
30302501---08-----------------------------------------------------------------03
30302501---08-----------------------------------------------------------------04
30302601---083020067853000045075----------------------------------------------01
30302601---081011101111110001100111111111100100000000000000000000-------------02
30302601---08133330221144-------------------------0-------0000----------------03
30302601---08----------------------------------------106644-------------------04
30302701---082123450035900045074----------------------------------------------01
30302701---081111111111111111101111111111110100000000000000000000-------------02
30302701---08-34330222233----3030----4040----000051111----0000----------------03
30302701---08----------------------------------------107700-------------------04
30302801---083020067847100040075----------------------------------------------01
30302801---080000111111110011010111411111001000000000000000000000-------------02
30302801---083-----------------35----------------0---1---30000----------------03
30302801---08----------------------------------------107755-------------------04
30302901---083120067817800045074----------------------------------------------01
30302901---081101111111111111100111111111111100000000000000000000-------------02
30302901---08111222004422----3535--4040----------0--22----0000-0--00003377----03
30302901---08---------------1--------------11--------003355-------------------04
30303001---082023450039500040074----------------------------------------------01
30303001---081101111111111111101111111111101100000000000000000000-------------02
30303001---08-44220221155---------------------------11----0000----------------03
30303001---08-----------------------------------------05433-------------------04
30303101---083020067830100040004----------------------------------------------01
30303101---081111111111111111111111111111111100000000000000000000-------------02
30303101---0814433044225000--404050503535----010003333----000000000000--------03
30303101---08------5555--------5555------------------003300-------------------04
30303201---082023450043100000075----------------------------------------------01
30303201---080000000000330000000004000040000000000000000000000000-------------02
30303201---08-----------------------------------------------------------------03
30303201---08----------------------------------------00-----------------------04
30303301---082123450030200045074----------------------------------------------01
30303301---081111111111111111111111111111111100000000000000000000-------------02
30303301---08322330111033----303540404040----000002222----0000100000003300----03
30303301---08----2255------000044------------------00004400-------------------04
30303401---083120067845500005075----------------------------------------------01
30303401---080000000000000000000000000000000000000000000000000000-------------02
30303401---08-----------------------------------------------------------------03
30303401---08----------------------------------------00-----------------------04
30303402---083120067825600045074----------------------------------------------01
30303402---08111111911911111-212111111111210100000000000000000000-------------02
30303402---08133--044--------50--40404040--------02222---3--0-000000001-3-----03
30303402---08----3---5-----------5-------------33----203333-------------------04
30303501---082123450049300005075----------------------------------------------01
30303501---08----------------000000000100000000000000000000000000-------------02
30303501---08-----------------------------------------------------------------03
30303501---08-----------------------------------------------------------------04
```

```
30303601---082003450043900040075----------------------------------------------01
30303601---08100011011100100000100111114101100000000000000000000--------------02
30303601---08-----------------------------------------------0-----------------03
30303601---08------------------------------1--5--11--105555-------------------04
30303602---082003000036700040004----------------------------------------------01
30303602---08100111111111111101111111111110000000000000000000000--------------02
30303602---08022220440055000020----40--35--------0--00----00000100-000--------03
30303602---08------5-------1---3-----------11--------104444-------------------04
30303701---081000000013012000003----------------------------------------------01
30303701---08511111111111111551111111111111500000000000000000000--------------02
30303701---0832211022000000003030404035350000000002222----0000000000003300----03
30303701---082---22--44------00--00--00--00----------000000-------------------04
30303801---082023450043000040005----------------------------------------------01
30303801---08110101111110111111111110011110010000000000000000000--------------02
30303801---080333-0442200----3030----------------0-1------0000----------------03
30303801---08------------------------------11--2-2---107655-------------------04
30303901---083023450048100040005----------------------------------------------01
30303901---08000101111110101100011114011010000000000000000000000--------------02
30303901---08------------------------------------0---1------------------------03
30303901---08----------------------------------------007755-------------------04
30303902---083020067841100040074----------------------------------------------01
30303902---083--3310122133--300000122222000000000000000000000000--------------02
30303902---08-3---05---------4040----------------0----11----00----------------03
30303902---08------------------------------1---------105555-------------------04
30304001---083120067843900045075----------------------------------------------01
30304001---08101111011111101110001011110100100000000000000000000--------------02
30304001---08----4100-4-0----5050----------------01--------000----------------03
30304001---08------------------------------11-2------106655-------------------04
30304002---081000000050120000002505000440044116633111133440022----------------01
30304002---08-51555555555515--51555555555515-1111111111111111111--------------02
30304002---08--5--0-2------------40404040330022---11--------------------------03
30304002---084411116655221111--444422000000----------001100-------------------04
30304003---082023450049400000075----------------------------------------------01
30304003---08----------------00000000000000000000000000000000000--------------02
30304003---08-----------------------------------------------------------------03
30304003---08-----------------------------------------------------------------04
30304101---0810000000090120000024040223300----55----0055000033----------------01
30304101---08551555111155515525155511115551521110000111110000111--------------02
30304101---08333330442233----353540403535000022--0--------0000--------8901----03
30304101---081111115555000022--55--00000000----------001100-------------------04
30304201---08100000000101200000140400000--44115522001155000011----------------01
30304201---08665666666666665666656666666665662131111313511111115--------------02
30304201---08----------------------40-----------------------------------------03
30304201---084411--66--1100----44--11--00------------001100-------------------04
30304202---082023450040000040004----------------------------------------------01
30304202---083-333-33333-33-300011111111111000000000000000000000--------------02
```

```
30304202---08-----3112222----30305050----00------0--001---0000----------------03
30304202---08-----------------------------------------044-3-------------------04
30304301---083120067834800045074----------------------------------------------01
30304301---081111111111111111111111111111111100000000000000000000-------------02
30304301---083--220112233--------------40--------02222----0000----------------03
30304301---08--------55----------44----------------00005500-------------------04
30304302---083120000816012000003----------------------------------------------01
30304302---085312111123331115511211222111211500000000000000000000-------------02
30304302---08-2-700002-00----303040401010000000000000011--0000-00000--43------03
30304302---081112224444000021220000000000001100222----01100-------------------04
30304401---083120067846900045075----------------------------------------------01
30304401---081101111111111011111111111111110000000000000000000000-------------02
30304401---084----04444------4040----------------0--00----0000----------------03
30304401---08------55--------------------------------105533-------------------04
30304501---083000067827300040004----------------------------------------------01
30304501---081111111111111111111111121111111000000000000000000000-------------02
30304501---08422220442255----503540403030--55000002222----0000000000003300----03
30304501---08001133-566----0100-444-055-000--------01103300-------------------04
30304601---083020067843900045075----------------------------------------------01
30304601---080000000000000000000100000011000000000000000000000000-------------02
30304601---08-----------------------------------------------------------------03
30304601---08-------------------------------1--------00---5-------------------04
30304801---083120067840800045074----------------------------------------------01
30304801---080401010144144001110114001111111000000000000000000000-------------02
30304801---08-----------------------------------------------------------------03
30304801---08-----------------------------------211--008855-------------------04
30304901---082123450015012000003----------------------------------------------01
30304901---085111111111111815518111111111182500000000000000000000-------------02
30304901---08-33220441233--------40--10100-003-000222211--00000000000---00----03
30304901---08--------5-----------4---0---0------------01133-------------------04
30305001---082123450044800045075----------------------------------------------01
30305001---080001011114101111000411000111000000000000000000000000-------------02
30305001---08------------------40--50--40-----0-00-1-----3---0----------------03
30305001---08----------------------------------------104855-------------------04
30305002---082123450052000045075----------------------------------------------01
30305002---080000010000000000000000000000000000000000000000000000-------------02
30305002---08-----------------------------------------------------------------03
30305002---08----------------------------------------00-----------------------04
30305101---082023450044200040075----------------------------------------------01
30305101---08---33--33----------0-1111111810100000000000000000000-------------02
30305101---08-----044-----------------------------------1---------------------03
30305101---08-------5-----------4---0---0-------------04400-------------------04
30305102---081000000007012000002--40-0-3-0331155----0055000033----------------01
30305102---08--3--32112555150--155511215551--3--00001111110000111-------------02
30305102---08333--022------------4040--4000-000-0-00-0---------0--------------03
30305102---082211--55--000011--44--00--00-------------01100-------------------04
```

```
30305103---082023450031800040074----------------------------------------------01
30305103---0821112222222222112221222222222212200000000000000000000-------------02
30305103---08-----------------------------------------------------------------03
30305103---08------55----------44--00--00------------004400-------------------04
30305104---083000067847000040005----------------------------------------------01
30305104---08-111111111011131001111111111100100000000000000000000-------------02
30305104---08---------------------------------------------00------------------03
30305104---08----------------------------------------106733-------------------04
30305201---082123450047000045075----------------------------------------------01
30305201---08000011101833--3-411111110111100000000000000000000000-------------02
30305201---08--2--0-20-0------------------------------1---0-------------------03
30305201---080-1---5-----------4---0---0---11--2-2----04455-------------------04
30305301---081000000008012000002----------------------------------------------01
30305301---08-3--------33515----333311155515------------3-0000111-------------02
30305301---08----------------------403030-000-000--000---------0--0-0-6-9-----03
30305301---08-3-1-1-6-5-0-0-2-0-4-4-3-0-0-0-----------01100-------------------04
30305401---082123450035300045074----------------------------------------------01
30305401---081181111111118811101011111111100100000000000000000000-------------02
30305401---08-22220551-4-----4040----4040--00--000--01--330000000-00-067-4----03
30305401---08--1---------------4-----------11--2-----103354-------------------04
30305501---0810000000701200000024040001111331155--111155000022----------------01
30305501---08-51553333355515--51555111155515-11133321111110000211-------------02
30305501---08-22220220244--------35352020000033-----------00---0--------------03
30305501---083311116655221011--444422000000----------001100-------------------04
30305502---0810000000400200000024040114400--1155----1155000033----------------01
30305502---08-35663333333-3---35666666656655-11123---331111111111-------------02
30305502---08-22220440000--------404035--000-00-----------00----0-------------03
30305502---083411325544220011--450000000000-----------011-0-------------------04
30305601---083120067855000045075----------------------------------------------01
30305601---080004340400443000000000000000000000000000000000000000-------------02
30305601---08-----------------------------------------------------------------03
30305601---08----------------------------------------00-----------------------04
30305701---082123450052000045075----------------------------------------------01
30305701---081100881111888011000081110111000000000000000000000000-------------02
30305701---08411110221133----3535----3535--00----0--22--330000----------------03
30305701---08------------------------------11-4------104455-------------------04
30305801---082123450042200045074----------------------------------------------01
30305801---08000000000000000000000000110000000000000000000000000-------------02
30305801---08-----------------------------------------------------------------03
30305801---08----------------------------------------10-----------------------04
30305901---082123450048100045075----------------------------------------------01
30305901---08180111100110110011180111111111110000000000000000000-------------02
30305901---08----------------40----40------------0-0--1---000-----------------03
30305901---08------------------------------11------00004554-------------------04
30305902---083120067819812045074----------------------------------------------01
30305902---081111111111111111111111111211111100000000000000000000-------------02
```

```
30305902---08-33331000033----3535404040400000000001111----0000000000007777----03
30305902---08--11125555--------444400000000--------00102200-------------------04
30306001---082123450039200045074----------------------------------------------01
30306001---081111111111111100000111111111108100000000000000000000-------------02
30306001---083-------1000----35--4040------------0222-----000-----------------03
30306001---08----------------------------------------104433-------------------04
30306101---082123450038000040074----------------------------------------------01
30306101---080000000000080108000011111111100000000000000000000000-------------02
30306101---08-----------------------------------------------------------------03
30306101---08----------------------------------------1055---------------------04
30306201---083020067846500040075----------------------------------------------01
30306201---081111111111111111008111111111101100000000000000000000-------------02
30306201---08344440111150----404040404040--------00000----0000----------------03
30306201---08------------------------------1111---2-0106633-------------------04
30306301---081000000003012000002505000220033116622111122440011----------------01
30306301---086656665555566566665665555556656611111111111121111111-------------02
30306301---08--------------------3535----00-----------------------------------03
30306301---084411--66--1110----44--33--00------------001100-------------------04
30306401---081000000001012000001----------------------------------------------01
30306401---08-------------3--665666666666656633333333335555115555-------------02
30306401---08-----------------------------------------------------------------03
30306401---08--11--66--2200----44--22--0000------------1100-------------------04
30306402---081000000000512000001----------------------------------------------01
30306402---08----------------666666666666666633333-33335555555555-------------02
30306402---08-----------------------------------------------------------------03
30306402---08------------------------------------------11---------------------04
30306501---083120067829100040074----------------------------------------------01
30306501---081111111111111111118111111111101100000000000000000000-------------02
30306501---08133331002033----3535----4040--------02222----000000000000--------03
30306501---08----11--55------22--44--00--00--------00104403-------------------04
30306601---082123450019012005074----------------------------------------------01
30306601---081111111111111111111111111111111100000000000000000000-------------02
30306601---08422220112233----3030404035350000300001111----0000000000003300----03
30306601---0833112-5555--------44440000000011------00102200-------------------04
30306701---081000000001012000001----------------------------------------------01
30306701---086666666666666666665666666666656655511125555555333525-------------02
30306701---08-----------------------------------------------------------------03
30306701---08----------------------------------------001100-------------------04
30306801---081000000003012000002404000000033116633000033440011----------------01
30306801---086656665555666566665666555566656611112111111111212111-------------02
30306801---08--------------------4040----33-----------------------------------03
30306801---084411--55--3300----55--00--00------------001100-------------------04
30306901---083120067841100045074----------------------------------------------01
30306901---08----------------010100000001001000000000000000000000-------------02
30306901---08-----------------------------------------------------------------03
30306901---08----------------------------------------008855-------------------04
```

```
30307001---083020000813010000003----------------------------------------------01
30307001---08-----------------------------------------------------------------02
30307001---08-----------------------------------------------------------------03
30307001---08-----------------------------------------------------------------04
30307101---081000000000112000001----------------------------------------------01
30307101---08666666666666666666666666666666663-3333333-33333--3-3-------------02
30307101---08-----------------------------------------------------------------03
30307101---08------------------------------------------11---------------------04
30307201---081000000000712000001----------------------------------------------01
30307201---08-------------3--65656666666663--33333-3-335555525555-------------02
30307201---08-----------------------------------------------------------------03
30307201---08------------------------------------------11---------------------04
30307301---083120067842100045074----------------------------------------------01
30307301---080000000000000011000111111111100000000000000000000000-------------02
30307301---08--------------------------30---0----0---0------------------------03
30307301---08------------------------------11---------05500-------------------04
30307401---083000067813012000003----------------------------------------------01
30307401---085111111111111115518111111111188500000000000000000000-------------02
30307401---08322470442000----2020404030300000330001100----0000000000003311----03
30307401---0800--1---6------1----4---2---0-11--22-----01133-------------------04
30307402---083000060844000040005----------------------------------------------01
30307402---08------3-----3-333------33-------00000000000000000000-------------02
30307402---08-----------------------------------------------------------------03
30307402---08------------------------------------------44---------------------04
30307601---081000000010012000002----------------------------------------------01
30307601---08-515151111555155551515111151515510000008181010000108-------------02
30307601---08-33221000100--------4040353500000000-0000----00--00--00--33------03
30307601---083311226666330000--443322110000----------001100-------------------04
30307701---083120067838300045074----------------------------------------------01
30307701---081111111111111111111111221111111100000000000000000000-------------02
30307701---08322220331144------3540403535--------00000----000100--------------03
30307701---08------------------------------11--222200105533-------------------04
30307801---083120067825000045074----------------------------------------------01
30307801---081811111111111811111111111111111100000000000000000000-------------02
30307801---08-11002002200----404040----400--0----02--2----0000000000003300----03
30307801---08--112265----------44--00--30----------00002200-------------------04
30307901---081000000003012000002505000220044335522001155000011----------------01
30307901---086656665555666566665666555566656611111111111111111111-------------02
30307901---08--------------------40------0------------------------------------03
30307901---084433--66--0000----44--22--00------------001100-------------------04
30308001---081000000003012000002505000340044116622000033550011----------------01
30308001---086656663333636566--3--333333--3--1111333111333333-333-------------02
30308001---08--------------------50------0------------------------------------03
30308001---083311--66--220011--44--12--00------------0-110--------------------04
30308002---083020000835000040004----------------------------------------------01
30308002---08------3--3------33-3333-33333-3300000000000000000000-------------02
```

```
30308002---08---00---0000---------------------------------00-----------3-0----03
30308002---08--------55----------44--00--001100--22----33---------------------04
30308101---081000000004012000002--40-0-2-033335522011155000022----------------01
30308101---08--366633336333----5666555566655-113--333-31111111111-------------02
30308101---08-2222044------------4040----00--00-----------00---0-0------------03
30308101---083333--66--220022--44--11--00-------------011-0-------------------04
30308201---081000000002012000001505022110044336533101155100011----------------01
30308201---086656665555666566665666555566656651111111155111111115-------------02
30308201---08--------------------4040----00-----------------------------------03
30308201---08----------------------------------------001100-------------------04
30308301---081000000001512000001----------44115533000055000011----------------01
30308301---08--3---33-----3--665666666666656633333333335151211515-------------02
30308301---08--------------------3535----00-----------------------------------03
30308301---08----------------------------------------001100-------------------04
30308401---081000000002012000001505011000044115522000055000011----------------01
30308401---086656665555666566665666555566656651211111155111111115-------------02
30308401---08--------------------50------0------------------------------------03
30308401---08----------------------------------------001100-------------------04
30308501---081000000002000000001----------------------------------------------01
30308501---08-----------------------------------------------------------------02
30308501---08-----------------------------------------------------------------03
30308501---08-----------------------------------------------------------------04
30308601---081000000006012000002404022220044116633112233440011----------------01
30308601---086516665555666156651666555566615611111111111111111111-------------02
30308601---08--------------------35353030000000-------------------------------03
30308601---083311116666220011--443333330000----------001100-------------------04
30308701---081000000008012000002353500000044116622111133440011----------------01
30308701---086516665225666156251666111166615211100001111110000111-------------02
30308701---08---44---4400--------3030202000000000---------00------------------03
30308701---082211116655220000--444433000000----------001100-------------------04
30308801---0820200500510000000075----------------------------------------------01
30308801---08--------------------------------00000000000000000000-------------02
30308801---08-----------------------------------------------------------------03
30308801---08-----------------------------------------------------------------04
30308901---0830000008----------4----------------------------------------------01
30308901---08--------------------------------00000000000000000000-------------02
30308901---08-----------------------------------------------------------------03
30308901---08-----------------------------------------------------------------04
30309001---082000050050000040005----------------------------------------------01
30309001---08--3-3-00003-33--000000000000000000000000000000000000-------------02
30309001---08--------------------4040-----------------------------------------03
30309001---08----------------------------------------106----------------------04
30309101---082123450045000045075----------------------------------------------01
30309101---08001001000000000001011111400000000000000000000000000000-------------02
30309101---08--------------------40------0------------------------------------03
30309101---08------------------------------1---------103333-------------------04
```

```
30309201---0821234500037500045074-------------------------------------------------01
30309201---0811001111111111111081111111111120100000000000000000000000--------------02
30309201---08-2244055-----------30----3030--00--000-222----0000-------------------03
30309201---08------------------------------------------104433---------------------04
30309301---0820234500246000040074-------------------------------------------------01
30309301---0833333333-11111111101111111111111100000000000000000000000--------------02
30309301---08-3-330331050----404040404040----------022221-3-000000000000009900----03
30309301---08--11-155-5---------44-400-000-0110022-----044-0----------------------04
30309401---0820204500321000040074-------------------------------------------------01
30309401---08--11122222221122211111222222111010000000000000000000000--------------02
30309401---08---------------------------------------------------------------------03
30309401---08------------------------------------------005500---------------------04
30309402---0830200608350000000074-------------------------------------------------01
30309402---08----------------------------------000000000000000000000--------------02
30309402---08---------------------------------------------------------------------03
30309402---08---------------------------------------------------------------------04
30309501---0821234500160000040004-------------------------------------------------01
30309501---08-1111111111111---------3----------000000000000000000000--------------02
30309501---08-22112001030---------404035--000-330--000-----00--0000---------------03
30309501---08------------------------------------------0-1-0----------------------04
30309502---0830200678416000040074-------------------------------------------------01
30309502---08-3311121332111120081111011111111000000000000000000000000--------------02
30309502---08---------------------------------------------------------------------03
30309502---08-------------------------------------------05533---------------------04
30309503---0810000000003002000002-------------------------------------------------01
30309503---08--3--333--3------------333-33--3--1133-------3-----------------------02
30309503---08-2-2-02---------------40------0----------------0---------------------03
30309503---08-2-3---6---2-0-----4---1---0--------------11-------------------------04
30309701---081000000000301200000240400033003-1-5-0-0-1-4-0-0-11-------------------01
30309701---08--3------------3--66566666666666566333----3331111222111--------------02
30309701---08----------------------4040----00--11---------------------------------03
30309701---083311--55--2200----44--00--00-------------011-0-----------------------04
30309801---0810000000000712000001-------------------------------------------------01
30309801---08------------------66566666666666566-333---3333555115555--------------02
30309801---08---------------------------------------------------------------------03
30309801---083311--55--1100----44--00--00--------------11-------------------------04
```

APPENDIX C

DENTAL TRAITS FROM SOUTHWEST POPULATIONS

For the following data, to be considered a positive manifestation of a trait (pres.), the following standards were used (from Scott 1973):

shoveling I1 (SHOV1)	>2
shoveling I2 (SHOV2)	>2
tuberculum dentale (TD)	>0
hypocone M1 (HYPO1)	<4
hypocone M2 (HYPO2)	<4
metaconule M1 (M1C5)	>0
Carabelli's trait M1 (CARAM1)	>2
cusp number M1 (CNM1)	>4
cusp number M2 (CNM2)	>4
cusp 6 M1 (C6M1)	>1
cusp 6 M2 (C6M2)	>1
cusp 7 M1 (C6M1)	>0
cusp 7 M2 (C7M2)	>0

Population	Trait	Pres.	N	Frequency
Santa Catalina	SHOV1	21.0	61.0	0.34426
	SHOV2	42.0	86.0	0.48837
	TD	25.0	62.0	0.40323
	HYPO1	12.0	173.0	0.06936
	HYPO2	115.0	149.0	0.77181
	M1C5	30.0	113.0	0.26549
	CARAM1	41.0	97.0	0.42268
	GPM1	125.0	142.0	0.88028
	GPM2	21.0	140.0	0.15000
	CNM1	130.0	130.0	1.00000
	CNM2	109.0	109.0	1.00000
	C6M1	32.0	128.0	0.25000
	C6M2	36.0	114.0	0.31579
	C7M1	5.0	128.0	0.03906
	C7M2	0.0	114.0	0.00000
Santa Maria	SHOV1	20.0	43.0	0.46512
	SHOV2	18.0	42.0	0.42857
	TD	25.0	42.0	0.59524
	HYPO1	5.0	51.0	0.09804
	HYPO2	23.0	38.0	0.60526
	M1C5	4.0	34.0	0.11765
	CARAM1	5.0	31.0	0.16129
	GPM1	27.0	31.0	0.87097
	GPM2	11.0	24.0	0.45833
	CNM1	35.0	35.0	1.00000
	CNM2	23.0	23.0	1.00000
	C6M1	10.0	30.0	0.33333
	C6M2	3.0	21.0	0.14286
	C7M1	1.0	31.0	0.03226
	C7M2	0.0	23.0	0.00000

Population	Trait	Pres.	N	Frequency
Papago	SHOV1	144.0	171.0	0.84211
	SHOV2	86.0	168.0	0.51190
	TD	72.0	133.0	0.54135
	HYPO1	8.0	178.0	0.04494
	HYPO2	119.0	147.0	0.80952
	M1C5	28.0	126.0	0.22222
	CARAM1	54.0	160.0	0.33750
	GPM1	83.0	90.0	0.92222
	GPM2	16.0	95.0	0.16842
	CNM1	175.0	175.0	1.00000
	CNM2	98.0	140.0	0.70000
	C6M1	54.0	135.0	0.40000
	C6M2	16.0	129.0	0.12403
	C7M1	53.0	158.0	0.33544
	C7M2	22.0	128.0	0.17188
Navajo	SHOV1	324.0	376.0	0.86170
	SHOV2	232.0	386.0	0.60104
	TD	226.0	324.0	0.69753
	HYPO1	18.0	462.0	0.03896
	HYPO2	223.0	291.0	0.76632
	M1C5	72.0	339.0	0.21239
	CARAM1	122.0	434.0	0.28111
	GPM1	213.0	267.0	0.79775
	GPM2	27.0	185.0	0.14595
	CNM1	404.0	404.0	1.00000
	CNM2	180.0	252.0	0.71429
	C6M1	118.0	362.0	0.32597
	C6M2	36.0	230.0	0.15652
	C7M1	76.0	414.0	0.18357
	C7M2	15.0	279.0	0.05376

Population	Trait	Pres.	N	Frequency
Apache	SHOV1	30.0	31.0	0.96774
	SHOV2	16.0	26.0	0.61538
	TD	14.0	24.0	0.58333
	HYPO1	0.0	43.0	0.00000
	HYPO2	14.0	20.0	0.70000
	M1C5	6.0	39.0	0.15385
	CARAM1	10.0	48.0	0.20833
	GPM1	34.0	41.0	0.82927
	GPM2	3.0	17.0	0.17647
	CNM1	48.0	48.0	1.00000
	CNM2	12.0	19.0	0.63158
	C6M1	19.0	48.0	0.39583
	C6M2	5.0	19.0	0.26316
	C7M1	4.0	49.0	0.08163
	C7M2	0.0	22.0	0.00000
Hopi	SHOV1	206.0	251.0	0.82072
	SHOV2	157.0	271.0	0.57934
	TD	149.0	210.0	0.70952
	HYPO1	4.0	287.0	0.01394
	HYPO2	170.0	232.0	0.73276
	M1C5	34.0	180.0	0.18889
	CARAM1	98.0	279.0	0.35125
	GPM1	87.0	105.0	0.82857
	GPM2	3.0	82.0	0.03659
	CNM1	278.0	280.0	0.99286
	CNM2	148.0	184.0	0.76289
	C6M1	77.0	215.0	0.35814
	C6M2	40.0	166.0	0.24096
	C7M1	68.0	277.0	0.06335
	C7M2	14.0	221.0	0.06335

Population	Trait	Pres.	N	Frequency
Zuni	SHOV1	47.0	57.0	0.82456
	SHOV2	18.0	40.0	0.45000
	TD	30.0	38.0	0.78947
	HYPO1	0.0	44.0	0.00000
	HYPO2	7.0	7.0	1.00000
	M1C5	1.0	34.0	0.02941
	CARAM1	18.0	47.0	0.38298
	GPM1	30.0	40.0	0.75000
	GPM2	0.0	7.0	0.00000
	CNM1	46.0	46.0	1.00000
	CNM2	4.0	7.0	0.57143
	C6M1	16.0	42.0	0.00000
	C6M2	0.0	7.0	0.00000
	C7M1	10.0	45.0	0.22222
	C7M2	0.0	5.0	0.00000
Yuma	SHOV1	61.0	67.0	0.91045
	SHOV2	30.0	61.0	0.49180
	TD	33.0	60.0	0.55000
	HYPO1	0.0	63.0	0.00000
	HYPO2	23.0	26.0	0.88462
	M1C5	7.0	56.0	0.12500
	CARAM1	23.0	63.0	0.36508
	GPM1	50.0	61.0	0.81967
	GPM2	9.0	38.0	0.23684
	CNM1	67.0	68.0	0.98529
	CNM2	17.0	36.0	0.47222
	C6M1	9.0	68.0	0.13235
	C6M2	2.0	36.0	0.05556
	C7M1	12.0	66.0	0.18182
	C7M2	1.0	37.0	0.02703

Population	Trait	Pres.	N	Frequency
Amer White	SHOV1	1.0	94.0	0.01064
	SHOV2	2.0	102.0	0.01961
	TD	68.0	104.0	0.65385
	HYPO1	0.0	108.0	0.00000
	HYPO2	59.0	104.0	0.56731
	M1C5	9.0	71.0	0.12676
	CARAM1	70.0	111.0	0.63063
	GPM1	9.0	11.0	0.81818
	GPM2	2.0	19.0	0.10526
	CNM1	91.0	95.0	0.95789
	CNM2	18.0	101.0	0.17822
	C6M1	0.0	67.0	0.00000
	C6M2	2.0	102.0	0.01961
	C7M1	21.0	92.0	0.22826
	C7M2	22.0	86.0	0.25581