DEMOGRAPHIC INVESTIGATION OF A PISCATAWAY CREEK OSSUARY

by
Rebecca Anne Huss Ashmore

Thesis submitted to the Faculty of the Graduate School
of the University of Maryland in partial fulfillment
of the requirements for the degree of
Master of Arts
1974

APPROVAL SHEET

Title of Thesis: Demographic Investigation of a Piscataway Creek Ossuary

Name of Candidate: Rebecca Anne Huss Ashmore
Master of Arts, 1974

Thesis and Abstract Approved: Ellis R. Kerley
Dr. Ellis R. Kerley
Professor
Department of Anthropology

Date Approved: JUL 27 1974

ABSTRACT

Title of Thesis: Demographic Investigation of a Piscataway Creek Ossuary

Rebecca Anne Huss Ashmore, Master of Arts, 1974

Thesis directed by: Professor Ellis R. Kerley

Skeletal material from an ossuary on Piscataway Creek was analyzed to determine the minimum number of individuals present, and their sex, stature, developmental life stage, and age at death. Cultural debris indicated a date of about 1400-1500 A.D. for the burial. At least 281 individuals were recovered, based on a count of right femora and temporal petrous portions. Although no sex determination was possible for the 68 juveniles, age at death for this group ranged from 7 foetal months to 18 years. For the 213 adults, sex was evenly divided for the population, and mean stature was fixed at 172.86 cm. for males and 160.61 cm. for females. 107 adults died during young adulthood; 81 died during middle age; and 16 died during old age. A sample of each life stage was tested microscopically to determine age at death. Young adults in the sample averaged 45.99 years; middle-aged adults averaged 56.19 years; and old adults averaged 65.71 years. Average age at death for the entire population was 39.33 years.

ACKNOWLEDGMENT

I would like to thank the members of my graduate committee for their time and interest in this project. In particular, I am grateful to Dr. Melburn Thurman for choosing me as his Field Assistant during the excavation of this ossuary, and for making the skeletal material available to me for analysis. Without his attention and encouragement, the work could not have been completed. I am also grateful to Dr. Ellis Kerley for providing me with the laboratory facilities and methodology necessary for the investigation, and for taking over the chairmanship of the committee when Dr. Thurman left. Recognition is also due Stuart Greenberg, whose resorting of cranial material helped me to revise my counts of petrous portions. Several unnamed students also participated in reconstructing a portion of the femoral material, and have my appreciation. Finally, I am grateful to Dr. J. Lawrence Angel for granting me the use of the microscope with which age determinations were made.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

THE PROBLEM AND DESIGN OF THE STUDY

Importance of Ossuary Studies.

This study of a Piscataway Creek ossuary dating from perhaps 1400-1500 A.D., is presented as a contribution to the understanding of the prehistoric demography of the lower Potomac River area. The skeletal population of the ossuary was analyzed by osteometric and micro-osteological techniques. Such regional studies can provide information which may be useful in reconstructing the North American population for that period.

Widely varying estimates have been made for the aboriginal population of North America (Ubelaker, 1973). Analysis of Indian burial patterns can provide information for intelligent revision of these estimates. If skeletal material can be recovered for the entire population of an area, sex and age at death can be determined. If the time span covered by the burials is known, death rates and survivorship curves can be constructed, and the living population projected. The percentage of the population represented by the Potomac River ossuaries is not presently known, and the time span that they cover is still unresolved. Nevertheless, the relatively large number of individuals commonly present in an ossuary burial makes data on their sex and age at death valuable for future adjustment of population figures. In the framework of a systemic investigation of area-wide settlement patterns, such figures can considerably enhance understanding of cultural process.

Ethnographic Considerations.

The nature of the social system among the aboriginal people on the lower Potomac River is not well understood. From ethnohistorical accounts, it appears to have been a series of small chiefdoms, in Service's (1962) sense. Large central villages are implied to be the residences of "werowances", "kings", or "emperours", with smaller outlying villages subservient to them (Anonymous, 1635; Hall,1910:41). Social integration for these villages appears to have been supplied by an annual ceremony in which they all participated (Hall, 1910:45). It is possible that this took the form of a "green corn" or "first fruits" ceremony (Anonymous, 1635). There is very little archaeological information to confirm or deny this hypothesis. Only isolated ossuaries and a few large villages, such as Patawomeke and the purported Moyaone site, have been excavated. The small outlying villages have not been excavated, nor have other types of burial sites which can be dated to the same period of time as the ossuaries. If they exist, they have not yet been located.

Almost nothing is known ethnographically of the burial practices of the Piscataway Indians, but some material is available for neighboring groups. The great degree of cultural homogeneity for Algonkian groups along the Atlantic coast, from North Carolina to southern New York, makes this material of interest. Information for the Indians of Virginia was supplied by Smith in 1612. The bodies of the leaders were reported to have been disembowelled and dried, then decorated, filled with beads, and wrapped in skins and mats. The wrapped body was then placed in a charnel house, where it was apparently kept indefinitely, attended by priests. For ordinary burials, a hole was dug, in which the wrapped corpse was placed upon a layer of sticks (Tyler, 1907:109). It is not clear from Smith's description whether these burials were individual or multiple, but the term "corpses" implies primary burial, without prior exposure or defleshing of the body. It is also possible, although Smith did not observe it, that after a given period of time, the remains of the leaders were removed from the charnel house and redeposited permanently elsewhere.

Information for the Nanticoke of the Eastern Shore of Maryland indicates that the dead were placed on shelves in a "Chiacason House" or charnel house, the skeleton scraped to deflesh it, and the bones later collected and communally buried (Weslager, 1948; Davidson, 1935). Marye notes that leaders may have been differently treated. He cites a letter from Dr. William Vans Murray to Thomas Jefferson dater September 18, 1792, in which Dr. Murray mentions the body of the last Nanticoke king being preserved in a "Quacasum-house" for 70 years. In the same article, Marye notes that in August, 1678, Nicotagsen, Emperor of Piscattaway, excused the absence of several of his chiefs from Lord Baltimore's Council by saying that they were gathering together their dead bones. Marye concludes that this is a reference to a Piscataway burial practice (Marye, 1936).

Ossuary burial is best documented for the Huron. Detailed descriptions of this practice are provided in the ethnographic records, and these indicate secondary ossuary burial for the entire population, It has therefore been argued by analogy that the Potomac River ossuaries represent the entire population of the area for a given period of time (Ubelaker, 1973). Thurman (personal communication), however, has cautioned against acceptance of this view without further evidence. The state of Huron social organization is not wholly understood, and there is still confusion as to the nature of clans and tribes for this group (Trigger, 1969). It is known that burial among the Huron was tribally organized, with several villages contributing periodically to an ossuary burial. In the absence of systemic studies of the Potomac region, it would be incautious to assume identity. Binford (1967) has argued for the use of ethnographic analogy to generate deductively testable hypotheses. According to this view, the completeness of the population in the Potomac ossuaries can only be tested by a systemic survey of the settlement and burial throughout this area. In this way, the model of social organization proposed for the population served by the ossuaries may be archaeologically confirmed. Thurman notes (personal communication) that no survey of this scope has been undertaken until the present, and that other burial types cannot be assumed nonexistant because they have not yet been found.

Local Ossuaries.

There are important differences in the sizes and shapes of the Potomac River ossuaries presently excavated, with those of the Port Tobacco River, for example, being consistently smaller than those from the area of Piscataway Creek. Graham described the ossuaries along the Port Tobacco River as being roughly oval in shape, and very shallow, the deepest being only 2.7 feet deep. Four of these were excavated by Graham and T. Dale Stewart, and contained 10, 25, 50, and 100 individuals, respectively. The fifth had been extensively looted at the time of discovery, and no estimate could be made of its contents (Graham, 1935). In 1937, two more such small ossuaries, containing 63-70 persons each, were excavated in Anacostia by T. Dale Stewart and Waldo R. Wedel (Ubelaker, 1973).

By contrast, the ossuaries discovered by Alice L. Ferguson at the site she called Moyaone contained 288, 288

248, and 618 skulls, respectively, deposited in pits (Ferguson, 1937; Stephenson and Ferguson, 1963). Ferguson and Stewart (1940) reported that 254 individuals were recovered by Ferguson from an ossuary south of Piscataway Creek, on a parcel of land owned by John Claggett. This ossuary was trench-shaped, 16 feet long and 20 feet wide, and only 3 1/2 feet deep. Unfortunately, the method of excavation did not permit a complete analysis of the skeletal material. The exact location of this ossuary was not reported, and local residents presently disagree as to the site. It is not possible, therefore, to define the relationship between this ossuary and the Piscataway ossuary, apparently from the same parcel of land, which is the subject of this report.

The only Potomac River ossuaries for which systematic data are available are those excavated by T. Dale Stewart and Douglas Ubelaker between 1953 and 1972. These were the two Juhle ossuaries on Nanjemoy Creek. They were shallow, ovoid pits containing 131 and 188 individuals (Ubelaker, 1973). Determinations were made of sex and age at death for the population, and death rates and survivorship curves constructed. From these, an attempt was made to reconstruct the population of the area served by the ossuaries. This represents the first such attempt to systematically utilize potential ossuary data. When complete, the analysis of the Piscataway ossuary will supplement their data.

The obvious differences in size and shape of these ossuaries cannot simply be discounted. Again the lack of systemic archaeology makes cultural interpretation risky. There is no evidence of correlation of these ossuaries with other types of sites, such as villages, and no evidence of the type of social group they represent. The Port Tobacco ossuaries are small and shallow; those at Nanjemoy are shallow and of medium size. The Moyaone and Piscataway ossuaries are all large (over 200 people), and in general, pit-shaped rather than trench-shaped. Future comprehensive studies of settlement patterns may clarify the significance of these associations.

Design of Present Study.

The skeletal material from an ossuary on Piscataway Creek was subjected to a preliminary sorting, and selected portions analyzed to determine minimum number of individuals, sex, stature, life stage, and age at death. Since methods of age determination useful for juveniles do not apply to adults, and adult sex determinations are not valid for juveniles, the two groups were analyzed separately. The femur was chosen for analysis because of its durability and high rate of recovery. In addition, the large number of studies which have been conducted on the femur provide a wealth of comparative data not available for other individual bones.

Population counts for juveniles and adults were based on an inspection of both whole femora and femoral fragments. Since, for juveniles, proximal portions of right femora were most numerous, these provided the basis for subadult population figures. Right femora were also used for adults, with axial portions being most numerous. Counts of adults and subadults were combined to yield a minimal number of individuals for the entire population, and this figure was checked against a count of temporal petrous portions, one of the most durable sections of the skull. While several methods have been suggested for determining sex in juvenile skeletal material, none was considered sufficiently accurate to be employed in this study. Adult sex determinations were based on measurement of the maximum diameter of the femoral head, a method employed by Pearson (1917-1919).

As formulas do not presently exist for the reconstruction of stature from fragmentary juvenile long bones, only adult stature was computed. Maximum lengths of adult femora were computed from lengths of fragments, according to Steele's (1970) regression for whites, and Steele and McKern's (1969) regression for Indians. Stature was then estimated according to the formulas of Trotter and Gleser (1952) for whites and Genoves (1967) for Mesoamericans, a composite Mexican-Indian group. Mean femoral length and mean stature were computed for males and females.

Although age determinations for juveniles are fairly readily obtainable, adult age estimation has only recently become feasible. In this study, juvenile ages were obtained by measuring femora without epiphyses, and comparing maximum lengths with Stewart's (1968) data on femoral length vs. age. For those juvenile femora with one or more attached epiphyses, age was estimated from the stage of epiphyseal union (Krogman, 1962). Adult material was treated in two essentially different ways. The work of Kerley (1965) made it possible to accurately determine adult age from the degree of internal remodeling of the bone of the leg, while his observations on gross resorption patterns (1969) provide a rapid means of identifying the life stage of an adult. The resorptive pattern of each adult right femur was consequently examined to determine life stage. A sample of 12 specimens was selected from each of the life stages, for the purpose of exact age determination using Ahlqvist and Damsten's (1969) modification of Kerley's (1965) method. Age and life stage were compared and inferences drawn on the aging process in primitive and modern populations. Finally, age-at-death profiles were constructed for the entire ossuary population, based on the combined age profiles of juveniles and adults.

CHAPTER II

DESCRIPTION OF THE OSSUARY

Excavation.

In 1970, the University of Maryland began excavation of an ossuary discovered on the John Claggett farm. This parcel of land is located on Piscataway Creek, a tributary of the Potomac River in southern Prince Georges County, Maryland. Approximately half the ossuary was excavated during the first year, under the direction of a student supervisor. During this initial phase of excavation, a trench was dug completely surrounding the bone mass, unfortunately removing the possibility of establishing assosciations between bone levels and soil profiles. Few useable records remain from this phase of the work, so that proveniance of the bone material recovered is unknown. At the close of the field season, a preliminary sorting of the remains was begun under the direction of Douglas Clymer.

In 1971, the excavation was taken over by Melburn Thurman, director of the University of Maryland Archaeological Field School. Under Thurman's direction, the lower half of the ossuary was excavated by arbitrary levels, with level elevations recorded by transit. The bone mass was divided into quadrants, and the bones numbered in sequence within each quadrant and level. Quadrants were numbered clockwise from the northwest corner: northwest - 100; northeast - 200; southeast - 300; southwest - 400. Thus a bone numbered A 100 would be the first bone labelled in the northwest quadrant of level A. Polaroid photographs were taken of each quadrant at each level, to record the position of the numbered bones in relation to each other. Small bones which were initially found on the floor of the trench were labelled FD - floor debris. Fragments without numbers assigned to them were labelled with the initials of the level and quadrant from which they came (e.g., H NW - H level, Northwest quadrant). When all skeletal and cultural material had been removed, the pit was refilled. A modern house presently occupies the site.

Contents of the Ossuary.

Skeletal material recovered represented a minimum of 281 individuals as determined from a count of femoral fragments and temporal petrous portions. Except for two partially articulated skeletons, all were evidently secondary burials, defleshed elsewhere, probably by exposure. The disarticulated bones were almost certainly deposited as bundles of bone. Although no evidence of hides or fabric was found, it is evident from the association of many bones that they were deposited in containers. In the lower half of the ossuary, major long bones were frequently found together, with a skull apparently associated. Phalanges were occasionally found inside the skull vault. At least two pockets of cremated bone were found in the lower half of the ossuary. These were also secondary deposits, as the surrounding bone was not scorched.

Cultural materials were few, consisting of small shell and copper beads, evidently worn at the time of death, two slightly larger copper ornaments, and four bone awls which may have been associated with one of the partially articulated skeletons. The small ring-shaped shell beads and copper tubular beads were found within skulls and scattered throughout the mass of bone with no significant concentration in any one place. The flat copper ornaments were likewise lacking in association. The only cultural differentiation noted was the apparent association of the bone awls with one individual. This lack of status differentiation within the ossuary lends support to the idea that high status persons were differently treated and have yet to be recovered.

The dating of the ossuary is problematical. It is either a very late prehistoric or early protohistoric site. A few sherds of Potomac Creek pottery were found in the ossuary. This type of pottery is known from sites with European trade goods and sites where no trade goods have been found. There is no evidence of European contact, with the possible exception of the copper artifacts. Witthoft (personal communication to Thurman) is of the opinion that they are brass and date to perhaps 1550 A.D. If this is proven to be correct, it places the ossuary in a protohistoric or historic context, in that brass was unknown in prehistoric North America. Chemical analysis is being undertaken to resolve this problem. A seriation of the Potomac River ossuaries is presently in progress (Thurman, manuscript), and when complete, may resolve these questions of chronology.

CHAPTER III

ANALYSIS OF JUVENILE MATERIAL

Analysis of the juvenile portion of the ossuary population was based on a study of right and left femora. The relative durability of the femur makes it one of the bones most likely to be recovered and recognized, even for very small foetal specimens. Further, reliable age estimations can be made from the length of the immature femur minus epiphyses. For the purpose of this study, juvenile specimens were defined as all those femora for which epiphyseal union was not yet complete. An attempt was made to determine the minimum number of subadult individuals in the ossuary population. Methods for determining sex and age at death were reviewed and, where appropriate, chosen for application.

Number of Individuals.

The minimum number of juvenile individuals represented in the ossuary was 68, based on an analysis of the 216 immature femora and femoral fragments recovered. Of the 115 right specimens, 16 were complete or could be completely reconstructed; and of the 101 lefts, only 10 were complete. To avoid redundancy in attempting a population count, therefore, only bones with recognizably distinct proximal articular portions were considered. Proximal portions were selected for analysis because they outnumbered both axial and distal fragments. The data in Table I show that right proximals had the highest occurrance of any category of bone segments, outnumbering both left proximals and right and left distals. This was true whether the axial and distal portions occurred separately or as part of a more complete bone. These data indicate a minimal juvenile population of 68. Attempts to confirm this figure from a count of subadult temporal bones were largely unsuccessful, since the small size of petrous portions in infant specimens was the only reliable indicator of immaturity.

Sex.

No determination of sex was attempted for the juvenile material in this study. Those features of the immature skeleton which have been suggested as sex indicators include measurements of the pelvis, age of tooth eruption, and rate of development of the bony skeleton. It is generally agreed, however, that none of these methods provides sufficient accuracy for determining sex in the individual case. This is particularly true in an ossuary situation, where the skeletal remains frequently exist not as whole skeletons but as isolated bones or even fragments of bone. Any overall impression of size or robusticity versus age is therefore

TABLE I

SEGMENTS OF JUVENILE FEMUR

SEGMENT	RIGHT	LEFT
Proximal	68	43
Complete Axial	20	15
Distal	52	55
Complete Femora	16	10

lacking. A number of studies have attempted to assosciate sex with differential measurements of the immature pelvis (Reynolds, 1945, 1947; Boucher, 1955, 1957), but none has achieved results sufficiently accurate for prediction. Despite Boucher's report of significant sex differences in the foetal sciatic notch for British whites and American Negroes, her results for American whites were non-significant. This implies that racial and ethnic factors may have to be considered, and mediates against the use of her data for a Mongoloid population. A generally more useful approach was reported by Hunt and Gleiser (1955). They noted that sex differences in dental maturation are much less pronounced than those of the bony skeleton. Using these differential maturation rates, they were able to predict sex for 73% of a sample of 2-year-olds. Accuracy increased to 76% at 5 years, and 81% at 8 years. Unfortunately, application of this method requires that dentition and developing centers of ossification (particularly those of the hand and wrist) be supplied for each individual. Since these conditions were impossible to reproduce in the ossuary sample, and other methods appeared inaccurate or inapplicable, sex determination was not attempted.

Age at Death.

Determination of age of an individual at death is accomplished by comparison of age-related skeletal factors with those in a population of known age. Factors which have commonly been used for immature individuals include patterns of dental eruption, appearance and fusion of secondary ossification centers, and the relationship between age and length of long bones.

When a complete skeleton is available, highly accurate age determinations can be made from the appearance and ossification of secondary ossification centers such as those in the hand and wrist (Greulich and Pyle, 1959), and from the degree of ossification and fusion of the epiphyses of the long bones. Studies of patterns of dental eruption have also provided a basis for accurate age determination, providing both mandibular and maxillary dentition are present and reasonably intact. Separation and fragmentation of either portion noticeably reduces accuracy, as does postmortem tooth loss. The dissociation and fragmentation of ossuary remains has been noted before, and its bearing on age determination is considerable. Small bones, such as those of the wrist, are easily lost or broken, either prior to interment or during exhumation. Loose epiphyses are often not recovered for the same reasons, and even when found and recognized, often cannot definitely be associated with a specific bone. The almost total lack of complete, articulated mandibles in the Piscataway ossuary, and the extreme degree of apparent tooth loss rendered these methods impracticable for this study.

A number of attempts have been made to correlate juvenile long-bone length with age. Most of these have been cross-sectional studies, involving the use of radiographic techniques on living populations (Anderson and Green, 1948; Maresh, 1955; Anderson, Messner, and Green, 1964). While such studies have provided valuable data on the growth rates of modern populations, it is not certain that these data can be generalized to apply to prehistoric groups, whose developmental rates might well have been relatively accelerated or retarded (Krogman,1962). A second, minor difficulty is the very slight discrepancy between the measurement of the original specimen and that of its slightly enlarged image on a roentgenogram. Of greater importance to the archaeologist, however, is the fact that such measurements recorded the maximum length of the entire bone, including epiphyses and cartilaginous growth plates, segments which are almost certain to be missing in an archaeological situation.

For determination of age from long bones without epiphyses, Johnston's (1962) study of subadult material from Indian Knoll, Kentucky, provides data on specimens from birth to 5.5 years. Stewart (1968) published comprehensive data on specimens of Eskimo and white femora from birth to 18 years, correlating maximum length of the bone (minus epiphyses) with age as determined from dental examination. The resulting regression lines represent the only such data available for a native American population in the age range of birth to 18 years. However, since the average length of adult femora in the ossuary closely approximates that of Anglo-Americans (Chapter IV) the Eskimo data are not applicable for individuals in the older adolescent range. The longest specimen measured had a maximum length of 396 mm., clearly above the maximum for Eskimo femora, and very close to the average for whites at age 17 (Stewart, 1968:153). Since the actual rate of growth for the ossuary population was not known, ages assigned were stated as a range, rather than as a single year. For example, a white femur measuring 240 mm. would be assigned an age of 7 years, whereas an Eskimo femur of that length would be assigned an age of 8 years. In this study, a femur 240 mm. long was assigned an age of 7-8 years.

All juvenile femora with recognizably distinct proximal articular portions (and without epiphyses) were measured on an osteometric board, and maximum length recorded. Imcomplete specimens were compared to complete bones of similar size and developmental stage, in order to derive an estimated maximum length. The resulting measurements are recorded for each specimen in Appendix I. An age estimation was made for each specimen as discussed above, based on Stewart's (1968) data. For foetal specimens, Stewart's (1968) data correlating femoral length with foetal age were utilized.

In four cases, one or more epiphyses were present and had begun fusion. Since maximum length could not be used for these specimens, age was determined from the degree of epiphyseal union. Krogman (1962) gives a variety of ages for the onset of fusion of the femoral epiphyses. This process may begin as early as 13-14 years, and is reported to be complete for white males by 22 years of age (McKern and Stewart, 1957). All specimens considered here showed recent fusion for the proximal epiphyses only, with distal epiphyses completely separate. While estimates of the age of fusion of the distal epiphyses vary widely among authorities, there appears to be agreement that it has begun by 18 years of age in most cases (McKern and Stewart, 1957; Krogman, 1962). These specimens were therefore assigned a tentative age range of 15-18 years.

Table II shows the number of individuals in each of the assigned age ranges. Based on right femora, deaths in the first 5 years numbered at least 22, or 32% of the total juvenile population. More than half of these specimens were newborn or in the last 3 months of foetal life. Deaths at ages 5-10 years totalled 18, or 26.5% of juveniles recovered. Most of these deaths appear to have occurred around age 7. Twenty specimens or 29.5% were recovered from ages 10-15, with the number of deaths being slightly greater at the lower end of the age range. The final 12% were specimens from 15 years of age to adulthood. A listing of ages for left femora is included for comparison.

TABLE II

JUVENILE AGE FROM FEMORA

AGE	NUMBER OF SPECIMENS RIGHT	LEFT
Foetal	7	3
Newborn	5	3
Birth-1	1	3
1-2	2	0
2-3	1	0
3-4	0	2
4-5	6	1
5-6	3	3
6-7	7	0
7-8	5	6
8-9	1	1
9-10	2	3
10-11	7	3
11-12	4	2
12-13	5	2
13-14	3	5
14-15	1	2
15-18	8	4
Total:	68	43

CHAPTER IV

ADULT ANALYSIS: NUMBER, SEX, AND STATURE

Demography of the adult population was based on analysis of all mature right femora. It has become axiomatic that the femur is one of the most thoroughly studied bones of the body. Its large size and dense cortex make it one of the bones most likely to be recovered from an ossuary intact. Ubelaker (1973) found femoral representation in the Juhle ossuaries to be 99% and 86% respectively, in a situation where bone preservation was good. In the Piscataway ossuary, however, bone preservation was not good, especially in the lowest layers. Cranial material was notably distorted throughout, and in all but a few cases, badly fragmented. Pelves were likewise broken, scattered, and eroded, with few innominates recovered intact. The relatively good preservation of the femur, therefore, made it the best source of data for population counts, as well as for estimation of sex, stature and age at death. Right femora were chosen for analysis because a greater number of right than left specimens could be significantly reconstructed.

Number of Individuals.

The minimal number of adult individuals in the ossuary was 213, determined from counts of three segments of the right femur. The segments used were: (1) the entire proximal end, to include the lesser trochanter; (2) the shaft including a clearly identifiable linea aspera and nutrient foramen, or the equivalent of Steele's (1970) Segment 2; and (3) the distal end, including medial and lateral condyles, and the popliteal surface, when present. All occurrences of each segment were counted, whether the segment occurred as an isolated fragment or as part of a complete bone. Proximal segments numbered 111, shafts numbered 213, and distal segments numbered 98. The minimal adult population was therefore fixed at 213 individuals.

Sex.

Traditional methods of determining sex from adult skeletal material include morphological and anthropometric assessments of the skull, the pelvis, and the long bones. Given a complete skeleton, an experienced investigator can assign sex accurately in almost all cases. A lack of one or more of these skeletal parts reduces the ease and accuracy of assessment.

Krogman (1962) has summarized the morphological traits of interest in sexing the skull. These reflect, in general, the greater massiveness of the male skull with its more rugged muscle attachments and more prominent supra-orbital ridges. The general shape of the skull is also of interest, with the female skull more round and the forehead fuller and more infantile. From such distinctions, about 90% accuracy is possible, but since this method requires crania which are relatively complete and undistorted, it was not appropriate for the ossuary material.

A similar problem was encountered with pelvic material. While Washburn (1948) was able to determine sex in 95% of his cases using the ischium-pubic index and the width of the sciatic notch, his accuracy was only 75% using the sciatic notch alone. In the ossuary sample, few innominates were complete enough to permit both measurements to be taken, and in many instances, the ilium was broken just at the point of the sciatic notch. It was felt, therefore, that the pelvis could not be used for sexing a large enough sample of the population.

Data available for the sexing of long bones include measurements of the length and of width or diameter of the articular ends. Of these, the measurements of the head of the femur and the humerus are most widely used. While Krogman (1962) reports only 80% accuracy for sexing from long bones alone, the greater number of these renders them the most useful for this population. Average vertical diameter of the femoral head for males and females has been reported by several investigators (Dwight, 1904-1905; Parsons, 1913-1914; Maltby, 1917-1918), with the general conclusion that those under 43 mm. are female and those over 46 mm.

are male. Probably the most widely quoted and most useful data on the femoral head are those of Pearson (1917-1919), who presented his measurements in terms of ranges. Femoral heads whose greatest vertical diameter was less than 41.5 mm. were definitely female, those measuring 41.5-43.5 mm., probably female. Those in the range of 43.5-44.5 mm. could be of either sex, while those measuring 44.5-45.5 were probably male, and those over 45.5 mm., definitely male.

The application of these ranges to the 110 right femoral heads recovered from the ossuary resulted in the following sex distribution: females=29; probable females=20; ambiguous=12; probable males=9; definite males=40. This is a remarkably even distribution, with total males and total females each numbering 49. Sex is thus accounted for in 89% of the sample, with the remaining 11% being ambiguous. Since fewer femoral heads were recovered than complete axial portions, sex determination is not available for the entire adult population. However, there is no evidence to suggest that the present sample is other than random, and no reason to assume the results biased. In the absence of ethnographic or archaeological evidence to the contrary, an even division between males and females is assumed for the population.

Stature.

The reconstruction of living stature from skeletal material is important in the identification of both individuals and prehistoric populations. Attempts have long been made to correlate the lengths of long bones with total stature (Krogman, 1962:153-6). Since bodily proportions differ among races, specific regressions have been developed for individual racial groups.

For modern American males, the data gathered by Trotter and Gleser (1958) are the most accurate. They report stature reconstruction regressions for whites, Negroes, Mongoloids, and Mexicans, based on casualties from the Korean War. Since no females were included in this sample, reconstruction of white and Negro female stature is probably best accomplished by the earlier formulas of Trotter and Gleser (1952).

Statural reconstruction for American Indians has been largely of interest to archaeologists. There is an appreciable difficulty in establishing regressions from modern populations which can be applied to prehistoric ones. Genoves (1967) developed formulas for the proportionality of long bones and their relation to stature in a population of lower-class Mexicans. He hypothesized that this population was likely to be more "Indian" in composition than one from higher classes of Mexican society, and that the results would be more applicable to Mesoamerican archaeological populations. His figures would appear initially to be the most applicable to North American Indians as well, in that Trotter and Gleser's (1958) Mongoloid sample included Japanese, Hawaiians, and American Indians. However, the mean stature reported by Genoves for his sample was 161.50 cm. for males and 149.80 cm. for females, figures which appear to be far too short for Indians of the eastern woodlands of North America. Graham (1935:35) noted that the individuals in his ossuaries were tall and long-headed, ". . . of height and physical development quite comparable with the white race of today." The proportionality of long bones, as well as total length,may also have differed from the the short-legged, long-bodied Mesoamerican type.

In consideration of these problems, it was initially decided to reconstruct stature for the Piscataway ossuary on the basis of data for American whites. Only complete femora of known sex were used for these initial computations. Trotter and Gleser's (1952) formulas were used, since they provided regressions for males and females. Table III presents maximum length and proposed stature for these complete femora.

For fragmentary femora to be of use in stature estimation, the maximum length of the bone must first be projected. The work of Steele and McKern (1969; Steele, 1970) is valuable in this regard. By measuring four defined segments of the bone and establishing the proportion of the total length in each, regressions were developed to predict total length from the length of each segment. The fragmentary ossuary femora of known sex were measured for

TABLE III

FEMUR LENGTH AND STATURE FROM COMPLETE BONES

MALE

Bone Number	Maximum Length (cm)		Stature (cm)
199	48.6		177.08 ± 3.27
204	43.6		165.18 ± 3.27
219	50.38		181.31 ± 3.27
255	47.2		173.75 ± 3.27
274	47.65		174.82 ± 3.27
277	46.9		173.03 ± 3.27
323	47.8		175.17 ± 3.27
328	46.5		172.08 ± 3.27
363	47.7		174.94 ± 3.27
A 208	47.5		174.46 ± 3.27
C 119	46.7		172.56 ± 3.27
F 100	45.5		169.70 ± 3.27
F 200	45.3		169.22 ± 3.27
F 269	49.1		178.27 ± 3.27
H 203	46.9		173.03 ± 3.27
I 109 & J 252	44.2		166.61 ± 3.27
H 121 & J 107	47.8		175.17 ± 3.27
J 278 & J NE	46.6		172.32 ± 3.27
L 401	44.6		167.56 ± 3.27
M 236	44.8		168.03 ± 3.27
M 352	45.5		169.70 ± 3.27
FD & 228	49.4		178.98 ± 3.27
Mean Length	46.83	Mean Stature	172.86 ± 3.27

TABLE III

FEMUR LENGTH AND STATURE FROM COMPLETE BONES

FEMALE

Bone Number	Maximum Length (cm)		Stature (cm)
213	43.3		161.05 ± 3.72
216	41.1		155.62 ± 3.72
229	47.75		172.04 ± 3.72
249	41.5		156.60 ± 3.72
276	43.6		161.79 ± 3.72
286	43.7		162.04 ± 3.72
350	44.1		163.03 ± 3.72
378	43.9		162.53 ± 3.72
C 187 & A 101	41.4		156.36 ± 3.72
C 272	39.1		150.68 ± 3.72
G 209 & H 210-1	41.6		156.85 ± 3.72
J 113 & J NW	44.1		163.03 ± 3.72
K 267	42.7		159.57 ± 3.72
K 336	44.9		165.00 ± 3.72
M 124	44.0		162.78 ± 3.72
Mean Length	43.12	Mean Stature	160.61 ± 3.72

the present study, to establish length of available segments. Maximum length was then projected according to the formulas for whites and American Indians. The estimated maximum lengths were used to reconstruct stature.

Statural reconstruction for fragmentary femora was accomplished by several methods. The maximum lengths projected by Steele's (1970) regressions for white males and females were substituted in Trotter and Gleser's (1952) formulas for white males and females. These formulas were, for males: 2.38Fem + 61.41 $\pm$ 3.27; and for females: 2.47Fem + 54.10 $\pm$ 3.72. Maximum femur lengths computed from Steele and McKern's (1969) formulas for American Indian males and females were substituted in the formulas for Mesoamerican male and female stature. These formulas were, for males: 2.26Fem + 66.379 $\pm$ 3.417; and for females: 2.59Fem + 49.742 $\pm$ 3.816. Results of these computations appear in Tables IV-V.

In comparing the results of these two basic methods, mean femur length for males and females was computed for complete femora, and for femora reconstructed by white and Indian regressions. Mean maximum length for 22 complete male femora was 46.83 cm. For 25 male femora reconstructed from the white regression, the mean length was 45.17 $\pm$ 1.32 cm., whereas the mean length derived from the Indian regression was 45.23 $\pm$ 1.01 cm. Similarly, for 14 complete female femora, mean length was 43.12 cm., while the white reconstruction

TABLE IV

RECONSTRUCTED FEMUR LENGTH AND STATURE

MALE

Bone Number	Maximum Length (cm)	Stature (cm)
191	46.83 ± .48	172.86 ± 3.75
198	46.30 ± .48	171.60 ± 3.75
218	45.36 ± .48	169.37 ± 3.75
231	45.06 ± .48	168.65 ± 3.75
233	45.75 ± 1.2	170.29 ± 4.47
239	40.32 ± 1.2	157.37 ± 4.47
264	42.05 ± 1.2	161.49 ± 4.47
267	45.59 ± 1.2	169.91 ± 4.47
268	44.01 ± 1.2	166.15 ± 4.47
284	44.90 ± 1.2	168.27 ± 4.47
294	44.79 ± .48	168.01 ± 3.75
298	44.71 ± 1.2	167.82 ± 4.47
302	44.53 ± 1.2	167.39 ± 4.47
334	44.87 ± 1.2	168.20 ± 4.47
382	45.80 ± 1.2	170.41 ± 4.47
431	46.63 ± 2.32	172.38 ± 5.59
C 202	45.43 ± 1.2	169.53 ± 4.47
E 400	45.91 ± 2.32	170.67 ± 5.59
G 203 & N 209	44.93 ± 1.2	168.34 ± 4.47
G 315	45.72 ± 2.32	170.22 ± 5.59
G 472	44.67 ± 2.32	167.72 ± 5.59
I 130	44.90 ± 1.2	168.27 ± 4.47

Bone Number	Maximum Length (cm)		Stature (cm)
I 217	45.78 ± 2.32		170.36 ± 5.59
M 336	45.52 ± 2.32		169.75 ± 5.59
O SE-2	48.93 ± 1.2		177.86 ± 4.47
Mean Length	45.17 ± 1.32	Mean Stature	168.91 ± 4.59

TABLE IV

RECONSTRUCTED FEMUR LENGTH AND STATURE

FEMALE

Bone Number	Maximum Length (cm)	Stature (cm)
188	41.14 ± .86	155.71 ± 4.58
190	41.35 ± .86	156.23 ± 4.58
203	40.31 ± .86	153.66 ± 4.58
208	41.14 ± .86	155.71 ± 4.58
215	42.12 ± 2.15	158.14 ± 5.87
220	42.18 ± 2.15	158.28 ± 5.87
236	41.66 ± .86	157.00 ± 4.58
237	41.87 ± .86	157.52 ± 4.58
261	38.02 ± .86	148.01 ± 4.58
263	38.44 ± .86	149.05 ± 4.58
280	41.87 ± .86	157.52 ± 4.58
293	41.25 ± 2.15	155.99 ± 5.87
330	43.15 ± .25	160.68 ± 3.97
335	42.05 ± 2.15	157.96 ± 5.87
374	42.86 ± 1.03	159.96 ± 4.75
379	42.60 ± .86	159.32 ± 4.58
F 136	42.29 ± .86	158.56 ± 4.58
F 284	38.96 ± .86	150.33 ± 4.58
G 219	42.49 ± 2.15	159.05 ± 5.87
H 436	42.24 ± 2.15	158.43 ± 5.87
I 354 & I 355	40.52 ± .86	154.18 ± 4.58
I 400 & I SW	42.54 ± .25	159.17 ± 3.97
J 307 & L 352	41.50 ± 2.15	156.60 ± 5.87

Bone Number	Maximum Length (cm)		Stature (cm)
J 412 & K 415	40.83 ± .86		154.95 ± 4.58
M 105	42.61 ± 2.15		159.35 ± 5.87
M 345	40.10 ± .86		153.15 ± 4.58
M SE	43.36 ± 2.15		161.20 ± 5.87
Mean Length	41.46 ± 1.25	Mean Stature	156.51 ± 4.97

TABLE V

RECONSTRUCTED FEMUR LENGTH AND STATURE - MALE

"INDIAN" REGRESSIONS

Bone Number	Maximum Length (cm)	Stature (cm)
191	45.11 ± .33	168.33 ± 3.747
198	44.55 ± .33	167.06 ± 3.747
218	43.46 ± .33	164.60 ± 3.747
231	43.26 ± .33	164.15 ± 3.747
233	46.40 ± 1.09	171.24 ± 4.507
239	42.44 ± 1.09	162.29 ± 4.507
264	43.70 ± 1.09	165.14 ± 4.507
267	46.10 ± 1.09	170.56 ± 4.507
268	45.02 ± 1.09	168.12 ± 4.507
284	45.74 ± 1.09	169.75 ± 4.507
294	43.07 ± .33	163.72 ± 3.747
298	45.50 ± 1.09	169.21 ± 4.507
302	45.44 ± 1.09	169.07 ± 4.507
334	45.86 ± 1.09	170.02 ± 4.507
382	46.46 ± 1.09	171.38 ± 4.507
431	47.11 ± 1.39	172.85 ± 4.807
C 202	46.28 ± 1.09	170.97 ± 4.507
E 400	45.30 ± 1.39	168.76 ± 4.807
G 203 & N 209	45.62 ± 1.09	169.48 ± 4.507
G 315	44.87 ± 1.39	167.78 ± 4.807
G 472	45.62 ± 1.39	169.48 ± 4.807

Bone Number	Maximum Length (cm)		Stature (cm)
I 130	45.82 ± 1.09		169.93 ± 4.507
I 217	45.03 ± 1.39		168.15 ± 4.807
M 336	44.39 ± 1.39		166.70 ± 4.807
O SE-2	48.62 ± 1.09		176.27 ± 4.507
Mean Length	45.23 ± 1.01	Mean Stature	168.60 ± 4.418

TABLE V

RECONSTRUCTED FEMUR LENGTH AND STATURE - FEMALE

"INDIAN" REGRESSIONS

Bone Number	Maximum Length (cm)	Stature (cm)
188	44.05 ± .86	163.81 ± 4.676
190	44.19 ± .86	164.19 ± 4.676
203	43.61 ± .86	162.69 ± 4.676
208	44.47 ± .86	164.92 ± 4.676
215	41.68 ± 1.23	157.69 ± 5.046
220	41.76 ± 1.23	157.90 ± 5.046
236	44.22 ± .86	164.27 ± 4.676
237	44.30 ± .86	164.48 ± 4.676
261	41.47 ± .86	157.15 ± 4.676
263	42.11 ± .86	158.81 ± 4.676
280	44.42 ± .86	164.79 ± 4.676
293	40.56 ± 1.23	154.79 ± 5.046
330	42.49 ± .28	159.79 ± 4.096
335	41.60 ± 1.23	157.49 ± 5.046
374	43.91 ± 1.02	163.47 ± 4.836
379	45.33 ± .86	167.15 ± 4.676
F 136	44.00 ± .86	163.70 ± 4.676
F 284	41.74 ± .86	157.85 ± 4.676
G 219	42.16 ± 1.23	158.94 ± 5.046
H 436	41.84 ± 1.23	158.11 ± 5.046
I 354 & 355	43.57 ± .86	162.59 ± 4.676
I 400 & I SW	41.87 ± .28	158.18 ± 4.096

Bone Number	Maximum Length (cm)		Stature (cm)
J 307 & L 352	40.88 ± 1.23		153.62 ± 5.046
J 412 & K 415	44.02 ± .86		163.75 ± 4.676
M 105	42.32 ± 1.23		159.35 ± 5.046
M 345	43.23 ± .86		161.71 ± 4.676
M SE	43.28 ± 1.23		161.84 ± 5.046
Mean Length	42.93 ± .95	Mean Stature	160.93 ± 4.766

regression yielded a mean of 41.46 ± 1.25 cm. for 27 female femora. Mean length from the Indian regression was 42.93 ± .95 cm. for these bones.

When stature was reconstructed from these figures, a similar pattern was seen. For complete male bones, mean stature was 172.86 ± 3.27 cm., while for reconstructed bones, mean "white" stature was 168.91 ± 4.59 cm., and mean "Indian" stature was 168.60 ± 4.418 cm. For complete female femora, mean stature was 160.61 ± 3.72. For reconstructed bones, "white" stature averaged 156.51 ± 4.97 cm., and "Indian" stature averaged 160.93 ± 4.766 cm.

These stature figures reflect the discrepancy between complete and reconstructed bone lengths. In all cases, mean length of complete femora was greater than mean reconstructed length. Only for female femora reconstructed by the Indian formula was there close agreement. While results of the Indian formulas for the reconstruction of long bones appear generally more useful than those from the white formulas, a comparison with mean femoral length from other populations indicates that femora from the Piscataway ossuary approximate those of Anglo-Americans in length (Steele and McKern, 1969:224). Living stature of the Piscataway Indians is, of course, unknown, and the real predictive value of different statural formulas cannot be checked. Nevertheless, future attempts to project stature for this group should include, for comparison, the use of Trotter and Gleser's (1958) revised formulas for white and Mongoloid males, and the use of "Indian" femur lengths in "white" stature reconstruction regressions.

CHAPTER V

ADULT ANALYSIS: LIFE STAGE AND AGE AT DEATH

Determination of age from adult skeletal material presents problems not encountered in the analysis of juvenile material. Most epiphyses have fused by the age of 23 (Krogman, 1962:27) and longitudinal growth of long bones has ceased. With the eruption of the third molar, between 16 and 27 years, dentition is complete. The age of individuals beyond this point is consequently difficult to identify. Estimations based on the closure of cranial sutures have been shown to be unreliable (Singer, 1953; McKern, 1970), and many other considerations, such as parietal thinning, are of value only for the limited number of cases in which they appear. An additional difficulty encountered in an ossuary situation is the lack of articulated skeletons, and the extreme fragmentation of the material. An analysis of tooth wear and dental attrition was thus rendered impracticable by extreme post-mortem tooth loss. The difficulty in assigning separate ribs and vertebrae to any one individual likewise made them useless for analysis of age. Post-mortem erosion of the friable bone material made it impossible to apply Todd's (1920-1921) stages of metamorphosis of the surface of the pubic symphysis. Only those methods based on the internal remodeling of long bones were viewed as applicable to the entire adult population, and useable even for severely fragmented material.

Life Stage.

In 1969, Kerley described the gross resorptive patterns he had observed in the cross-sections of long bones. He noted that areas of intense osteoclastic activity varied with age and that, particularly for the leg bones, the general age range of a fragment of midshaft could be easily determined. In the young child, osteoclastic resorption is greatest in the area of the medullary cavity, while in the adolescent it is just beneath the outer surface. The cortex of the bone of an active young adult appears dense and solid, with only occasional resorptive holes visible, distributed randomly throughout the cortex. With the onset of middle age, osteoclastic activity increases in the area of the medullary cavity, and the inner third of the cortex becomes gradually more porous. In old age, the medullary cavity appears noticeably enlarged, and the cortex frequently thin and lacey. This thinning is first seen and most pronounced in the anterior of the femur, but inactivity assosciated with old age can extend marked resorption even into the linea aspera.

While Kerley assigned numerical ages to these resorptive changes, it is perhaps more useful to view them as indicators of life stage. He notes that medullary resorption begins earlier in females than in males (mid-forties in females, as opposed to approximately 60 in males). It can therefore be seen as a function of the onset of middle age and the accompanying changes in hormone levels, a process which varies considerably with sex and perhaps population. Just as onset of puberty appears to vary between one population and another and within a single population over time (Watson and Lowrey, 1967;49), so developmental stages in bone may also vary. Kerley's age assignments are based on a modern, industrialized population, and may therefore not apply to a primitive group. Consequently, for this study, adults were assigned to one of three life stages: young adult; middle age; and old age.

Assignment to life stage was made from a visual inspection of a cross-section cut from the diaphysis of the femur. A segment approximately 3 inches long was removed from the midshaft with a metallurgical cut-off saw with a carborundum blade. The segment was cleaned first manually and then in an ultra-sonic cleaner with Liqui-Nox and tap water for a period of 20 minutes. The specimen was then rinsed manually under running water and again in the ultra-sonic cleaner in tap water for 20 minutes. Following this, the specimen was allowed to dry overnight. The cut ends were then ground briefly on a motor-driven rotary grinding wheel with a 180-grit A.B. Buehler Carbimet cover, and water as a lubricant. This grinding removed the portions of bone which had burned during sawing, and produced a flat surface perpendicular to the long axis of the bone. Both ends of the segment were observed for resorptive pattern. Following Kerley's (1969) description, specimens with a thick, solid cortex were assigned to Stage 1, young adulthood. Bones which showed a concentration of resorptive holes on the inner third of the cortex and some enlargement of the medullary cavity were assigned to Stage 2, middle age. Only those bones which showed marked resorptive thinning of the cortex, particularly in the anterior of the femur, were assigned to Stage 3, old age.

A complete listing of femora and life stages appears in Appendix II. Of the 204 femoral shafts analyzed, 107 or 52.5% were in Stage 1. Stage 2 accounted for 81 individuals, or 39.7%, while Stage 3 accounted for 16 individuals, only 7.8%. Nine specimens with evidence of pathology in the midshaft area were not sectioned, and life stage is not presently available for these.

To determine the age at which each of these life stages occurred, a sample of 12 specimens was chosen from each stage. An attempt was made to select specimens which most clearly exhibited the characteristic patterns of resorption. Ambiguous specimens were avoided, as were those with extensive erosion of the outer layer of the cortex. While examples of both sexes were included in the sample for each stage, it was not possible to include equal numbers of males and females for all groups. The small number of individuals in Stage 3, for example, and the relatively high percentage of midshafts of unknown sex, limited the available choices. When the most suitable specimens had been selected, they were prepared for microscopic age determination.

Age.

Adult age determinations were made by Ahlqvist and Damsten's (1969) modification of Kerley's (1965) method. For each femur in the sample, a thin cross-section of the midshaft was prepared and mounted for microscopic examination. The degree of internal remodeling of microscopic structures was ascertained, and a regression formula applied to determine age at death.

After life-stage determinations had been recorded, the three-inch segments of femoral midshaft were again placed in the ultra-sonic cleaner and washed for 20 minutes in a solution of Liqui-Nox and water. They were then rinsed in the ultra-sonic cleaner in tap water for a period of 20 minutes to remove any detergent residue. While this process removed most of the soil adhering to the exterior of the bone, it did not sufficiently clean the medullary cavity, and was ineffectual in removing impurities from the interior of the cortex. It was therefore necessary to infuse the bone with a mild oxidizing agent, in this case a 20% by volume solution of Clorox. The segments were placed in the Clorox solution under house vacuum for 1-2 days, or until the cut ends appeared white. They were then removed and rinsed in the ultra-sonic cleaner in tap water for 15 minutes. Specimens which still appeared dirty or smelled strongly of Clorox after this rinsing were placed in tap water under house vacuum for 2-3 hours to complete their cleaning. After the segments had been dried for at least 48 hours at room temperature, they were impregnated with an Araldite epoxy resin mixture(available from the Chemical and Engineering Co., Inc. of Media, Pennsylvania) under house vacuum for 1 hour. They were then placed in a 60° C. oven overnight to cure. This was necessary to harden the extremely friable specimens sufficiently to prevent their disintegration during further sawing. In spite of this precaution, a number of specimens broke during the final sawing. In this final sawing step, a 5 mm. slab of bone was removed from one end of the three-inch segment. These small slabs were then impregnated with the Araldite resin. Untreated or inadequately treated specimens absorbed water during grinding, causing them to expand and come off the slide. For embedding of both large segments and small slabs, the Araldite resin AY105 and Hardener 935F were mixed in a 1:1 ratio and dissolved in 4 parts toluene. While three-inch segments were removed after 1 hour, the 5-mm. slabs remained in the Araldite for 2-4 days, until the epoxy had attained a solid, rubbery consistency. The specimens were then removed and manually cleaned of any adhering Araldite. After a 24-hour curing period in a 60° C. oven, the specimens were hardened sufficiently to be mounted and ground without breakage or undue expansion.

Prior to mounting the specimen, one side of the 5-mm. slab was ground to an optically level surface, using a motor-driven grinding wheel with a 180-grit A.B. Buehler Carbimet cover and water as a lubricant. This surface was then ground further on an 800-grit A.B. Carbimet wheel to remove any striations remaining after coarse grinding. When the surface appeared flat and smooth, the specimen was washed for 5 minutes in Liqui-Nox and water in an ultra-sonic cleaner, rinsed briefly under running water, and dried on a 200° F. hot plate for 30 minutes. The ground surface was then polished manually on bond paper, and with a motor-driven polishing wheel with an A.B. Texmet cloth treated with a Metadi diamond polishing compound and polishing oil. The The slab was once again cleaned in the ultra-sonic cleaner, rinsed, and dried on the hot plate.

For mounting, a cleaned 1x3 glass microscope slide (2x3 for large specimens) was placed on the 200° F. hot plate along with the specimen to be mounted and a mounting clamp. Equal parts Araldite resin AY105 and Hardener 935F were placed in a foil container and mixed until clear. The mixture was spread evenly over the worked side of the specimen and the slide lowered into place. Slide and specimen were placed into the clamp, which was tightened and left on the hot plate at 200° F. for 45 minutes. The assemblage was allowed to cool to room temperature before the mounted specimen was removed.

For the final grinding process, the slide was placed in a hand-held Lucite holder and the specimen ground on the coarse (180-grit) grinding wheel until approximately 200 microns thick. It was further reduced to a thickness of 100 microns by manual grinding on the 800-grit wheel. Thickness was periodically checked with a standard micrometer. When the specimen was thin enough for structures to be visible under an ordinary monocular laboratory microscope, the specimen was washed, rinsed, and dried. It was then polished on the polishing wheel until smooth and glossy, and cleaned of residual polishing oil and diamond dust. Slides prepared in this manner did not have the visual clarity of those prepared from fresh bone, but microscopic structures were nonetheless readily identifiable for most specimens.

When slides had been prepared for all 36 specimens, they were examined with a Leitz Ortholux microscope, with an ocular square-ruled reticule mounted in the left eyepiece. The grid was so calibrated that one side measured 1 mm. at the level of the surface of the specimen. Four evenly spaced fields were chosen from the periphery of the of the bone, avoiding the linea aspera. A count was made of the number of squares in the 100-square grid which were at least 50% filled with osteons or osteon fragments. The total number of squares was averaged for the four fields, to determine the mean per cent remodelled for each bone. This figure was then substituted for "x" in the regression $y = 0.991x - 4.96 \pm 6.71$, to determine age (Ahlqvist and Damsten, 1969).

The age range for specimens in Stage 1 was 30.96 ± 6.71 years to 52.52 ± 6.71 years, with the mean age at 45.99 ± 6.71 years. Males in this group averaged 48.39 ± 6.71 years and females, 44.34 ± 6.71. For Stage 2, the ages ranged from 38.40 ± 6.71 to 68.62 ± 6.71 years, with the mean at 56.19 ± 6.71. Males averaged 51.90 ± 6.71 and females, 57.47 ± 6.71 years. In the third stage, a range of 55.99 ± 6.71 to 73.82 ± 6.71 years yielded a mean age of 65.71 ± 6.71. The males in this group averaged 60.95 ± 6.71 and the females averaged 65.34 ± 6.71. The mean per cent of the bone remodelled and the projected age are recorded for each specimen in the sample in Table VI. The small number of individuals of each sex known for each group makes it unlikely that meaningful conclusions can be reached as to the effect of sex on age and life stage.

TABLE VI

AGE, SEX, AND LIFE STAGE

STAGE I

BONE NUMBER	MEAN % REMODELLED	AGE	SEX
262	61.00	55.49 ± 6.71	
268	51.25	45.83 ± 6.71	M
292	36.25	30.96 ± 6.71	
328	54.25	48.80 ± 6.71	M
337	50.00	44.59 ± 6.71	
369	47.25	41.86 ± 6.71	
378	59.75	54.25 ± 6.71	F
379	39.75	34.43 ± 6.71	F
A208	56.00	50.54 ± 6.71	M
C200	58.00	52.52 ± 6.71	
F326	48.75	43.35 ± 6.71	
P SE	54.75	49.30 ± 6.71	
	MEAN AGE =	45.19 ± 6.71	

TABLE VI

AGE, SEX, AND LIFE STAGE

STAGE 2

BONE NUMBER	MEAN % REMODELLED	AGE	SEX
193	68.50	62.92 ± 6.71	
241	53.00	47.56 ± 6.71	
276	64.25	58.71 ± 6.71	F
306	67.00	61.44 ± 6.71	
307	72.25	66.64 ± 6.71	
365	51.50	46.08 ± 6.71	
C272	74.25	68.62 ± 6.71	F
F100	71.00	65.40 ± 6.71	M
F136	51.75	46.32 ± 6.71	F
J412 & K415	61.75	56.23 ± 6.71	F?
M236	43.75	38.40 ± 6.71	M
M446	61.50	55.99 ± 6.71	
	MEAN AGE =	56.19 ± 6.71	

TABLE VI

AGE, SEX, AND LIFE STAGE

STAGE 3

BONE NUMBER	MEAN % REMODELLED	AGE	SEX
187	78.75	73.08 ± 6.71	
190	63.50	57.97 ± 6.71	F?
203	71.75	66.14 ± 6.71	F
217	76.75	71.37 ± 6.71	
247	62.50	56.98 ± 6.71	
294	71.50	65.90 ± 6.71	M
335	79.50	73.82 ± 6.71	F
339	76.25	71.29 ± 6.71	
395	75.25	69.61 ± 6.71	
J234	68.50	62.92 ± 6.71	
K267	69.00	63.42 ± 6.71	F
FD & 228	61.50	55.99 ± 6.71	M
	MEAN AGE =	65.71 ± 6.71	

CHAPTER VI

DISCUSSION AND CONCLUSIONS

Number of Individuals.

Number of Individuals totalled for the ossuary was at least 281, based on the count of 68 juveniles and 213 adults. Petrous portions of the temporal bone were counted in an attempt to confirm this figure. A total of 494 petrous portions were recovered, 248 right and 246 left. Stewart commented in 1940 that, in the ossuaries he had excavated, skulls always outnumbered long bones. However, in the Juhle ossuaries, Ubelaker found the reverse to be true (Ubelaker, 1973). The nature of ossuary burial makes it likely that some bones will not be included. If the initial mortuary treatment was exposure on a scaffold or on shelves in a charnel house, there is ample opportunity for scavengers to have removed portions of the corpse, or for individual bones to have been lost from the defleshed skeleton. It seems unlikely that so large and obvious an item as a skull would have been lost in transit to the final interment, but it must be remembered that infant skulls are small and fragile, and the segments more liable to separate at the sutures than those of an adult. In fact, the petrous portions analyzed included very few examples of bones that were obviously juvenile, and few juvenile mandibles were encountered during sorting. If, during complete tabulation of all bones, these missing crania are shown to be primarily juvenile, their absence will seem less remarkable. If, however, they are primarily adult crania, other hypotheses will need to be formulated to explain their absence.

Age Profile.

The total ossuary age profile was constructed on the basis of 272 individuals, as 9 adults demonstrated pathology of the midshaft of the right femur, and were not assigned to a life stage. Although mean ages for each adult life stage seem high for a primitive population, this is probably an artifact of the sampling procedure used. Individual bones were included in the sample for their unambiguous demonstration of resorptive patterns typical of each stage. It is possible that those displaying the most characteristic patterns were in fact the older members of each stage, and that the younger end of the range remains untested. While this is plausible for middle- and old-age groups, it does not seem to adequately explain the lack of persons under 30 in Stage 1. The cortex of specimens chosen for Stage 1 was notably thick and dense, a condition which denotes active use of the bone, as well as its developmental stage. It is possible that these criteria select more for activity than simply for age. Less robust, well-muscled individuals might display the characteristics of young adulthood to a less marked degree, and may be found to have died earlier. When microscopic age determinations have been made for the entire ossuary population, younger individuals in each category will undoubtedly emerge.

Aside from the lack of younger individuals in Stage 1, the age pattern presented by each life stage generally agrees with Kerley's (1969) assessments. Onset of middle age seemed to be the most easily identifiable phenomenon, and occurred between 45 and 55 years in most cases. Unfortunately, the small number of individuals in each category for whom sex was known makes generalization from these cases unwise. Mean male age was higher than female age for Stage 1, as might be expected, but for Stages 2 and 3, the reverse was true.

From a developmental point of view, old age appears to be an extension and intensification of the features of middle age. Only 16 persons were placed in the "old age" category, from the extreme enlargement of the medullary cavity and large number of resorptive holes in the cortex. None of these tested was under 55 years of age, and 4 were in their seventies. The mean age for this group was about 65 years. In this one primitive group, at least, age perameters for each life stage appear to conform to those for modern populations.

Using the mean age at death for each of the adult life stages, and the age ranges established for juveniles, mean age at death was computed for the entire population. Juvenile ages were computed from the midpoint of each age category (e.g., the six individuals aged 4-5 were assigned the age 4.5 years for the purposes of computation). The 107 adults in Stage 1 were assigned the age of 45.99 years. The 81 individuals in Stage 2 were assigned the age 56.19 years; and the 16 persons in Stage 3 were computed at 65.71 years. The mean age for the entire population was 39.33 years. This is higher than Johnston and Snow (1961) report for the Indian Knoll population. Their average age was 18.56 years, which they explained as resulting from an infant mortality rate of 20.48%. In the Piscataway ossuary, deaths at less than 1 year accounted for 13 cases, or 4.5% of the total 281, and total juvenile deaths were 24% of the total population. Ubelaker (1973) reports that persons under 5 years of age comprise 29.03% and 32.37% of the two Juhle ossuaries. For the Piscataway ossuary, this group represented only 7.8% of the total population. This figure seems low enough that it is probable that not all juveniles who died during the time period represented by the ossuary are buried within it. A larger proportion of juvenile deaths would lower the average age, as would the discovery of younger individuals in Stage 1, the most numerous category of adults.

Microscopic age determinations for the entire ossuary population will undoubtedly resolve many of the problems introduced in this study. When this analysis is complete, age-at-death curves can be constructed and more detailed conclusions drawn. However, meaningful demographic reconstruction of the living population depends on the systemic assessment of burial and settlement, to determine the place of the ossuaries in the social system of the people who constructed them.

APPENDIX I

JUVENILE FEMUR

Bone Number (Right)	Total Length (mm.)	Estimated Age
504	275	9 - 10
505	249	8 - 9
506	220	6 - 7
507	220	6 - 7
508	220	6 - 7
509	168	4 - 5
510	60	8 foetal mo.
512	175	4 - 5
513	295	10 - 11
514	350	13 - 14
515	390	15 - 18
516	295	10 - 11
517	295	10 - 11
518	245	7 - 8
519	220	6 - 7
520	220	6 - 7
521	310	11 - 12
523	220	6 - 7
524	80	newborn
525	100	birth - 1
526	80	newborn
527	110	1 - 2
528-1	75	9½ foetal mo.

Bone Number (Right)	Total Length (mm.)	Estimated Age
528-2	185	5 - 6
529	165	4 - 5
530	350	13 - 14
531	340	12 - 13
532	310	11 - 12
533	175	4 - 5
534	310	11 - 12
557	392	15 - 18
377	(Proximal Epiphyses Fused)	15 - 18
D 254	340	12 - 13
E 103-1	220	6 - 7
F 219	390	15 - 18
G 162 & H NW	164	4 - 5
H NW-3	80	newborn
H NW-4	62	7 foetal mo.
H SW	120	2 - 3
I SE & FD	82	newborn
J 244	185	5 - 6
J 315	348	13 - 14
J 360	(Proximal Epiphyses Fused)	15 - 18
J NW-2	340	12 - 13
J NE	340	12 - 13
J SE	295	10 - 11
K 307	110	1 - 2
K SW	294	10 - 11
L 110 & I 163	239	7 - 8

Bone Number (Right)	Total Length (mm.)	Estimated Age
L 121 & K NW	360	14 - 15
L SE-3	295	10 - 11
L SE-4	240	7 - 8
L NW	70	9 foetal mo.
L NE-1	79	newborn
L SW	185	5 - 6
L NE-2	240	7 - 8
M 353	383	15 - 18
M 427	310	11 - 12
M 441	365	15 - 18
M SE-2	70	9 foetal mo.
M SE-3	165	4 - 5
M SE-4	275	9 - 10
M SE-8	242	7 - 8
M SE-9	(Head Fused)	15 - 18
M SE-10	295	10 - 11
M NE	70	9 foetal mo.
M NW-2	340	12 - 13
P SW-1	57	7½ foetal mo.

Bone Number (Left)	Total Length (mm.)	Estimated Age
440	390	15 - 18
441	396	15 - 18
443	264	8 - 9
447	(Proximal Epiphyses Fused)	15 - 18
449	360	14 - 15
456	141	3 - 4
461	385	15 - 18
462	350	13 - 14
463	310	11 - 12
464	235	7 - 8
468	295	10 - 11
471	350	13 - 14
474	240	7 - 8
478	87	birth - 1
479	360	14 - 15
480	275	9 - 10
485	100	birth - 1
489	275	9 - 10
492	240	7 - 8
493	76	9½ foetal mo.
G NW	80	newborn
H 119	334	12 - 13
H SW-1	70	9 foetal mo.
I SE	68	8½ foetal mo.
I SW	350	13 - 14
J 140	350	13 - 14

Bone Number (Left)	Total Length (mm.)	Estimated Age
J NE-1	145	3 - 4
J NE-2	185	5 - 6
K NW-1	80	newborn
L 379 & L 393	348	13 - 14
L NE-1	295	10 - 11
L SE-1	100	birth - 1
M 358	340	12 - 13
M 408	200	5 - 6
M 413	290	10 - 11
M NW-1	165	4 - 5
M SE-1	310	11 - 12
M SE-2	240	7 - 8
M SE-6	268	9 - 10
M SW	240	7 - 8
N 409	245	7 - 8
N 415	185	5 - 6
O SE-1	80	newborn

APPENDIX II

RIGHT FEMUR, ADULT

Bone Number	Percent Present	Maximum Length (mm.)	Head Diameter (mm.)	Sex	Life Stage
186	40				2
187	30				3
188	60	411.44 ± 8.6	43	F?	2
190	70	413.52 ± 8.6	43	F?	3
191	80	468.35 ± 4.8	47	M	1
192	60				2
193	30				2
194	50				2
196	60				1
197	60				1
198	90	463.04 ± 4.8	48	M	1
199	80	486	48.5	M	2
200	60				1
201	50				1
202	40				1
203	60	403.12 ± 8.6	40	F	3
204	100	436	45	M?	1
205	80				1
206 (P)*	50				
207	40				1
208	60	411.44 ± 8.6	42	F?	2
209	50				1
210	80	435	44	?	1

Bone Number	Percent Present	Maximum Length (mm.)	Head Diameter (mm.)	Sex	Life Stage
211	60				2
213	100	433	40.5	F	2
214 (P)	60				
215	50	421.16 ± 21.5	40.5	F	2
216	80	411	38	F	1
217	60	460.45 ± 23.2	44	?	3
218	70	453.60 ± 4.8	46	M	1
219 (P)	100	503.8	49	M	
220	50	421.78 ± 21.5	39.2	F	2
221	60				1
223 (P)	50				
225	50				2
226	70				2
229	100	477.5	43.2	F?	1
231	80	450.63 ± 4.8	49	M	1
232	30				
233	70	457.50 ± 12.0	48	M	2
236	60	416.64 ± 8.6	42	F?	1
237	50	418.72 ± 8.6	41.5	F	1
239	70	403.16 ± 12.8	45	M?	1
240	60				1
241	30				2
242	50				1
243	40				2
244	20				1
245	30				1

Bone Number	Percent Present	Maximum Length (mm.)	Head Diameter (mm.)	Sex	Life Stage
246	50				1
247	40				3
248	30				1
249	90	415	42.2	F?	2
250	40				2
253 (P)	50				
254	20				1
255	100	472	47	M	2
257	30				2
261	60	380.24 $\pm$ 8.6	40	F	1
262	40				1
263	60	384.40 $\pm$ 8.6	41.5	F	1
264	60	420.49 $\pm$ 12.0	46	M	1
265	50				1
267	60	455.93 $\pm$ 12.0	46	M	2
268	60	440.07 $\pm$ 12.0	47.5	M	1
269	70	401.04	44	?	2
271	50				1
272	50				1
273	60				1
274	100	476.5	48	M	1
275	40				2
276	100	436	42	F?	2
277	100	469	48	M	1
278	30				1
279	50				2

Bone Number	Percent Present	Maximum Length (mm.)	Head Diameter (mm.)	Sex	Life Stage
280	70	418.72	41	F	2
282	50				1
284	60	449.03	45.5	M	1
286	100	437	40	F	1
288	50				2
291	40				3
292	50				1
293	50	412.48 $\pm$ 21.5	40.2	F	2
294	80	447.86 $\pm$ 4.8	46	M	3
296 (P)	50				1
297	30				2
298 (P)	60	447.07 $\pm$ 12.0	46	M	
299	50				2
302	70	445.26 $\pm$ 12.0	46.5	M	2
304	40				2
305	30				1
306	40				2
307	50				2
309	30				1
310	60				2
311	20				2
312	40				2
313	40				1
314 (P)	70				
315	20				1
316	40				2

Bone Number	Percent Present	Maximum Length (mm.)	Head Diameter (mm.)	Sex	Life Stage
323	100	478	50.2	M	1
326	30				1
328	100	465	46	M	1
330	70	431.49 $\pm$ 2.5	40.2	F	2
334 (P)	60	448.69 $\pm$ 12.0	47	M	
335	60	420.54 $\pm$ 21.5	42	F?	3
337	20				1
338	40				1
339	50				3
341	20				2
342	80				1
344	80				1
345	30				2
348	30				1
349	20				1
350	60	441	42	F?	1
352	40				2
356	30				2
363	100	477	48	M	2
365	50				2
366	50				2
367	70				2
368	30				1
369	40				1
370	30				1
371	30				2

Bone Number	Percent Present	Maximum Length (mm.)	Head Diameter (mm.)	Sex	Life Stage
374	60	428.58 $\pm$ 10.3	39	F	2
378	100	439	41	F	1
379	60	426 $\pm$ 8.6	41	F	1
382	70	457.99 $\pm$ 12.0	49	M	1
383	20				2
384	50				1
386	50				2
388	20				1
392	20				2
393	20				
395	20				3
396	20				1
397	20				2
398	20				3
399	20				2
408	10				2
409	20				
410	10				
414	25				
416	20				
417	10				
418	20				
419	30				2
421	25				
424	20				
426	10				

Bone Number	Percent Present	Maximum Length (mm.)	Head Diameter (mm.)	Sex	Life Stage
427	20				
428	20				
429	20				
431	30	466.3 $\pm$ 23.2	45	M?	
432	15				
434	10		44	?	
435	20				
436	20				
437	20				
495	5		41.2	F	
496 (P)	15				
497 (P)	5				
498	10				
499	10				
500	10				
501	5				
502 (P)	15				
503 (P)	10		44.2	?	
A 201	30				3
A 208	100	475	48	M	1
C 119	100	467	47	M	1
C 128 & D 120	70				1
C 187 & A 101	100	414	38	F	1
C 200	70				1
C 202	60	454.32 $\pm$ 12.0	48	M	2
C 250	5				

Bone Number	Percent Present	Maximum Length (mm.)	Head Diameter (mm.)	Sex	Life Stage
C 272	70	391	41	F	2
E 101-1	5				
E 116-1	5		49	M	
E 283	5				
E 400	50	459.15 $\pm$ 2.32	49.5	M	2
F 100	90	455	49.5	M	2
F 136	60	422.88 $\pm$ 8.6	40	F	2
F 200	100	453	46	M	1
F 269	100	491	48.5	M	1
F 284	60	389.60 $\pm$ 8.6	39.5	F	2
F 302	70				1
F 302 & F 308	50				1
F 326	30				1
G 100	40				2
G 126	60				2
G 203 & N 209	70	449.37 $\pm$ 12.0	45.2	M?	2
G 209 & H 210-1	100	416	43	F?	1
G 219	60	424.88 $\pm$ 21.5	40	F	2
G 256	5		38	F	
G 311	5				
G 315	40	457.2 $\pm$ 23.2	47.5	M	1
G 320	40				1
G 347	40				2
G 472	70	446.72 $\pm$ 23.2	50	M	1
H 120	5				

Bone Number	Percent Present	Maximum Length (mm.)	Head Diameter (mm.)	Sex	Life Stage
H 133	60				1
H 179	90	450	44	?	1
H 203 (P)	100	469	46.2	M	
H 287	20				
H 309	5				
H 320 & H 322	100	432	44	?	1
H 436	60	422.4 $\pm$ 21.5	42	F?	1
H NE	5				
H SE-1	20				
H SE-2	20				
H SW	5				
I 109 & J 252	85	442	46.2	M	2
I 130	70	448.93 $\pm$ 12.0	47.8	M	1
I 217	50	457.85 $\pm$ 23.2	45	M?	2
I 223	80				1
I 269 & H NE	50				1
I 354 & I 355	60	405.20 $\pm$ 8.6	42	F	1
I 400 & I SW	90	425.36 $\pm$ 2.5	41.5	F	1
I 442	5				
J 102	75	456	44	?	1
H 121 & J 107	100	478	49.5	M	1
J 113 & J NW	100	441	41	F	1
J 206	20				

Bone Number	Percent Present	Maximum Length (mm.)	Head Diameter (mm.)	Sex	Life Stage
J 234	40				3
J 247	5		42	F?	
J 278 & J NE	100	466	47	M	2
J 307	5				1
J 307 & L 352 (P)	60	414.96 ± 21.5	39.5	F	2
J 309 & K 365	40				
J 310	90				1
J 330	5		42	F?	
J 412 & K 415	50	408.32 ± 8.6	43.2	F?	2
J 418 & FD	50				1
J 467	5		45	M?	
K 267	100	427	43.2	F?	3
K 312-1	5				
K 305	5		43	F?	
K 332-1	5				
K 336	100	449	42	F?	1
K 375	40				1
K 376	80	450	44	?	1
K 416	5				
K 426	50				1
K 435	5				
K 457	5				
K 464	5				
K SE-1	5				

Bone Number	Percent Present	Maximum Length (mm.)	Head Diameter (mm.)	Sex	Life Stage
K SE-2	5				
K SE-3	5		44	?	
L 225	100	463	44	?	1
L 324	5				
L 401	100	446	45.5	M	1
L 414 & M NW	60				2
L NE	5				
L SE	5				
M 105	50	426.12 ± 21.5	40.5	F	1
M 124	90	440	40	F	1
M 236	90	448	45.5	M	2
M 243	5				
M 336	40	455.25 ± 23.2	44.5	M?	1
M 345	50	401.04 ± 8.6	43	F	1
M 352	100	455	45	M?	2
M 354	40				2
M 379	70				1
M 400	30				
M 405	40				2
M 446	40				2
M SE-1	40	433.56 ± 21.5	43.2	F?	2
M SW-1	5		40	F	
M SE-2	5				
M SW-2	20				
N 312	10				1
N 316	5				

Bone Number	Percent Present	Maximum Length (mm.)	Head Diameter (mm.)	Sex	Life Stage
N NE	5		42	F	
O NE	10		44	?	
O SE-1	5				
O SE-2	50		48	M	3
P SE	60				1
FD-1	30				2
FD-2	40				
? 389	5				
FD & 228	80	494	46	M	3

* Specimens marked (P) showed evidence of pathology.

SELECTED BIBLIOGRAPHY

AHLQVIST, J. and O. DAMSTEN.
1969. A Modification of Kerley's Method for the Microscopic Determination of Age in Human Bones. Journal of Forensic Sciences, 14 :205-212.

ANDERSON, M. and W.T. GREEN.
1948. Lengths of the Femur and Tibia. American Journal of Diseases of Children, 75 :279-290.

ANDERSON, MARGARET, M.B. MESSNER and W. T. GREEN.
1964. Distribution of Lengths of the Normal Femur and Tibia in Children from One to Eighteen Years of Age. The Journal of Bone and Joint Surgery, 46A :1197-1202.

ANONYMOUS.
1635. A Relation of Maryland. William Peasley. London.

BASS, WILLIAM M.
1971. Human Osteology: A Laboratory and Field Manual of the Human Skeleton. Missouri Archaeological Society Special Publications. University of Missouri. Columbia.

BINFORD, LEWIS R.
1967. Smudge Pits and Hide Smoking: The Use of Analogy in Archaeological Reasoning. American Antiquity, 32:1-11.

BOUCHER, B.F.
1955. Sex Differences in the Foetal Sciatic Notch. Journal of Forensic Medicine, 2:51-54.

1957. Sex Differences in the Foetal Pelvis. American Journal of Physical Anthropology, 15:581-600.

BROTHWELL, D. R.
1965. Digging Up Bones. British Museum. London.

CHURCHER, C. S. and W. A. KENYON.
1960. The Tabor Hill Ossuaries: A Study in Iroquois Demography. Human Biology, 32:249-273.

DAVIDSON, D. S.
1935. Burial Customs in the Delmarva Peninsula and the Question of their Chronology. American Antiquity, 1:84-97.

DUPERTUIS, C. W. and JOHN A. HADDEN, JR.
1967. On the Reconstruction of Stature from Long Bones. American Journal of Physical Anthropology, 9:15-53.

DWIGHT, T.
1904-05. The Size of the Articular Surfaces of the Long

Bones as Characteristic of Sex: An Anthropological Study. American Journal of Anatomy, 4:19-31.

FERGUSON, A. L.
1937. Burial Area in Moyaone. Journal of the Washington Academy of Sciences. 27:261-267.

FERGUSON, A. L. and T. D. STEWART.
1940. An Ossuary Near Piscataway Creek. American Antiquity, 6:4-18.

GENOVES, S.
1967. Proportionality of Long Bones and Their Relation to Stature among Mesoamericans. American Journal of Physical Anthropology, 26:67-78.

GRAHAM, W. J.
1935. The Indians of Port Tobacco River, Maryland, and Their Burial Places. Private Printing. Washington.

GREULICH, W. M. and S. I. PYLE.
1959. Radiographic Atlas of Skeletal Development of the Hand and Wrist. Stanford University Press.

HALL, C. C.
1910. Narratives of Early Maryland. Charles Scribners Sons. New York.

HUNT, E. E. JR. and I. GLEISER.
1955. The Estimation of Age and Sex of Preadolescent Children from Bones and Teeth. American Journal of Physical Anthropology, 13:479-487.

JOHNSTON, F. E.
1962. Growth of Long Bones of Infants and Young Children at Indian Knoll. American Journal of Physical Anthropology, 20:249-254.

JOHNSTON, F. E. and C. E. SNOW.
1961. The Reassessment of the Age and Sex of the Indian Knoll Skeletal Population: Demographic and Methodological Aspects. American Journal of Physical Anthropology, 19:237-244.

KERLEY, E. R.
1965. The Microscopic Determination of Age in Human Bone. American Journal of Physical Anthropology, 23:149-163.

1969. Age Determination of Bone Fragments. Journal of Forensic Sciences, 14:59-67.

1970. Estimation of Skeletal Age after about Age 30. In Personal Identification in Mass Disasters, Edited by T. D. Stewart:57-70. Washington.

KROGMAN, W. M.
1962. The Human Skeleton in Forensic Medicine. Charles C Thomas. Springfield.

MALTBY, J. R. D.
1917-18. Some Indices and Measurements of the Modern Femur. Journal of Anatomy, 52:363-382.

MARESH, M. M.
1955. Linear Growth of Long Bones of Extremities from Infancy through Adolescence. American Journal of Diseases of Children, 89:725-742.

MARYE, W. B.
1936. Former Indian Sites in Maryland as Located by Early Colonial Records. American Antiquity, 2:40-46.

McKERN, T. W.
1970. Estimation of Skeletal Age: From Puberty to About 30 Years of Age. In Personal Identification in Mass Disasters. Edited by T. D. Stewart. 41-56. Washington.

McKERN, T. W. and T. D. STEWART.
1957. Skeletal Age Changes in Young American Males. Technical Report EP-45, Quartermaster Research and Development Center, Environmental Protection Research Division, Natick.

PARSONS, F. G.
1913-14. The Characters of the English Thigh Bone. Part I. Journal of Anatomy and Physiology, 48: 238-267.

PEARSON, K.
1914-15. On the Problem of Sexing Osteometric Material. Biometrika, X:479-487.

1917-19. A Study of the Long Bones of the English Skeleton I: The Femur. Dept. of Applied Statistics, University of London, University College. Drapers' Company Research Memoirs, Biometric Series X. Chap. 1-4.

REYNOLDS, E. L.
1945. The Bony Pelvic Girdle in Early Infancy. American Journal of Physical Anthropology, 3:321-354.

1947. The Bony Pelvis in Prepuberal Childhood. American Journal of Physical Anthropology, 5:165-200.

SCHRANZ, D.
1959. Age Determination from the Internal Structure of the Humerus. American Journal of Physical Anthropology, 17:278-278.

SERVICE, E. R.
1962. Primitive Social Organization. Random House, New York.

SINGER, R.
1953. Estimation of Age from Cranial Suture Closure. A Report on its Unreliability. Journal of Forensic Medicine, 1:52-59.

STEELE, D. G.
1970. Estimation of Stature from Fragments of Long Limb Bones. In Personal Identification in Mass Disasters. Edited by T. D. Steart: 85-87.

STEELE, D. G. and T. W. McKERN.
1969. A Method of Assessment of Maximum Long Bone Length and Living Stature from Fragmentary Long Bones. American Journal of Physical Anthropology, 31:215-227.

STEWART, T. D.
1934. Sequence of Epiphyseal Union, Third Molar Eruption and Suture Closure in Eskimos and American Indians. American Journal of Physical Anthropology, 19:433-452.

1940. A Report on the Skeletal Remains from the Piscataway Creek Ossuary. American Antiquity, 6:13-18.

1968. Identification by the Skeletal Structures. In Gradwohl's Legal Medicine. Edited by F. E. Camps, 2nd Ed. Bristol.

STEWART, T. D. (Ed.)
1970. Personal Identification in Mass Disasters. National Museum of Natural History, Smithsonian Institution. Washington.

TODD, T. W.
1920-21. Age Changes in the Pubic Bone (Parts I-IV). American Journal of Physical Anthropology, 3:285-334; 4:1-70.

TODD, T. W. and D. W. LYON.
1924-25. Cranial Suture Closure: Its Progress and Age Relationships (Parts I and II). American Journal of Physical Anthropology, 7:326-384; 8:23-45.

TRIGGER, B. R.
1969. The Huron: Farmers of the North. Holt, Rinehart, and Winston. New York.

TROTTER, M. and G. C. GLESER.
1952. Estimation of Stature from Long Bones of American Whites and Negroes. American Journal of Physical Anthropology, 10:463-514.

1958. A Re-evaluation of Estimation of Stature Based on Measurements of Stature Taken During Life and of Long Bones After Death. American Journal of Physical Anthropology, 16:79-123.

TYLER, L. G.
1907. Narratives of Early Virginia. Charles Scribner's Sons. New York.

UBELAKER, D. H.
1973. The Reconstruction of Demographic Profiles from Ossuary Skeletal Material: A Case Study from the Tidewater Potomac. Unpublished doctoral dissertation. University of Kansas. Lawrence.

WASHBURN, S.
1948. Sex Differences in the Pubic Bone. American Journal of Physical Anthropology, 6:199-208.

WATSON, E. H. and G. H. LOWREY.
1967. Growth and Development of Children. Year Book Medical Publishers. Chicago.

WESLAGER, C. A.
1948. The Nanticoke Indians: A Refugee Tribal Group of Pennsylvania. Pennsylvania Historical and Museum Commission. Harrisburg.