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CANADIAN THESES ON MICROFICHE | THÈSES CANADIENNES SUR MICROFICHE

NAME OF AUTHOR/NOM DE L'AUTEUR: E. Lorraine Hess

TITLE OF THESIS/TITRE DE LA THÈSE: Osteology and Odontology of the Sharphead Burial Site

UNIVERSITY/UNIVERSITÉ: University of Alberta

DEGREE FOR WHICH THESIS WAS PRESENTED/GRADE POUR LEQUEL CETTE THÈSE FUT PRÉSENTÉE: M.A.

YEAR THIS DEGREE CONFERRED/ANNÉE D'OBTENTION DE CE GRADE: 1978

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THE UNIVERSITY OF ALBERTA

[illegible] AND [illegible]

OF THE [illegible] BURIAL [illegible]

by

E. LARAINE [illegible]

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF ARTS

DEPARTMENT OF ANTHROPOLOGY

EDMONTON, ALBERTA

FALL, 1975

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled "The Osteology and Odontology of the Sharphead Burial Site" submitted by Laraine Hess in partial fulfilment of the requirements for the degree of Master of Arts in Anthropology.

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September, 1978

ABSTRACT

Twenty-five burials, twelve adults and thirteen children, were recovered from the Wolf Creek (Sharphead) Indian Reserve which historical records indicate was occupied by Alberta Stoney Indians from 1885-1897--a period of apparently great cultural instability and physical distress for these people.

The osteological material is studied in terms of basic demographic variables, to establish age distribution, sex ratio, and general state of health of the individuals. Metrical and non-metrical (discontinuously variable) data were obtained and analyzed for both the cranial and postcranial skeletons.

Generally speaking, sex differences which are apparent in the skeletons are minimal, with both sexes showing considerable range of variability for most measures and features.

Actual diseases of the bones are rare, although dental problems occur frequently. The high proportion of immature individuals in the sample helps to substantiate the poor state of health which historical sources indicate existed for the group.

High proportions of some skeletal anomalies, and almost total (or total) absence of others, suggests that this is not a purely random sample of individuals. Reserve associations could perhaps be expected to consist of closely related families with resultant concentrations of certain genes.

ACKNOWLEDGEMENTS

I wish to thank all those people who contributed in any way to the completion of this thesis, but my study committee must be the first to be acknowledged for their invaluable assistance and support over the years. Their considerable patience in awaiting the final result of their efforts was also greatly appreciated. My committee chairman, Dr. G. Steele, was most supportive in both a personal and professional way, and I will long value the time spent as his student and friend. Dr. Ruth Gruhn provided much basic background information concerning the archaeology of the Sharphead site, without which it would have been very difficult to interpret much of the information at hand. Mrs. Trudy Nicks cannot be thanked enough for her contributions and I feel that a good proportion of this thesis actually belongs to her. Trudy collected all of the historical data during her visits to the Public Archives in Ottawa, and willingly allowed the information to be included in this study. She was also the first to attempt the use of multivariate techniques for sexing and aging the Sharphead material. In this study I repeat and somewhat extend some of her work--with the same results that Trudy originally obtained.

Dr. G. H. Sperber of the Faculty of Dentistry, University of Alberta, proved to be an outstanding choice as an external examiner. His careful questions and suggestions helped me to a better understanding of some basic anatomy; and, therefore, greatly improved many of the discussions included in this thesis.

Among the other people who I wish to thank is Mr. John Nicks. Both John and Trudy provided much needed encouragement throughout my time at this university. John was of great assistance in completing many of the tasks required to get [illegible]esis ready for final presentation. Not the least among his ef[illegible]lp he gave me in developing some efficiency in dark[illegible]masterful drafting of maps will most certainly be appreciated by anyone who wishes to examine page 6.

James McDonald was a great asset as an office partner, particularly during the time that I was beginning the statistical analyses of the data. His practical assistance simplified many confusing problems for me.

Anne Zeller arrived at this university during the final stages of thesis preparation--still in time, however, to provide much encouragement and aid in such essential tasks as proofreading.

I would also like to extend special thanks to Kay Thatcher--just for being there and listening to it all whenever she was needed. She probably thought that I would never get this thing done.

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INTRODUCTION

The following report describes the structural features of a group of individuals recovered from the cemetery of an abandoned mission and Indian reserve near Ponoka, Alberta. In the latter part of the nineteenth century a group of Stoney Indians from central Alberta were eventually settled there after the signing of Treaty No. 6. In subsequent years disease, starvation, and cultural difficulties all seem to have contributed to the demise of many of the people to the point where the site was abandoned and the survivors moved to other locations. The reserve land was then sold to white settlers and the burial site was eventually rediscovered on the property of the Matejka family of Ponoka, Alberta, when power lines were being installed across the land. The Department of Anthropology, the University of Alberta undertook excavation of the site in 1965 and 1966, recovering twenty-five skeletons and associated cultural materials over the two seasons' work.

Historical Survey

There is no extensive historical documentation concerning the small band of Alberta Stoney Indians who in the late 1800's were led by a chief named Cheepostequan, or as he has more commonly been known, Sharphead. Those records we do find tell of an ill-fated group of people seemingly plagued by a long series of misfortunes; diseases of various kinds and starvation being among the most common. At least as devastating, however, was an obvious difficulty in adapting to a rapidly transformed environment, social and political as well as ecological, as white settlers moved in to disrupt native life. It is not an unusual story, nor is it more unfortunate than that told by many other native peoples.

Sharphead's band was among the group of Stoneys who, in 1876, agreed to the terms of Treaty No. 6 negotiated with the Canadian government at Fort Carlton and Fort Pitt. The events befalling the band in those early years following the signing of the treaty are difficult to determine. They seem to have remained fairly mobile and unsettled, due perhaps in part to an increased difficulty in securing an adequate food supply following the encroachment of the white man into their hunting areas. The government's failure to fulfil many of the treaty obligations with regards to food provisions apparently aggravated the situation quite considerably (Edmonton Bulletin, 24 December, 1881). In January of 1881, a somewhat hysterical message from Hay Lakes to the NWMP detachment in Edmonton told of an "Indian scare", as members of Sharphead's band tried to obtain provisions from the terrified settlers (Edmonton Bulletin, 10 January, 1881). Although the strong reaction on the part of the settlers most probably exaggerated any real threat present in the event, it also brought attention to the plight of the band, and of many other neighboring native groups as well. Not surprisingly, the response of government officials was to make a more concerted effort to settle the people on reserves, to provide them with some of the cattle and equipment promised in the treaty, and generally to encourage the conversion to a settled agricultural way of life. Unfortunately, thoughout 1881 and 1882, the program did not seem to be particularly successful. After leaving Hay Lakes and settling at Pigeon Lake, Sharphead continued to complain about the quantity of rations being given his people by the sub-agent there (Edmonton Bulletin, 21 February, 1881). A winter buffalo hunt attempted by the men from the Battle River, Pigeon Lake, and Peace Hills

(Hobbema) bands was unsuccessful (Edmonton Bulletin, 17 December, 1881); so that by February 1882, many people were ill and surviving principally upon whatever fish and other resources that could be obtained from nearby lakes (Edmonton Bulletin, 18 February, 1882).

Although exact information is lacking, it can be assumed that life continued in the same marginal way until about 1883-1884, when still further difficulties seem to have arisen. Relations between Sharphead's band and other native groups do not appear to have been particularly good at this time. Friction between the band and their Cree neighbours at Pigeon Lake, coupled with the other unfavorable conditions, resulted in Sharphead's group taking a new reserve in 1884 (Nelson 1883-1884). This reserve, which was officially known as the Wolf Creek Indian Reserve (No. 141), was situated on the Battle River to the west of what is now Ponoka, Alberta; and consisted of 42.4 sections of mixed poplar, spruce, swamp, and muskeg, with some patches of good prairie land (Government of Canada 1889). When the band moved to the new reserve, Reverend John Nelson, a Methodist missionary, also moved from the Pigeon Lake reserve to establish a mission school and church at the new site (Nelson 1883-1884). The reserve was officially surveyed in 1885, at which time there were in residence 164 individuals belonging to the 36 families making up the band (Government of Canada 1885).

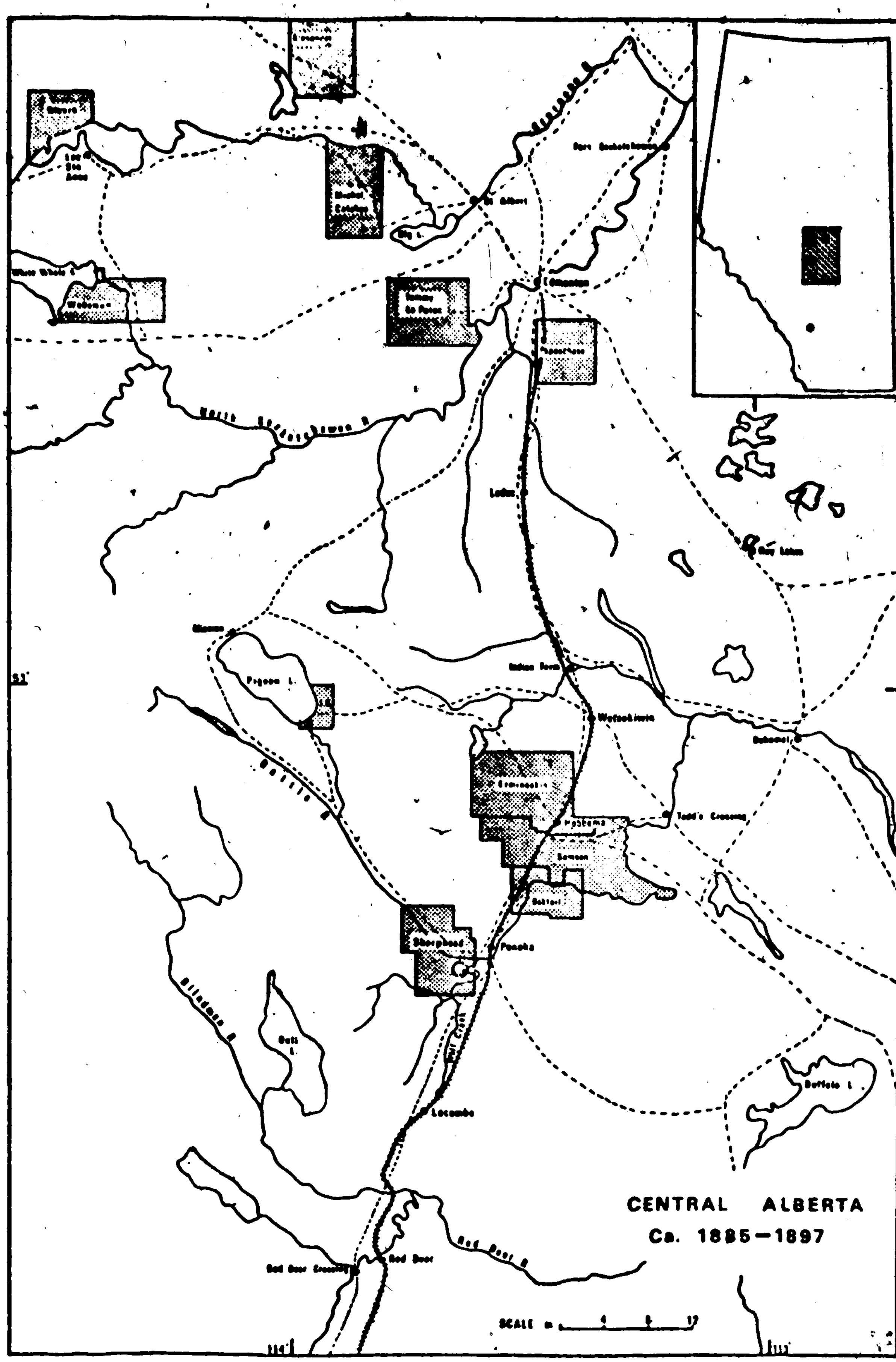
Conditions did not, however, improve with the new location. The band's relations with other groups remained poor; and when Sharphead refused to take any part in the rebellion of 1885, the reserve store was raided in retaliation by Cree and Metis who had been attempting to pressure the old chief into action (Laurie 1971). At the same time, health problems continued to pose threats to the very survival of the band. During the winter of 1886-1887, measles ravaged the band, leaving up to one-third of the population dead. Most of the victims were children, and the school population was reduced by more than one-half (Nelson 1889-1890). With their health so seriously undermined, it seems as if the group was never able to fully recover and reorganize itself before the winter of 1888 brought a further plague of severe colds (Lucas 1888). That season was a severe one with snow remaining on the ground until late into the spring; a season when most Indian groups cancelled plans for their usual spring hunt in order to get their fields seeded. The Stoneys, however, attempted a hunt in spite of the fact that so many of them were still recovering from illnesses. Reports from Indian agent Samuel B. Lucas suggest that in general at this time the Stoneys were in much poorer health than their Cree neighbours and were also considerably less inclined to take proper care of themselves (Lucas 1886). By leaving the reserve so often they not only exposed themselves to the elements, but also to the diseases which were afflicting the other villages which they would invariably visit while hunting. Serious illnesses remained with the group throughout the summer, with afflictions of "scrofula" (tuberculosis) complicating the already weakened condition of many individuals (Lucas 1888). Extensive provisioning was required to keep the group fed through these difficulties but reports indicate that supplies available would have been inadequate had not some members of the band moved off the reserve to locations where they could obtain some fish and game (Lucas 1888).

Reserve life thus continued to deteriorate, and it was during this time that the school was officially closed and very little farming done. In the fall, the Indians again participated in their customary hunt, ignoring the prescribed treatments of the doctor who until this point had been visiting the reserve on a fairly regular basis. Now too, the agent ceased bringing the doctor to the reserve in what was perhaps a final admission of the futility of dealing with a group of people so resistant to imposed changes (Lucas 1888).

In about September, 1888, Sharphead was replaced as chief by George Bear. The report from the Indian agent indicated that the former was then too old to take an active part in the affairs of the band (Lucas 1888). There is some mention also of the new chief trying to encourage the people to get back to work on the reserve and to follow directions given them by the doctor. Unfortunately, there are no other references available as to the effect of this change of leadership upon the affairs of the band; but it would seem that the potential influence of George Bear was seriously undermined by a recurrence of illness in 1890 (Clink 1891a). Influenza as well as other maladies seem to have been common among whites and natives in the area during the winter season, and again the Stoneys seem to have refused to remain settled on their reserve and were frequently away hunting and fishing (Clink 1891b).

In November, 1890, the farm on the Sharphead reserve was closed; and in 1891, the band dispersed to join other groups (Clink 1891c). Official transfers to other bands were completed between 1894 and 1896. Most families moved to White Whale Lake (Wabamun), while others joined the Ermineskin (Hobbema) and Ironhead (Edmonton Agency) bands. Sharphead himself moved to the Stoney reserve at Morley, Alberta, shortly before his death (Government of Canada 1897).

History has little more to say about the Sharphead people. In 1897, a small number of those who had settled at White Whale Lake tried to return to the old reserve, only to be sent back to Wabamun by government authorities (Forget 1897). Later in 1897, official surrender


CENTRAL ALBERTA
Ca. 1885—1897

of the Wolf Creek reserve was negotiated with the former members of the band. The final formal document was recorded in December, 1897, after assent to the surrender was received from nine surviving eligible voting members of the band residing at White Whale Lake (Government of Canada 1912).

The Site

The burials were recovered from the cemetery site on land now owned by Albert T. (Bill) and George Matejka. Personal communications with the former established the official location as S.E. 27, T. 42, R. 26, W. 4. The report by Karl MacDonald (1967) describes the site as follows:

> The site is on top of a gravel ridge running east to west with the northern edge dropping off into a small river valley, the Battle River. A Calgary Power transmission line runs north and south over the site. (p. 19)

The Borden system of site designation for Canada identifies this site as FkPd 100.

The Excavations

Excavations took place over two successive field seasons under the direction of the Department of Anthropology, the University of Alberta, Edmonton, Alberta. During the first season in 1965, fourteen skeletons were removed from twelve single and one double burials by Mr. and Mrs. W. D. Moore of Washington State University. In 1966, Karl H. MacDonald continued the excavations and removed eleven more individuals, all from single burials. While a brief account of the second season's work has previously been published by MacDonald (1967), few records of the first season's work are available and very little information can be extracted from departmental records. One particularly exasperating problem lies in the inability of researchers to align geographically the results of the two seasons' work. Maps made during the first season contain no data markers which can be used to match this map with the one made during the second season. It is fortunate, therefore, that in dealing with this group of burials, historical records exist to assure researchers that they are dealing with a single, local population.

Post-excavation Treatment of Remains

The remains were removed to the Department of Anthropology, University of Alberta, for cataloguing and storage. The bones were impregnated under vacuum with a mixture of white 'Bondfast' glue and water to help preserve them.

The skeletons were on a number of occasions used as student laboratory teaching materials. This has resulted in some of the more fragile features of the skulls and teeth being slightly damaged in some cases. Such apparent cases of damage have not, however, created significant difficulties in this study.

Since the fall of 1974, when the Department of Anthropology initiated discussions with Paul's Band of the Wabamun Reserve, the skeletons have been removed from the teaching and research collections until final disposition of the remains can be effected.

Goals of the Present Project

The primary goal of the present study is largely descriptive in nature, as it attempts to document the demographic variables of one relatively small, temporally and spatially restricted group of individuals. As with many skeletal collections from archaeological sites, certain limitations must be considered in researching the sample. Most obviously, the size of the group is very small. The fact that one-half of the individuals are children further limits the amount of data that can be derived from the remains as metrical and many non-metrical variables are commonly used to describe only adult specimens. Another factor of some concern is the possibility that such a group of individuals associated on a reserve may not be representative of the population, in this case of Alberta Stoney Indians, as a whole. Also, the high incidence of some skeletal traits suggests a closer genetic relationship than might be expected from a truly random sample.

Nevertheless, studies such as the following are essential in that they do provide the data base for more encompassing comparative studies. These latter types of studies may not only arrive at a more comprehensive evaluation of population genetic structure but may also trace genetic change through time and across geographical space to provide a fuller picture of human microevolutionary processes.

CHAPTER II

TECHNIQUES

Metrical Data

The set of measurements to be taken from a skeletal sample can be quite difficult to select. Traditional ones such as those described by Hrdlička (in Stewart 1952) and Montagu (1960) may be of limited value in what they reveal of the individuals and populations in question. The value of such measurements may often be based on little more than an easy recognition of the relevant landmarks involved or on the ease with which the measurements may be taken. As such, little attention has been paid to the anatomical significance of many of them. A great many of these measurements continue to be taken, however, partly as a matter of tradition; but more importantly because they provide the only basis upon which modern studies can be compared with those done in the past.

More recent studies such as those described by Howells (1966, 1969) tend to be more aware of the skeleton as a whole and of the possible meaning of measurements relative to each other. Ideally, such studies attempt to select those characters which indicate actual genetic influences. As a result, a whole new body of possible measurements has been added to an ever-expanding list. Whether or not these are of any greater value may be debatable since the underlying genetic base remains unknown in the great majority of cases. Nevertheless, a number of these new measurements form the bases of new techniques such as the various multivariate statistical techniques examined in this study and therefore must be included in the following list of measurements.

Cranial Measurements

Unless otherwise indicated the following cranial measurements were taken following procedures described in Montagu (1960).

1. Maximum cranial length. Spreading caliper. From glabella to opisthocranion.
2. Glabellar protrusion (Howells 1966). Spreading caliper. Maximum length is measured to an anterior point above glabella. This value is then subtracted from measurement "1" to give the degree of protrusion.
3. Maximum cranial breadth. Spreading caliper. Taken at right angles to the median sagittal plane, avoiding the supramastoid crests or posterior roots of the zygomatic arches.
4. Maximum frontal breadth (Howells 1966). Spreading caliper. Maximum at coronal suture.
5. Minimum frontal breadth. Spreading caliper. Minimum breadth between the temporal crests on the frontal bone.
6. Basion-bregma height. Spreading caliper.
7. Basion-nasion height (Brothwell 1965). Spreading caliper.
8. Basion-prosthion length. Spreading caliper.
9. Opisthion-forehead distance (Giles and Elliot 1963). Spreading caliper. From opisthion to the most distant point of the frontal bone in the mid-sagittal plane.
10. Mastoid length (Giles and Elliot 1963). Sliding caliper. Projection of the mastoid process downward, perpendicular to the ear-eye plane.
11. Biauricular breadth (Howells 1966). Spreading caliper. Measure the breadth of the skull base from one auriculare to the other.

12. Basion-porion distance (Lyon 1963). Spreading caliper.

13. Porion-nasion distance (Lyon 1963). Craniostat.

14. Porion-prosthion distance (Lyon 1963). Craniostat.

15. Porion-subnasale distance (Lyon 1963). Craniostat.

16. Biporial arc (Lyon 1963). Measuring tape. From porion, through bregma, to porion.

17. Upper cranial facial height. Sliding caliper. From nasion to prosthion.

18. Bizygomatic breadth (Giles and Elliot 1963). Sliding caliper. Greatest breadth of the zygomatic arches.

19. Nasal height. Sliding caliper. From nasion to subnasale.

20. Maximum nasal breadth. Sliding caliper. Maximum width of the aperture perpendicular to the mid-sagittal plane.

21. Orbital height. Sliding caliper. Maximum distance from the upper to lower borders perpendicular to the horizontal axis of the orbits.

22. Orbital breadth. Sliding caliper. Measured along the horizontal axis running from dacryon to ectoconchion.

23. Biorbital breadth. Sliding caliper. From ectoconchion to ectoconchion.

24. Interorbital breadth. Sliding caliper. From right to left dacryon.

25. Maxillo-alveolar length. Sliding caliper. From prosthion to the points of bisection of a line tangent to the posterior terminal borders of the alveolar processes.

26. Maxillo-alveolar width. Sliding caliper. From right to left ectomolare.

27. Bimaxillary breadth (Brothwell 1965). Sliding caliper. From one

zygomaxillare to the other.

28. Bifrontal distance (Howells 1966). Sliding caliper. Distance between the most anterior points of the fronto-malar sutures.

29. Zygomaxillary subtense (Howells 1966). Coordinating caliper. Measures the prominence of subspinale relative to the most anterior points of the zygo-maxillary sutures.

30. Anterior masseter length (Howells 1966). Sliding caliper. From the posterior limit of attachment of the anterior masseter to the most distant antero-medial point on the under surface of the maxillary bone.

31. Dacryon subtense (Howells 1966). Coordinating caliper. Prominence of the dacryon relative to the lateral borders of the orbits.

32. Nasion subtense (Howells 1966). Coordinating caliper. Prominence of nasion relative to the fronto-lateral limits of the frontal bone.

33. Bicondylar width. Sliding caliper. Distance between the most external points on the condyles of the mandible.

34. Bigonial width. Sliding caliper. Distance between the right and left gonion points.

35. Foramen mentalia breadth (Brothwell 1965). Sliding caliper. From one foramen mentalia to the other.

36. Minimum ramus breadth. Sliding caliper. Least distance between the anterior and posterior borders of the left ascending ramus perpendicular to its height.

37. Ramus height. Mandibulometer. From left gonion to the highest point on the left condyle.

38. Symphyseal height (Brothwell 1965). Sliding caliper. From gnathion to infradentale.

39. Mandibular length (Brothwell 1965). Mandibulometer. From the most posterior point of the condyles to the most anterior point of the chin.

40. Mandibular angle (Hrdlička from Stewart 1952). Mandibulometer. Measurement of the angle formed between the ascending and horizontal rami of the mandible.

Cranial Indices

The following all follow procedures described in Montagu (1960).

1. Cranial Index

Maximum breadth/Maximum length X 100

2. Cranial Length-Height Index

Basion-bregma height/Maximum length X 100

3. Cranial Breadth-Height Index

Basion-bregma height/Maximum breadth X 100

4. Upper Facial Index

Nasion-prosthion height/Bizygomatic breadth X 100

5. Nasal Index

Maximum nasal breadth/Nasal height X 100

6. Orbital Index

Maximum orbital breadth/Maximum orbital height X 100

7. Maxillo-Alveolar Index

Maxillo-alveolar width/Maxillo-alveolar length X 100

Dental Measurements

The following measurements were taken for all teeth.

1. Mesio-distal diameter. Needle tip calipers. Taken on each tooth along a line bisecting the mesial and distal margins with the end points located at the adjacent contact points (Goose 1963). For canines and incisors the end points were placed at the crest of curvature on the mesial and distal surfaces (Wheeler 1965).
2. Bucco-lingual diameter. Needle tip calipers. That line which bisects the tooth perpendicular to the occlusal surface with the end points located at the midpoint of the buccal or labial and lingual margins at the crest of curvature (Ditch and Rose 1972, modified from Goose 1963).

Postcranial Measurements

All measurements of the postcranial skeleton were taken according to Montagu (1960) unless otherwise indicated.

Humerus

1. Maximum length. Osteometric board. Between the most proximal and distal points, the bone being held parallel to the length of the board.
2. Antero-posterior shaft diameter. Sliding caliper. Taken at the middle of the shaft.
3. Medio-lateral shaft diameter. Sliding caliper. Taken at the middle of the shaft.
4. Maximum head diameter. Sliding caliper. Maximum diameter in any direction.
5. Proximal breadth (Singh and Bhasin 1968). Sliding caliper. Maximum medio-lateral breadth of the proximal end of the bone.
6. Minimum shaft circumference (Singh and Bhasin 1968). Measuring tape.

7. Epicondylar width (Singh and Bhasin 1968). Sliding caliper. Maximum width at the level of the epicondyles.

Radius

1. Maximum length. As for humerus.
2. Antero-posterior shaft diameter. As for humerus.
3. Medio-lateral shaft diameter. As for humerus.
4. Head diameter. As for humerus.
5. Distal breadth (Singh and Bhasin 1968). Sliding caliper. Maximum breadth of the distal end of the bone.

Ulna

1. Maximum length. As for humerus.
2. Antero-posterior shaft diameter. As for humerus.
3. Medio-lateral shaft diameter. As for humerus.
4. Proximal breadth. As for humerus.
5. Distal breadth. As for radius.

Clavicle

1. Maximum length (Hrdlička from Stewart 1952). Osteometric board.

Scapula

1. Morphological breadth. Sliding caliper. From the highest point of the superior angle to the lowest point of the inferior angle.
2. Morphological length. Spreading caliper. From the middle of the glenoid fossa to the vertebrion.
3. Breadth of the infraspinous fossa. Sliding caliper. From the inferior angle to the vertebrion.
4. Breadth of the supraspinous fossa. Sliding caliper. From the superior angle to the vertebrion.

Vertebral Column

The following measurements were taken for each of the lumbar vertebrae.

1. Anterior height of centrum. Sliding caliper. From the middle of the antero-superior lip to the middle of the antero-inferior lip of the body.
2. Posterior height of centrum. Sliding caliper. From the middle of the postero-superior border to the middle of the postero-inferior border of the body.

Sacrum and Pelvis

1. Anterior sacral length. Sliding caliper. From the middle of the sacral promontory to the middle of the antero-inferior margin of the last sacral element.
2. Anterior sacral breadth. Sliding caliper. Taken at the junction with arcuate lines.
3. Innominate height (Hrdlička from Stewart 1952). Osteometric board. Distance from the most superior point of the iliac crest to the most inferior point of the ischium.
4. Pubis length (Singh and Bhasin 1968). Sliding caliper. From the point of junction of the three innominate elements in the acetabulum to the most distant point of the pubis.
5. Ischium length (Singh and Bhasin 1968). Sliding caliper. From the point of junction of the three innominate elements in the acetabulum to the most distant point of the ischium.
6. Angle of the sciatic notch (Hrdlička from Stewart 1952). Protractor. A difficult measurement to obtain--the shape of the notch was outlined on paper and the angle then measured as accurately as possible.

Femur

1. Maximum length. Osteometric board. Maximum distance between the internal condyle and the head.
2. Bicondylar length. Osteometric board. Both condyles are placed against the fixed upright, and the distance to the head is measured.
3. Antero-posterior shaft diameter. Sliding caliper. Taken at the middle of the shaft.
4. Medio-lateral shaft diameter. Sliding caliper. Taken at the middle of the shaft.
5. Subtrochanteric antero-posterior diameter. Sliding caliper. Taken immediately below the lesser trochanter in the sagittal plane.
6. Subtrochanteric medio-lateral diameter. Sliding caliper. From the medial to lateral surfaces at the same point as the preceding measurement.
7. Maximum head diameter. Sliding caliper. Maximum diameter taken in any direction.
8. Epicondylar width (Singh and Bhasin 1968). Sliding caliper. Maximum width of the epicondyles.

Tibia

1. Maximum length. Osteometric board. From the tip of the medial malleolus to the superior surface of the lateral condyle.
2. Antero-posterior shaft diameter. Sliding caliper. Taken at the middle of the shaft.
3. Medio-lateral shaft diameter. Sliding caliper. Taken at the middle of the shaft.
4. Antero-posterior nutrient foramen diameter. Sliding caliper. Taken at the level of the nutrient foramen.

5. Medio-lateral nutrient foramen diameter. Sliding caliper. Taken at the level of the nutrient foramen.
6. Proximal diameter (Singh and Bhasin 1968). Sliding caliper. Maximum medio-lateral diameter of the proximal end of the bone.
7. Distal diameter (Singh and Bhasin 1968). Sliding caliper. Maximum medio-lateral diameter of the distal end of the bone.

Fibula

Only the maximum length (osteometric board) was measured from this bone.

Talus

Measurements for the talus and calcaneus were all taken using procedures described by Steele (1970).

1. Maximum length. Sliding caliper. Measurement along a projected line from the sulcus for the flexor hallucis longis muscle to the most anterior point of the articular surface for the navicular.
2. Maximum width. Sliding caliper. The line of the measurement should bisect the articular surface for the tibia slightly forward of the midpoint.
3. Body height. Sliding caliper. From the base to the most superior point of the tibial facet.
4. Trochlear width. Sliding caliper. Maximum medio-lateral distance.
5. Trochlear length. Sliding caliper. Maximum antero-posterior distance.

Calcaneus

1. Maximum length. Sliding caliper. Measurement along a projected line from the most posterior point of the tubercle to the most antero-superior point of the cuboidal facet.

2. Body height. Sliding caliper. Greatest height from the most inferior point of the tubercle to the most superior point of the posterior facet of the calcaneus, including any superior projection of this facet.
3. Load arm length. Sliding caliper. Measurement along a projected line from the most posterior point of the articular surface for the talus to the most antero-superior point of the cuboidal facet.
4. Load arm width. Sliding caliper. Measurement along a projected line from the most lateral point of the posterior articular surface for the talus to the most medial point of the sustenaculum tali.

Postcranial Indices

Unless otherwise indicated, the following indices are calculated according to Montagu (1960).

1. Lumbar Index

   Sum of posterior heights of centra/Sum of anterior heights X 100

2. Sacral Index

   Anterior sacral breadth/Anterior sacral length X 100

3. Ischio-Pubic Index

   Pubis length/Ischium length X 100

4. Platymeric Index

   Subtrochanteric antero-posterior diameter/Subtrochanteric medio-lateral diameter X 100

5. Platycnemic Index

   Medio-lateral nutrient foramen diameter/Antero-posterior nutrient foramen diameter X 100

Non-metrical Data

Non-metrical or meristic traits offer another source of data upon which populations may be compared. These traits have the advantage of being discrete, localized characteristics which are quite easily scored as 'present' or 'absent', and are often observable even on broken or otherwise damaged material. Another advantage is that sex differences are not considered to be significant for the vast majority of traits (Berry and Berry 1967) so sample size can therefore be increased by considering males and females as one sample. Age changes in some of these traits do appear to occur (Ossenberg 1973), but immature individuals may be included in the sample for many other traits.

It may also be a somewhat simpler matter to study the genetic base of many meristic traits. A number of studies of skeletal variations in rodents have helped to elucidate some patterns of inheritance (Berry 1963; Gruneberg 1963), and Berry (1968) suggests that evidence exists to support arguments for similar patterns of inheritance in humans.

Nevertheless, various investigators have noted the complexities which must be considered in these studies of inheritance. Berry (1963, 1967) has extensively discussed epigenetic traits where ontogenetic processes must also be considered. Searle (1954) and Deol and Truslove (1957) have noted variations in traits resulting from dietary deficiencies at critical stages of development. Studies of Wormian bones suggest that some traits may not be entirely independent and that presence of ossicles in one part of the skull may increase the likelihood of their appearance in other parts (Ossenberg 1973). Stress such as that caused by artificial deformation of the cranium has been suggested as a factor producing extra bones in some cranial sutures (Dorsey 1897; Ossenberg 1970).

The following discrete traits are those for which variation was observed. Unless otherwise indicated, descriptions are taken from Berry and Berry (1967).

1. Ossicle at lambda. A bone at the junction of the lambdoid and sagittal sutures--includes Os Inca.
2. Lambdoid ossicles present. One or more ossicles appear in the lambdoid suture.
3. Parietal foramen present.
4. Ossicle at asterion. A sutural bone occurs at the junction of the parietal, occipital, and mastoid portion of the temporal bone.
5. Foramen of Huschke. Foramen occurring in the floor of the external auditory meatus. While this is normal in small children, it normally does not persist past the fifth year.
6. Mastoid foramen exsutural.
7. Mastoid foramen absent.
8. Condylar facet double. The articular surface of the occipital condyle is divided into two facets.
9. Precondylar tubercle present. A bony tubercle may lie anterior and medial to the occipital condyle.
10. Accessory palatine foramen present. These may be found immediately posterior to the greater palatine foramen.
11. Zygomatico-facial foramen absent. This foramen pierces the zygomatic bone opposite the junction of the infraorbital and lateral margins of the orbit.
12. Supraorbital foramen complete. Either a notch or a foramen may transmit the supraorbital vessels and nerves.
13. Frontal notch or foramen present. This is a secondary notch or

foramen usually found lateral to the supraorbital foramen.

14. Anterior ethmoid foramen exsutural. This foramen usually is located in the suture between the orbital plates of the frontal and ethmoid bones.

15. Accessory intraorbital foramen. One or more secondary foramina may be found adjacent to the infraorbital foramen.

Descriptions of the following skeletal anomalies were taken from Ossenberg (1969).

16. Foramen ovale incomplete.

17. Foramen spinosum open.

18. Mylohyoid canal or bridge. The groove for the mylohyoid nerve on the inner surface of the ascending ramus of the mandible is converted to an enclosed canal.

19. Absence of the occipital condylar canal.

Further anomalies frequently discussed in the literature include:

20. Divided or missing foramen transversarium.

21. Spina bifida. The neural arch is not completely formed on the posterior surface of the sacrum, leaving the nerve cord somewhat exposed.

22. Septal aperture of the humerus. A foramen pierces the bone within the olecranon fossa.

The following dental traits are taken from Dahlberg (1963).

23. Carabelli's cusp. An accessory cusp occurs on the anterior medi[illegible] aspect of the lingual surface of the maxillary permanent and

deciduous molars. This cusp may vary from a small pit or furrow to a large cusp.

24. Protostylid. An accessory cusp found on the anterior portion of the buccal surface of the lower molar teeth. This may vary from a small pit or other irregularity to a large, well-defined cusp.
25. Shovel-shaped incisor teeth. Mesial and distal ridges enclose a central fossa on the lingual surface.
26. Mandibular molar morphology. Molars are examined for number of cusps present, and for either a 'Y' or '+' fissure pattern.
27. Maxillary molar morphology. The teeth are examined for numbers and patterns of cusps present, in this case following Greene's (1967) modifications of Dahlberg's original descriptions.

Multivariate Techniques

Multivariate analyses are used in this study as an aid in determining the sex of each of the individuals in the sample. Since this is the only context in which the techniques are used, they are discussed in detail in that chapter. The following discriminant functions are those which have been used here.

1. Giles and Elliot (1963). These authors derived various formulae for determining sex of American Whites and American Blacks. The one formula used to analyze the Sharphead material utilizes the following measurements, weighting factors, and sectioning point:

Glabello-occipital length	6.083
Maximum width	-1.000
Basion-bregma height	9.500

Bizygomatic diameter	28.250
Basion-prosthion distance	2.250
Prosthion-nasion distance	9.917
Palate breadth	-19.167
Mastoid length	25.417

Sectioning point=6237.95

2. Lyon (1963). Lyon derived his various formulae from Arikara crania from the northern plains. The formula used here is as follows:

Bizygomatic diameter	.75702
Basion-bregma height	.22641
Alveolar breadth	.2944

Sectioning point=150.0

3. Steele (1970). Two of the formulae which were derived for American Blacks and Whites are tested in this study. Both utilize various tarsal measurements.

a. Formula using the talus only:

Maximum length	0.436
Maximum width	0.441
Trochlear width/Trochlear length	9.232

Sectioning point=49.0

b. Formula using the talus and calcaneus

Body height of calcaneus	0.26867
Length of talus	0.76766
Talus width/Talus length	29.41820
Trochlear width/Trochlear length	11.67198

Sectioning point=84.79199

CHAPTER III

THE INDIVIDUALS

Age and sex of the individuals in the sample were assessed on the basis of morphological features used in common anthropological procedures. Most skeletons were essentially complete, and reasonably detailed analyses could therefore be made. Among sub-adults, dentition was of course the most useful criterion for determining age. No attempt was made to determine the particular sex of each juvenile since the standard methods for identification of sex are not considered reliable for pre-pubescent individuals. Sexing of adults was based primarily on the morphology of the pelvis. Most skeletons had the pubic symphysis intact; therefore, the ages of most adult males could be determined using McKern and Stewart (1957) standards of comparison for such analyses. A modification of this technique devised by Gilbert and McKern (1973) was used for the females.

Stature was estimated using the methods established by Trotter and Gleser (1958). Wherever possible the formulae used here combine the measurements of the femur and tibia. Since the authors did not derive a formula for Mongoloid females, the formula for males was used. The stature estimation obtained using the formula for white females is also given for each female in the sample.

There are twenty-five individuals present in this sample. The fact that they are numbered for 1 to 13 and from 17 to 27 is the result of a lack of communication between the two teams of excavators operating during the two different seasons; those of the second year were not aware of how many skeletons had previously been removed and selected a somewhat arbitrary number with which to commence their own system. All burials were single interments with the exception of burial number nine in which two children were buried together. The following discussion is meant to be only a general introduction to the individuals available for analysis. Most of the data presented here will be considered at greater length in the relevant sections dealing more specifically with particular problems.

Individual 1

Age and sex: an adult male, approximately twenty-six years old.

Stature: Approximately 160 cm.; this was the shortest male interred at the site. He is also the most gracile individual of either sex.

Parts present: The skeleton is complete except for a few of the carpals and some of the distal phalanges of the hands and feet. Sacral elements three to five are also missing.

Variations and anomalies: Double transverse foramina occur on cervical vertebrae numbers six and seven. The right ascending ramus of the mandible is seriously deformed-- a condition which seems to be associated with some overall distortion of the facial region. There is a noticeably deviated nasal septum.

Trauma: This individual apparently had his nose broken at one time; the bridge is very flat and irregular.

Individual 2

Age: a young child of three or four years.

Parts present: The skeleton is more or less complete considering the immature state of the individual in which many parts of the skeleton are not completely formed and/or are easily destroyed.

Most hand and foot bones are missing. Only one upper central incisor is present, and the left upper canine is also missing.

Variations and anomalies: The central maxillary incisor which is present has a divided root tip.

Lesions: Both upper first deciduous molars are carious.

Individual 3

Age: about twelve years old.

Parts present: This is a complete skeleton except for one missing cervical vertebra, some of the smaller epiphyses from various regions of the body, and a number of smaller bones from the hands and feet.

Variations and anomalies: Two large Os Inca are present. There is crowding of the anterior maxillary dentition.

Individual 4

Age and sex: a mature female approximately forty-eight years old.

Stature: Since the lower limb bones are missing, length of the radius was used as the basis for stature estimation; height is suggested as 163.4 cm. if the formula for Mongoloid males is used, and 163.9 cm. if the formula for white females is used.

Parts present: In this case, the lower part of the body is missing. There is one innominate present as well as the sacrum, but no lower limb bones. In addition, there are only two bones from the right hand and none from the left.

Variations and anomalies: There is a small osteoma located on the left side of the frontal bone.

Lesions: There is a very small amount of osteoarthritic spurring in the vertebral notches. Both upper first molars have small pit cavities on the occlusal surface, and there is some alveolar resorption evident on both the mandible and maxilla.

Individual 5

Age: about six or six and one-half years.

Parts present: The skeleton is quite complete for an individual of this age, but most hand and foot bones are missing.

Individual 6

Age: approximately five years.

Parts present: essentially complete.

Individual 7

Age and sex: male, approximately twenty-five years old.

Stature: approximately 166 cm..

Parts present: The skeleton is complete except for the broken innominates and proximal ends of the femora. The patellae as well as a number of carpals and tarsals and several phalanges of both the hands and feet are all missing.

Variations and anomalies: Double transverse foramina occur on cervical vertebrae numbers six and seven. This individual also has a deviated nasal septum.

Lesions: There is an abscess on the lower left first molar, and some dental caries.

Individual 8

Age and sex: male, about nineteen years old.

Stature: approximately 173 cm..

Parts present: a complete skeleton except for a small number of carpals, tarsals, and phalanges.

Variations and anomalies: The lower second deciduous molars are both still present. Both are carious.

Lesions: a broken and decayed lower left first molar.

Individual 9A

Age: approximately seven years of age.

Parts present: generally a complete skeleton.

Individual 9B

Age: approximately seven years of age.

Parts present: generally a complete skeleton, but the hand and foot bones are in very poor condition. The skull has been distorted, and the facial region broken.

Variations and anomalies: There has been premature fusion of the sagittal and lambdoid sutures, although the resulting deformation is difficult to assess since some crushing has occurred while the remains were interred. It has been suggested (Dr. G. H. Sperber, personal communication) that this combination of some prematurely fused and some wide open sutures is unusual and suggests a possible disease process.

Individual 10

Age and sex: female, about thirty-nine years of age.

Stature: This was a very robust woman, approximately 169 cm. tall if the formula for Mongoloid males is used, and 167 cm. tall if the formula for white females is used.

Parts present: The skeleton is complete except for a very few bones of the hands and feet. There is some damage to the lower limb bones.

Variations and anomalies: Double transverse foramina appear on cervical vertebrae numbers six and seven. There are six sacral elements with incomplete fusion of the first element.

Lesions: There is an abscess of the left maxillary second molar and some other minor dental caries.

Individual 14

Age: four or five years.

Parts present: generally a complete skeleton for an individual of this age. Although the cranium was originally excavated, it was, at some point prior to this study, removed from the collection and is thus not available for analysis.

Individual 15

Age: approximately six years.

Parts present: essentially complete; the cranium is somewhat crushed with the base broken.

Individual 16

Age: approximately seven years.

Parts present: generally complete.

Variations and anomalies: There are double transverse foramina on cervical vertebra number seven.

Individual 17

Age: seven years old.

Parts present: complete.

Variations and anomalies: double transverse foramina on cervical vertebrae numbers five, six, and seven.

Individual 18

Age and sex: male, approximately twenty years old.

Stature: about 173 cm..

Parts present: complete except for a very few bones of the hands and feet. There is some damage to the innominates.

Lesions: There is poor alignment of the mandibular anterior dentition, with the left first incisor and the right first premolar crowded out of position. The incisor is badly discolored, indicating that it was probably necrotic.

Individual 19

Age and sex: female, roughly thirty-five years old.

Stature: approximately 162 cm. if the formula for Mongoloid males is used, and 157. cm. if the formula for white females is used.

Parts present: complete except for a few b[illegible] of the hands and feet and a few teeth from the lower dentition.

Variations and anomalies: X-ray analysis reveals that there is a congenital absence of the upper right third molar. Double transverse foramina occur on cervical vertebra number seven. There is a somewhat crooked nasal septum. In addition, this person showed some slight evidence of spina bifida.

Individual 20

Age: six years.

Parts present: Although there is some damage to the lower limb bones, the skeleton sppears to be generally complete.

Variations and anomalies: There is a suggestion of one large Os Inca. The suture separating it from the rest of the occiput has a recently fused appearance. Double transverse foramina occur on cervical vertebrae numbers six and seven.

Individual 21

Age and sex: male, about thirty-six years of age.

Stature: This was an extremely robust individual of about 180 cm..

Parts present: complete.

Variations and anomalies: The nasal septum is extremely crooked. Double transverse foramina occur on cervical vertebrae numbers six and seven.

Lesions: The mandibular first premolars have been pushed out of alignment. The distal half of both mandibular first molars have been worn down into deep, smooth pits; otherwise, there is only one tooth exhibiting a minor dental cavity.

Individual 22

Age: approximately eleven years.

Parts present: essentially complete, although there is no sternum and a few teeth are missing from the mandible.

Variations and anomalies: Double transverse foramina occur on cervical vertebrae numbers six and seven.

Individual 23

Age: approximately nine years.

Parts present: essentially complete.

Variations and anomalies: Double transverse foramina occur on cervical vertebra number six. There is an incomplete costal bar on the left side of cervical vertebra number seven.

Individual 24

Age and sex: female, approximately twenty years old.

Stature: approximately 162 cm. if the formula for Mongoloid males is used, and 157 cm. if the formula for white females is used.

Parts present: complete except for a few teeth, one thoracic vertebra, and a few phalanges of the hands and feet.

Individual 25

Age and sex: female, approximately fifty-six years old.

Stature: Height is estimated to be 164 cm. if the formula for Mongoloid males is used, and 159.4 cm. if the formula for white females is used.

Parts present: complete, although some bones of the feet are in very poor condition.

Variations and anomalies: The nasal septum is quite deviated. There is a ninety degree rotation of the upper right second premolar. There are six sacral vertebrae, and some evidence of spina bifida.

Lesions: There is severe osteitis of the left lower limb. Some dental caries is present. There is also a small amount of arthritic spurring in the vertebral notches.

Individual 26

Age and sex: female, approximately twenty-one years old.

Stature: approximately 160.5 cm. if the formula for Mongoloid males is used, and 156 cm. if the formula for white females is used.

Parts present: complete except for most carpals of the right hand and a few phalanges of the hands and feet.

Lesions: extensive dental caries, particularly in the mandible. There is also some alveolar resorption, especially involving the right side of the mandible.

Individual 27

Age and sex: male, about thirty years of age.

Stature: approximately 167 cm. tall.

Parts present: complete except for four of the cervical vertebrae, the left maxillary third molar (post-mortem loss), and a number of bones from the hands and feet.

Variations and anomalies: The nasal septum is extremely deviated.

Lesions: There is poor alignment of the maxillary anterior dentition; the left lateral incisor and canine are pushed out of alignment. Dental caries is also present on the occlusal surfaces of both mandibular first molars.

CHAPTER IV

SEX DETERMINATION

Subjective Methods

Sex of the various individuals was originally determined through methods of visual examination of the bones, with greatest weight being given to the pelvis. Evaluations were made independently by different members of the Department of Anthropology, University of Alberta, and a consensus was arrived at.

Although all the skeletons are relatively complete, determining the sex of each was not as straightforward as might have been expected. Commonly utilized features of the pelvis gave indeterminate results in a number of cases. The sciatic notch and pre-auricular sulcus were not particularly useful, but the sub-pubic angle did appear to divide the sample quite clearly. These and other sex differences in pelvic structures are discussed in more detail in the chapter dealing with the morphology of the postcranial skeleton.

It should also be mentioned that, while pelvic features are generally considered to be reliable indicators of sex, they are still secondary indicators; and, since historical documentation indicating the exact identity of the individuals has not been found, there must remain the possibility of error in the determinations which have been made.

Further general observations of the skeletons did not reveal any other clear-cut sex differences. Most distinctions between sexes are usually related to differences in size and robusticity. Stating the present problem in its briefest sense, few correlations between sex as indicated by pelvic structure and general size and ruggedness of the skeleton could be established. A number of females tended to be quite large, with very well-defined markings of previous muscle attachments. In almost any other population, one would scarcely hesitate in identifying these individuals as "male". Conversely, one male in particular was extremely gracile and small. Other males, while not exceptionally slight, did appear noticeably more so when compared to the very robust females. Again, further details concerning this problem are included in chapters dealing with morphology.

Univariate Statistics

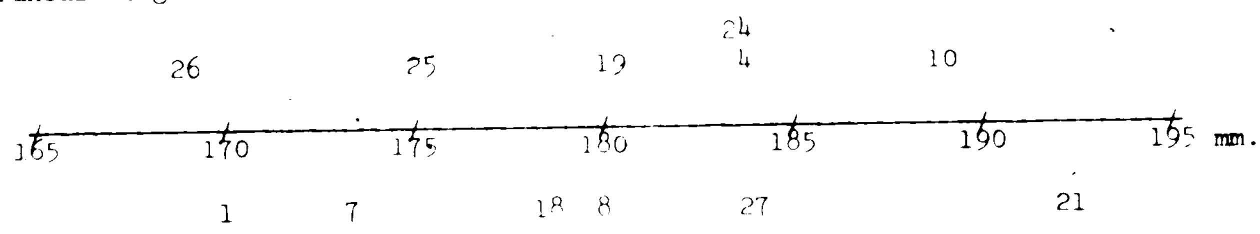
Examination of a number of metrical variables does little more than further illustrate the lack of sexual dimorphism within this sample. The histograms on the following pages indicate the distribution of both males and females for some selected variables.

The individual features used here are not meant to provide a comprehensive discussion of particular sex differences, since many of these are discussed in following chapters. The histograms do illustrate the different patterns of variation found among different measurements taken from the skeletons. In a great many cases, there is almost complete overlap in the range of values determined for each sex. This pattern is apparent in a number of the standard measurements such as cranial length, basion-bregma height, clavicular length, talus length, and numerous others. In other cases there appears to be a clumping of female values somewhere within the range established for the males. Mastoid length, opisthion-forehead distance, maxillo-alveolar length, tibia length, and again many others conform to this pattern. Individual measurements with good discriminating powers are rare, although for the

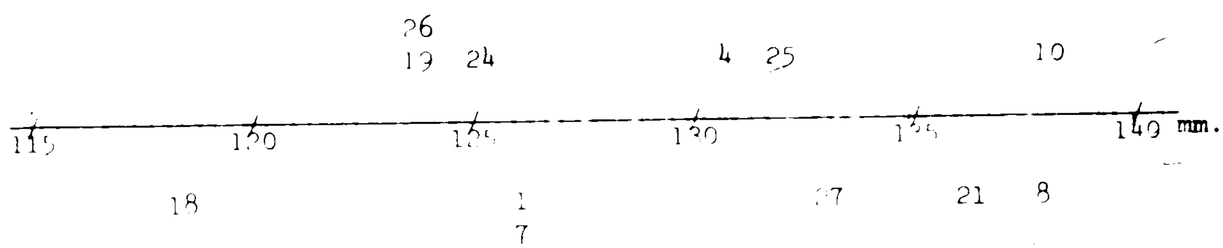
FIGURE 1: VARIATIONS IN CRANIAL MEASUREMENTS

Individuals are identified by number; females are placed above the scale line, and males are placed below it.

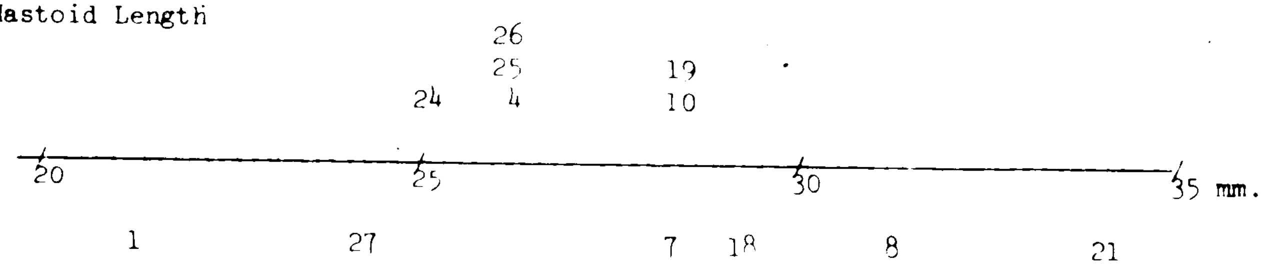
a. Cranial Length



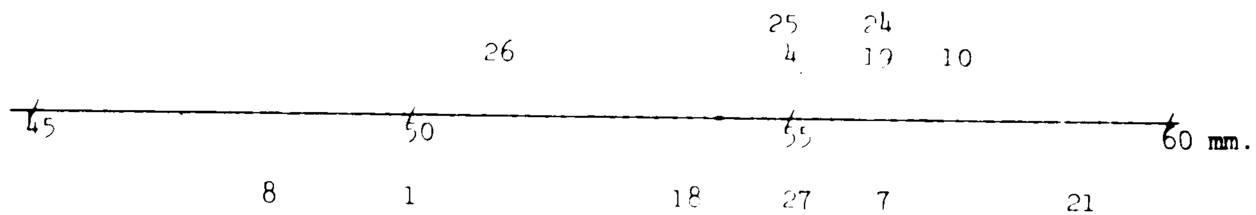
b. Basion-Bregma Height



c. Mastoid Length



d. Maxillo-Alveolar Length



e. Bizygomatic Diameter

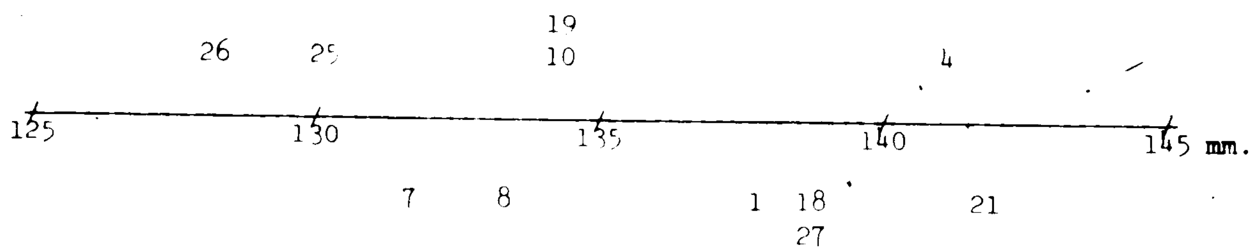
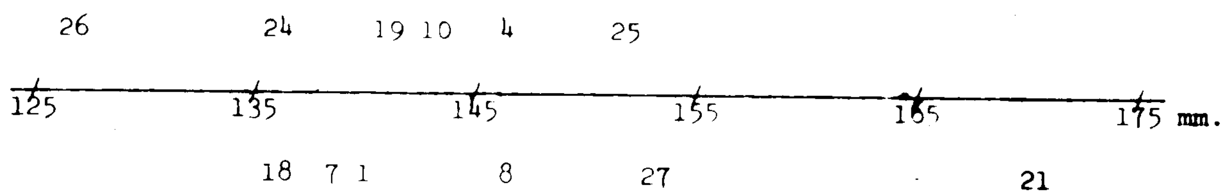


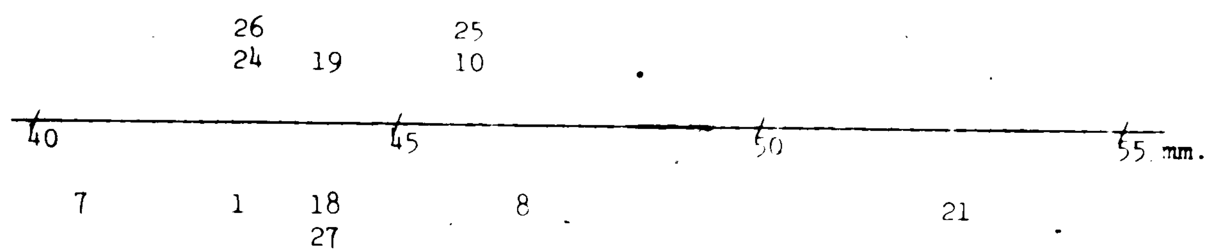
FIGURE 2: VARIATIONS IN POSTCRANIAL MEASUREMENTS

Individuals are identified by number; females are placed above the scale line, and males are placed below it.

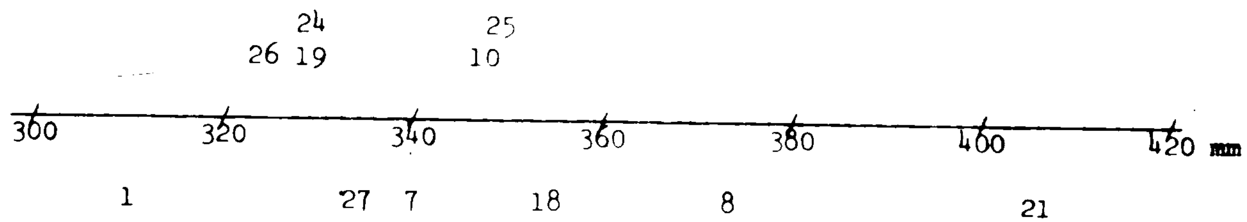
a. Clavicle Length



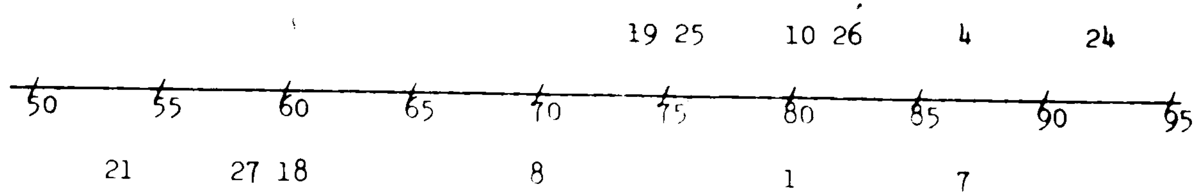
b. Femur Head Diameter



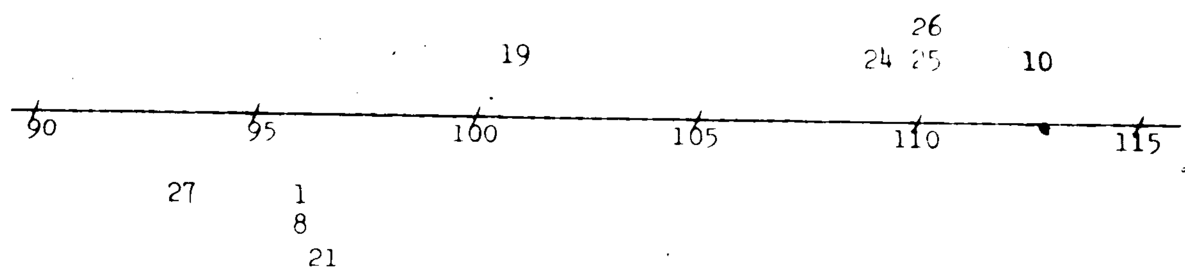
c. Tibia Length



d. Angle of Sciatic Notch



e. Ischio-Pubic Index



cranium bizygomatic diameter is relatively successful in this regard. Giles and Elliot (1963) and Lyon (1963) refer to this measurement as being valuable in sex discrimination; and the present study would tend to support their contention, even though three individuals (two males and one female) are identified incorrectly using this criterion alone. Postcranially, individual measurements are not extremely valuable, even for structures of the pelvis normally considered to be reliable. The angle of the sciatic notch, for example, misidentifies two males. Having relied heavily upon the appearance of the sub-pubic angle to previously determine the probable sex of each individual, it was reassuring to discover that [illegible]e visual determinations could be substantiated by analysis o[illegible]ischio-pubic index which does separate the sample into two distin[illegible]s.

Multivariate Statistics

It has been argued (Howells 1969) that comparisons between groups using single measurements such as those already discussed cannot provide complete structural profiles to provide a general impression of how the groups do in fact differ in total morphological pattern. Emphasis is given to isolated individual features with the biological significance and relative importance of the different criteria often being overlooked or simply not considered.

Multivariate statistical techniques attempt to overcome these limitations with the simultaneous consideration of numerous variables to provide a more complete impression of the groups under study. Discriminant function analysis has been used to separate sex groups by a number of investigators (Giles and Elliot 1963, Lyon 1963, Steele 1970, and others) working with different populations; and most of these have apparently met with considerable success--achieving 85% accuracy or more.

However, when small groups of burials or even isolated individuals are discovered, it is not possible to derive a new discriminant function if one is not already available for the population represented by such burials. In such situations, the Sharphead burials being a case in point, discriminant function analysis must rely on formulae previously derived for other groups. Certainly, some differences in the genetic structures of the populations will exist. It might be hoped, however, that a certain high degree of accuracy could still be attained--especially if a bimodal distribution appears in the analysis to suggest sex differences, even if the sectioning point between them must be adjusted to either a higher or lower value. This possibility was investigated using the various formulae previously described to determine the sex of each of the Sharphead individuals. The results are summarized in the histograms on the following pages.

As with the previous methods, the results here are quite disappointing. The formula established by Giles and Elliot identifies all except two individuals as male. The remaining two are correctly identified as female. No bimodal distribution is apparent although there tends to be clustering of individuals in different parts of the overall distribution. These clusters cannot, however, be used to establish a new sectioning point that will discriminate sex groups to correspond with those already established by visual methods.

Steele's function using measurements of the talus and calcaneus also fails to provide good separation within this sample. Using his sectioning point, four of five females are identified as males; and one of six males is identified as female. Clumping of individuals at similar values indicates a lack of bimodal distribution. Using his formula for the talus alone identifies two males as females and three females and males.

Lyon's formula derived for Arikara crania would appear to be somewhat more accurate when used to analyze the Sharphead burials, but it is still not particularly reliable. Two females are identified as males, although Individual 10 is almost exactly on the sectioning point. One male is clearly identified as female, but two other males are extremely close to the sectioning point of 150.599. Nevertheless, with values of 150.7 and 150.9, these individuals can be considered to be correctly identified.

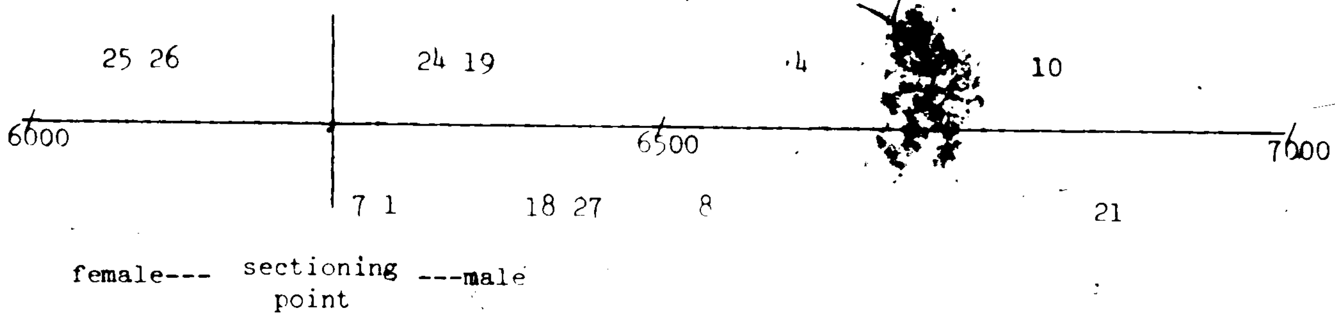
As is apparent in the preceding pages, attempting to sex these individuals by almost any method has not been particularly successful. Discriminant function analysis has not proved to be a superior method since none seems to produce a good bimodal separation of the sample. Also, no two formulae seem to order the individuals in the same pattern. Sex determination based upon the bizygomatic diameter alone gives results almost as satisfactory as Lyon's most successful formula and better than the other multivariate methods attempted. None of these methods, however, gives results equal to that of the ischio-pubic index--which in turn essentially only substantiates what was determined through visual examinations made at the beginning of the analysis.

Therefore, contrary to some suggestions (Giles and Elliot 1963), it cannot be claimed that discriminant functions derived for one group have extensive applicability among other populations. It appears that wide differences among gene pools would no doubt often produce the kinds of problems faced in this present study. Although Lyon's work was done on North American Indian material, it was not significantly more valuable for use with the Sharphead material than those formulae derived for American Blacks and American Whites. It is suggested then that one might wisely hesitate before indiscriminantly applying these methods to a broad range of populations; particularly when remains are incomplete and no supporting determinations can be made from pelvic material.

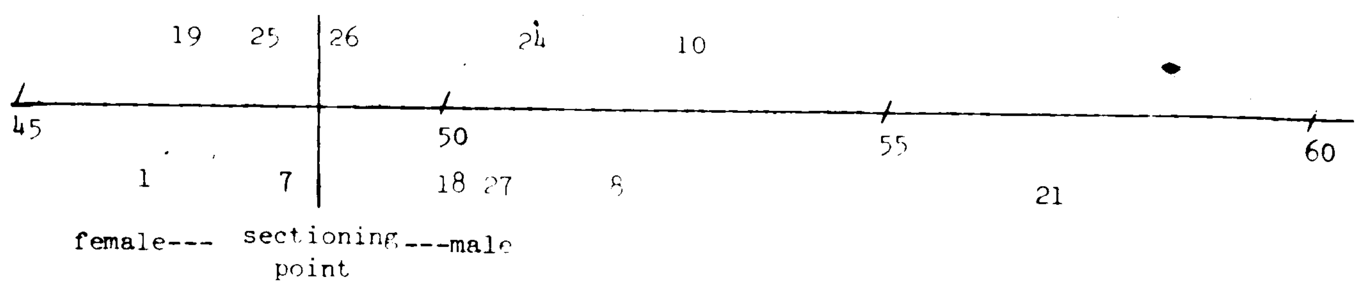
FIGURE 3: SEX DISCRIMINATION USING MULTIVARIATE ANALYSES

Individuals are identified by number; females (as identified by visual analysis) are placed above the scale line, males are placed below it.

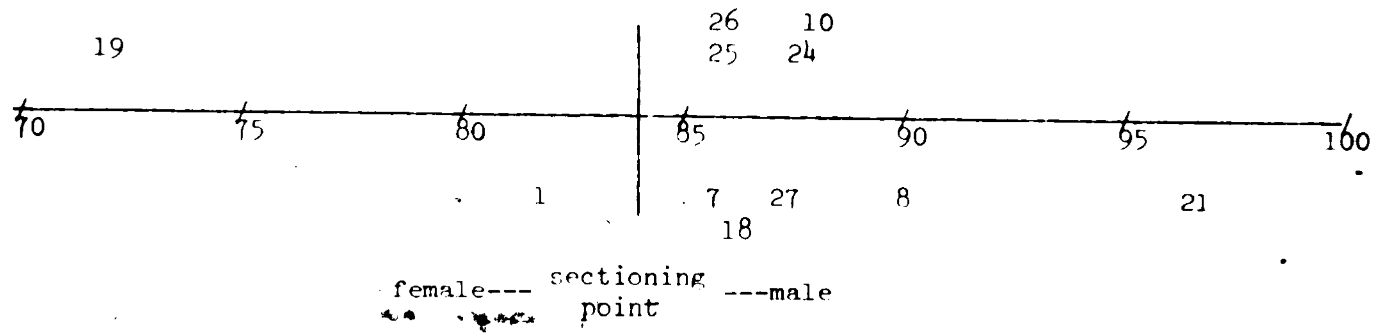
a. Cranial Analysis (Giles and Elliot 1963)



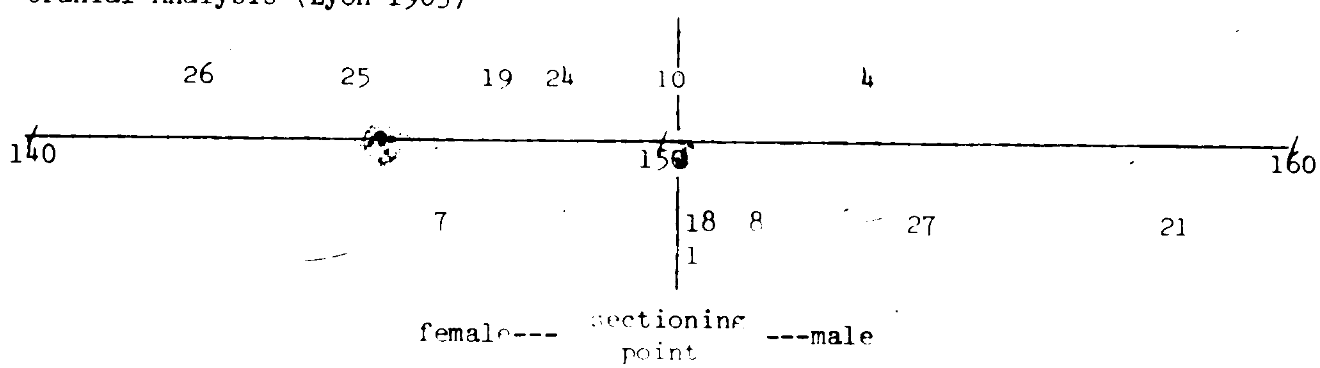
b. Analysis of the Talus (Steele 1970)



c. Analysis of the Talus and Calcaneus (Steele 1970)



d Cranial Analysis (Lyon 1963)



CHAPTER V

AGE DETERMINATION

Juveniles

The most reliable criteria for estimating the ages of immature individuals involve dental analysis--stages of tooth development and eruption. Unlike many other methods, it has been suggested that patterns of tooth eruption are relatively consistent; showing low degrees of inter-group variability, including only slight racial differences (Hunt and Gleiser 1955). While slight sex differences may exist, with females being somewhat more precocious than males, the degree of difference is again considered to be minimal (Miles 1963).

Patterns of osseous development are, on the other hand, much more difficult to evaluate. Considering the absence of comparative works, we should not hope to suggest that age-significant changes take place at the same times and at the same rates in all populations as they do in the modern American/European control groups from which the standards of comparison have been derived. There is the definite possibility of distinct genetic factors controlling both the patterns of events and the total range of variability within the different populations under study. Complicating the issue still further is the fact that postcranial remains are frequently not complete as a result of the ease with which small bones and unfused epiphyses may disintegrate. This has certainly been the case with the Sharphead material which, while generally in a state of excellent preservation, has many instances where such bones are either badly eroded or are missing altogether.

Regardless of the criteria being used as age indicators, non-genetic, environmentally controlled or influenced factors affecting growth rates must also be considered. Among these the effects of climate, nutrition, and/or disease may be of extreme importance. Relating specifically again to the Sharphead material, it is difficult to imagine that any developmental processes were completely unhindered by the recurring periods of starvation and disease visited upon the children over a period which for many of them constituted a lifetime.

So, while the ages given for the juveniles in this sample may have the aura of consistency and reliability about them, they must be accepted as accurate only if none of the fore-mentioned factors had any significant effects--an assumption that in itself cannot be tested. It is difficult to imagine that even dental development was unaffected by such poor living conditions; but since these processes are considered to be basically more reliable than others, they are used here to suggest the respective ages of the immature individuals.

Individual 2

All the deciduous dentition is in place and the six-year molar is not erupted. The suggested age is three or four years.

Individual 3

The permanent incisors and canines are present as are the first and second molars. Although the second deciduous molars should be replaced by about ten years, they are still present in both the upper and lower dentitions. Nevertheless, the age is estimated at twelve years.

Individual 5

The permanent central incisors are either erupting or are about to do so. The permanent first molars have also erupted. Age is therefore estimated to be six years.

Individual 6

All of the dentition is deciduous. The first molars are present in their sockets but are unerupted. Age is about five years.

Individual 9A

The permanent central incisors are present while the lateral incisors are just beginning to erupt. The first molar has erupted. The deciduous canines and deciduous molars are still present. Age is about seven years.

Individual 9B

The dentition is essentially the same as that of Individual 9A, and the two are of very similar ages.

Individual 11

Here the cranium is missing, and only the mandible is available for analysis. The central incisors are missing, but all the other dentition is deciduous. The first permanent molar is unerupted. The age is estimated to be five years.

Individual 12

The permanent incisors are beginning to erupt, while the first permanent molars appear to be newly erupted. All other dentition is deciduous. Age is about six years.

Individual 13

The permanent central and lateral incisors have erupted, as have the first molars. All other dentition is deciduous. Age is about seven years.

Individual 17

All permanent incisors and first molars are present. Deciduous canines and molars remain. Age is about seven years.

Individual 20

The permanent central incisors are present while the lateral incisors are only beginning to erupt. The first molar is recently erupted. Age is about six and one-half years.

Individual 22

All permanent incisors are in place. The permanent canines and premolars are beginning to erupt. The first molars have erupted and the second molars are beginning to do the same. Age is suggested to be eleven years.

Individual 23

The permanent incisors are all present as are the first molars. Deciduous canines and molars are still present, although the canines appear ready to be shed. Age is estimated to be nine years.

Adults

The borderline between juveniles and adults was loosely taken to be the eruption of the third molar and the fusion of the spheno-occipital synchondrosis. Wherever the pubic symphysis was intact, males were aged according to the McKern and Stewart standards of analysis (McKern and Stewart 1957); while females were aged using a modification of this basic method which has been devised by Gilbert and McKern (1973). Where the pubic symphysis was not suitable for analysis, more subjective evaluations had to be made based upon portions of the symphysis that were present and upon other indicators such as the general state of epiphyseal fusion.

The results of the age determinations made from the studies of the male pubic symphyses are given in Table I. Individual 7 was aged approximately on the basis of a somewhat damaged ventral surface of the pubic symphysis (the only portion present), giving him an estimated age of twenty-two years. All epiphyses, with the exception of one acromion, are fused; suggesting, perhaps, a slightly older age. Individual 8 has been considered an adult here even though the mandibular third molars are not quite completely erupted. The spheno-occipital synchondrosis still shows a line suggesting recent fusion. Although the pubic symphysis is not available for Individual 18, he was judged to be approximately twenty years old on the basis of fully erupted third molars but a state of eiphyseal fusion not markedly different from that of Individual 8.

The results of the age analysis for females using the Gilbert and McKern standards for evaluating the pubic symphysis are given in Table II. A word of caution is definitely in order concerning the reliability of one of the estimates. As can be seen in the table, Individual 19 was difficult to score in two of the three components used in the analysis; thus the total score ranges from nine to eleven. Using the established standards, a score of nine gives a calculated mean age of thirty-three years, but this particular score is also associated with the largest standard deviation and the age range actually extends from twenty-two to forty years. A score of ten or eleven has a calculated mean age of 36.9 years and an age range of from thirty to forty-seven years, also a fairly high standard deviation. The total possible age range for this individual then extends from twenty-two to forty-seven years. More "subjective"

INDIVIDUAL	SYMPHYSEAL FORMULA	TOTAL	MEAN AGE
1	4--2--2	8	26
7	unsuitable for analysis		
8	2--0--0	2	19
18	unsuitable for analysis		
21	5--5--4	14	36
27	5--4--4	13	30

TABLE I. AGE DETERMINATION OF MALES USING MCKERN AND STEWART STANDARDS OF THE PUBIC SYMPHYSIS.

INDIVIDUAL	SYMPHYSEAL FORMULA	TOTAL	MEAN AGE
4	5--4--4	13	48
10	4--4--4	12	39
19	3/4--3--3/4	9-11	33-36
24	1--0--0	1	20
25	5--4--5	14	56
26	1--1--0	2	21.5

TABLE II. AGE DETERMINATION OF FEMALES USING GILBERT AND MCKERN STANDARDS OF THE PUBIC SYMPHYSIS.

evaluations of the skeleton considered states of epiphyseal and cranial fusion as well as dental attrition. The results of these studies suggest that the individual was probably in the area of thirty-plus years, so the overall average obtained from the pubic symphysis is, in this case, as accurate as any other age which can be derived.

Summary

Figure 1 illustrates the frequencies with which different age groups are represented in this sample. Given the limited number of individuals, some gaps in the distribution are not surprising. Of particular interest, however, is the absence of any infants. It is difficult to suggest whether this is the result of separate (undiscovered) burial grounds being used for infants, or whether infants may have been buried in some other manner such as by the traditional custom of scaffolding (Denig 1930).

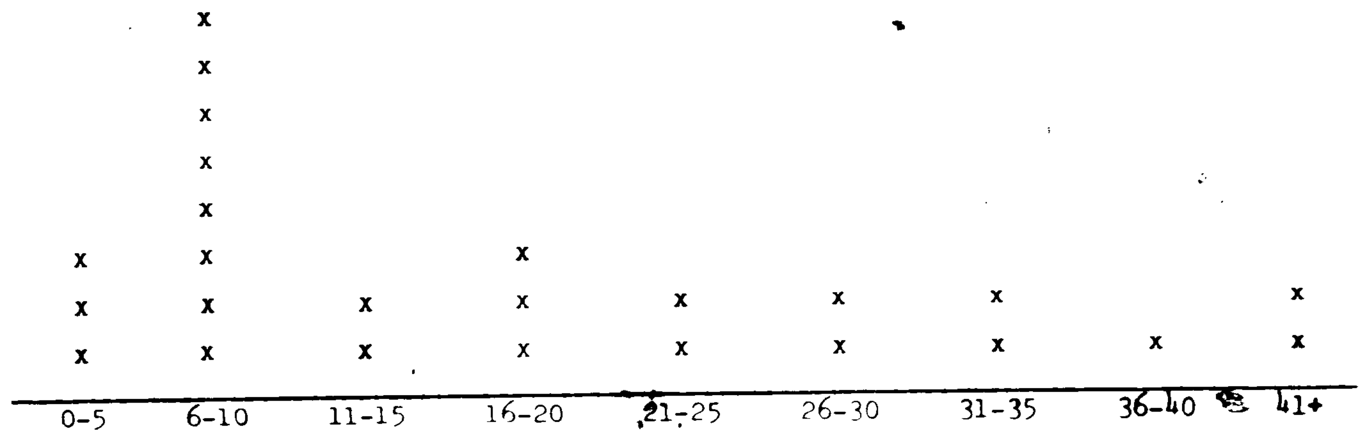


FIGURE 4. AGE DISTRIBUTION OF INDIVIDUALS IN THE SHARPHEAD BURIAL COLLECTION

CHAPTER VI

THE CRANIAL SKELETON

In terms of absolute size differences among the individuals present in this sample, it is difficult to make very many general observations. Frontal and lateral views of the crania of males 8 and 21, and of females 10 and 25 illustrate some of the variability present within each sex (plates 1 and 2). The smallest, most gracile individual in the sample is male 1 (plate 3); while the largest and most robust is male 21. A number of the females are noticeably larger and more robust than some of the males, while others are relatively quite gracile, as might be expected.

Cranial Indices

The average male cranial index is 76.9, falling into the lower range of the mesocranic category. Thus, while they are on the average neither extremely long nor extremely short in proportion to their breadth, they do tend toward the longer condition. Moreover, two of the individuals are longer; male 21 is definitely within the dolichocranic range with an index of 70.5, while male 27 has an index of 74.5. Male 1, on the other hand, is brachycranic, falling into the lower range of that category with a cranial index of 81.2.

The average female cranial index is 74.8, in the upper range of the dolichocranic category. Four of the six females present fall well within this range. Two of the individuals, however, fall within the mesocranic category: females 25 and 26 have indices of 77.7 and 75.7 respectively.

Both sexes are quite variable with regard to the length-height index. Four of the six males are orthocranic with indices ranging from 70.5 to 74.1, making them of moderate height relative to length. Male 18, however, does have quite a low skull; and falls within the chamaecranic category with an index of 66.3. Male 8, on the other hand, has a hypsicranic index of 76.7. Three of six females are also orthocranic with indices ranging from 71.2 to 73.4; two are chamaecranic with indices of 67.9 and 68.9; while one is hypsicranic with an index of 75.4.

The cranial breadth-height index is also variable for both sexes. Male 18 has the lowest skull relative to its breadth for any of the individuals in the sample, with an index of 82.5. Male 1 is also tapeinocranic, although not to such an extent, with an index of 91.3. Two of the remaining males are metriocranic, while the remaining two are acrocranic with indices of 100.0 each. Females tend to be more consistently metriocranic. Four of the six fall within this category with indices ranging from 93.9 to 97.0. Female 24 is one the boundary between the tapeinocranic and metriocranic categories with an index of 91.9; while female 10 is definitely acrocranic with an index of 98.6.

The average upper facial index of the males is 51.5, falling into the mesene category. Thus the face tends to be moderately long relative to its breadth. Only male 18 differs from this pattern, coming within the euryene category with an index of 49.6. Females are somewhat more variable with regard to this index. Two fall within the mesene category, three within the euryene, and one within the leptene; thus covering all possibilities as far as defined categories are concerned.

The orbits tend to be of variable height relative to their breadth. The average orbital index for males is 83.7; and that for females, 86.1 (mesoconch and hypsiconch, respectively). In actual fact, however, two of the six males are hypsiconch with high indices of 89.5 and 91.9, while the females are equally divided between the two categories.

The mean nasal index for males is 50.6 (mesorrhine); but this figure is misleading since three of the six individuals are chamaerrhine, one is mesorrhine, and two are leptorrhine. Th[illegible] the nasal aperture varies from being quite broad relative to [illegible]ght to being quite narrow. The six females, on the other hand, are more noticeably consistent with regard to this index. The mean is 53.8 (chamaerrhine) and all fall within this category with indices ranging from 51.0 to 56.5. Therefore, they tend to have nasal apertures quite broad (but not extremely so) in relation to height.

Among the males, the maxillo-alveolar index is quite consistent, the average being 121.4 (brachyuranic). Only male 7 falls outside this category by being mesuranic with an index of 112.3. The females, however, are considerably more variable: two are brachyuranic, three are mesuranic, and one is dolichuranic. While the mean is 113.7 (mesuranic), the actual range is from 107.0 to 119.6. It is perhaps noteworthy that even the brachyuranic females do not reach the extreme of this condition found among the males and therefore tend to have somewhat narrower palates relative to length than do the males.

As can be determined from the above discussion, it is difficult to make very many generalizations about this group of individuals except that, metrically speaking, they tend to be quite variable. With the considerable variation within each sex, it is difficult to make any reliable statements as to sex differences. Also, with the considerable variation observed for almost all the indices discussed, and with such a small sample to work from, it is impossible to estimate the

TABLE III.

SUMMARY OF CRANIOMETRIC DATA

CRANIAL INDEX

Dolichocranic (D)	X--74.9
Mesocranic (M)	75.0--79.9
Brachycranic (B)	80.0--84.9
Hyperbrachycranic (HB)	85.0--X

Category	D	M	B	HB	Mean
Number of Females	4	2	0		
Number of Males	2	3	1	0	76.9

LENGTH-HEIGHT INDEX

Chamaecranic (C)	X--69.9
Orthocranic (O)	70.0--74.9
Hypsicranic (H)	75.0--X

Category	C	O	H	Mean
Number of Females	2	3	1	71.7
Number of Males	1	4	1	72.0

BREADTH-HEIGHT INDEX

Tapeinocranic (T)	X--91.9
Metriocranic (M)	92.0--97.9
Acrocranic (A)	98.0--X

Category	T	M	A	Mean
Number of Females	1	4	1	95.9
Number of Males	2	2	2	93.8

UPPER FACIAL INDEX

Hypereuryene (HE)	X--44.9
Euryene (E)	45.0--49.9
Mesene (M)	50.0--54.9
Leptene (L)	55.0--59.9
Hyperleptene (HL)	60.0--X

Category	HE	E	M	L	HL	Mean
Number of Females	0	3	2	1	0	51.3
Number of Males	0	1	5	0	0	51.5

NASAL INDEX

Leptorrhine (L)	X--46.9
Mesorrhine (M)	47.0--50.9
Chamaerrhine (C)	51.0--57.9
Hyperchamaerrhine (HC)	58.0--X

Category	L	M	C	HC	Mean
Number of Females	0	0	6	0	53.8
Number of Males	2	1	3	0	50.6

ORBITAL INDEX

Chamaeconch (C)	X--75.9
Mesoconch (M)	76.0--84.9
Hypsiconch	85.0--X

Category	C	M	H	Mean
Number of Females	0	3	3	86.1
Number of Males	0	4	2	83.7

MAXILLO-ALVEOLAR INDEX

Dolichuranic (D)	X--109.9
Mesuranic (M)	110.0--114.9
Brachyuranic (B)	115.0--X

Category	D	M	B	Mean
Number of Females	1	3	2	113.7
Number of Males	0	1	5	121.4

craniometric characteristics of the population as a whole.

Cranial Morphology, Variations, and Anomalies

Cranial Vault

The vault form when viewed from above tends to be either rhomboidal or pentagonal depending upon the degree of protuberance of the occipital region. There was no case of artificial deformation that could be determined. One immature individual, 9B, suffered from premature closure of a number of the cranial sutures: the coronal, left lambdoid, and to some extent the right temporal. The degree of resulting deformation is difficult to assess because the cranium underwent a considerable amount of crushing while interred. Plate 4 illustrates the condition of the affected sutures.

In all skulls, the sutures meeting at pterion take the usual form of a letter 'H'. Parietal foramina are present in many individuals, either bilaterally (eight individuals), or on the right side only (nine individuals). Female 24 has two foramina on the right side. Female 26 is the only individual to have a single foramen on the left side.

There was a noticeable absence of Wormian bones among the individuals of this sample. Four individuals (10, 17, 20, and 22) had one or two very tiny ossicles in the lambdoid suture. A number of individuals had ossicles at asterion. These were bilateral in two cases, Individual 3 and Individual 7, and restricted to the right side of Individuals 8, 10, 20, and 23. Two cases of an Os Inca were observed. Individual 20 had one large ossicle separated from the rest of the occiput by a suture which was quite faint and had an almost completely fused appearance while Individual 3 had two large, clearly defined

Os Incae (plate 5).

No correlation could be observed between the extent of closure of the cranial sutures and ages of the various individuals. This is not an unexpected problem since other investigators such as Cobb (1955) and McKern and Stewart (1957) have previously discussed the subject. In addition to the variation intrinsic to the developmental processes among individuals, environmental factors may have post-mortem effects upon the skeleton. Singer (from Vallois in Heizer and Cook 1960) describes how highly acidic conditions may cause fused sutures to re-open. Tables IV and V illustrate the observations made concerning cranial fusions. Among the males, little variation could be determined among the individuals of all ages, with fusion varying only from 'none' to 'slight'. Females, encompassing a wider age range, showed more variation, but this could not be consistently correlated with age. Those females which fall within the age range represented by the males in the sample tend to show a greater degree of cranial fusion than do the males of comparable ages. Since only three of the six females can be used in this comparison, however, it would be very difficult to defend any generalizations made in this regard.

The Occipital Region

The occiput is variable in shape, ranging from a low mound to a large, "bun-shaped" protuberance. This latter condition reaches its extreme in Individual 21 where the protuberance is very large and roughened with bony spurs projecting inferiorly from the well-developed nuchal lines. It is interesting that a number of females also have large, protruding occipital regions. Females 4, 10, and 19 are most noticeable in this respect. Even male 1 who tends to be very gracile

INDIVIDUAL	AGE	DEGREE OF CRANIAL FUSION
8	19	none
18	20	none
7	23	beginning in the coronal suture
1	26	fusion observed only in the lateral portions of the coronal suture
27	30	beginning in the coronal suture
21	36	beginning in the coronal suture

TABLE IV. EXTENT OF FUSION OF CRANIAL SUTURES AMONG MALES

INDIVIDUAL	AGE	DEGREE OF CRANIAL FUSION
24	20	beginning in the coronal suture
26	21	coronal suture almost completely fused
19	36	coronal and sagittal sutures largely fused
10	39	beginning in the lateral portions of the coronal suture
4	48	coronal, sagittal, and lambdoid sutures largely fused
25	56	coronal and sagittal sutures largely fused

TABLE V. EXTENT OF FUSION OF CRANIAL SUTURES AMONG FEMALES has a somewhat bulging occipital region. The two youngest males, 8 and 18, lack this condition, suggesting that it may be correlated with the age of the individual.

Among the twelve adults only female 25 has double condylar facets. Juveniles were not assessed in this regard because of the unfused state of the epiphyses. Four individuals had double anterior condylar canals. This condition occurred bilaterally on Individual 6, on only the left side of Individuals 7 and 10, and on only the right side of Individuals 8 and 19. A precondylar tubercle was observed on the left side of Individual 17. A posterior condylar canal was observed to be absent in some cases. This condition occurred on the right side of five individuals, and on the left side on three others; it never occurred bilaterally however.

Temporal Region

A Foramen of Huschke is present either unilaterally or bilaterally in nine individuals. Of these only Individuals 18, 26, and 27 are adults, and it is possible that the foramina could still close in the immature individuals, all of whom are in the age range of six to seven years.

The chapter of sex determination has discussed the difficulty of using mastoid length as a means of discriminating between males and females since a number of large females have created considerable overlap in the measurements of both groups. Similarly, in the more robust females, the root of the zygomatic process extends posteriorly over the external auditory meatus in a well-defined ridge; a condition also usually thought of as a male characteristic.

Sphenoid Bone

Anomalies of the foramen ovale and foramen spinosum are present in a few cases. The foramen ovale is incomplete in Individual 7 (both sides) and Individual 23 (left side only). The foramen spinosum is open on the left side of four individuals and on the right side of one other.

A number of individuals have some anomalous bridging from the pterygoid plate to a position adjacent to the foramen spinosum. A complete bridge was observed bilaterally on two individuals, on the right sides of two further individuals, and on the left side of still another. Partial bridging was observed bilaterally on three individuals, on the right side of one, and on the left side of three others.

The Frontal Region

Supra-orbital ridges tend to be well-developed medially and are generally continuous across the mid-line. The development of the ridge is variable in both sexes. The more robust males have well-pronounced ridges and Individual 21 shows the most extreme development of the trait. On the other hand, the two youngest males, Individuals 8 and 18, show only slight ridge development. Female 10 and to some extent female 4 have rather robust brow ridges, equalling or exceeding the development found among all except the most robust males. The four remaining females show the more typical slight supra-orbital ridge development.

Male 21 is especially interesting with regards to the bony structure of the supra-orbital region. The bone is of a very porous nature and at the midline there exists an intricate and broadly convoluting line (plate 6). This condition has previously been described by Tappen (1973) for Neanderthal remains although that author notes its presence in modern populations and suggests a correlation with general robusticity of the cranium. Female 4 shows similar development although to a lesser extent.

Considerable variation was observed concerning the supra-orbital foramina. In only three individuals were there complete foramina on both sides of the cranium, while five individuals have notches present on both sides. Seven individuals have a foramen on one side and a notch on the other, but this is by no means the limit of the variations observed. Individual 27 has both a foramen and a notch present on both sides. Three individuals have a foramen as well as a notch on one side with only a notch on the other. Three further individuals have a foramen and a notch one one side with a foramen on the other. These observations reinforce those made previously by Greene and Armelagos (1972) regarding the possible variations of this "discrete" cranial feature.

The Facial Skeleton

The nasal bones are generally quite convex in profile. Where exceptions to this occur, the curve of the bones tends to be somewhat concave superiorly and becomes more convex inferiorly. Individual 1 exhibits the only example of trauma to the nasal region with extreme irregular flattening suggesting that the nose was quite badly broken at one time.

The interorbital region tends to be relatively broad, particularly among the females who have interorbital distances of from 21 to 23 mm.. Males overlap with this range, but all except Individual 27 are less than or only equal to the female minimum. Even male 21, who generally is very large, is quite narrow in this region, measuring only 20.0 mm.. While male 1 appears to be quite broad in the interorbital region, it is difficult to assess his condition in view of the damage to the area already mentioned.

Deviations of the nasal septum are quite common among the males of this sample. Individuals 7 and 8 have noticeably but not extremely crooked septa; whereas Individuals 21 and 27 are more severely affected. Individual 18 has a straight septum and Individual 1 was again not included in the observations because of his damaged condition. All females have relatively straight septa.

Only a few cases of accessory infraorbital foramina were observed. These were found on the left sides of Individuals 8, 10, and 19; and on the right side of Individual 22.

Zygomaxillary tuberosities were not observed; neither were any cases of an Os Japonicum or any other anomalies of the zygoma.

Mandible

Although there is some variation, the mandibles are not extremely robust. The most noticeable exception to this is Individual 21 who appears massive in comparison with even other fairly robust males such as Individual 27. The appearance of size is created largely by the extreme flare in the gonial regions. Bigonial width of this individual is 120.0 mm. as compared to 112.0 mm. for Individual 27, and 100.0 mm. or less for all other individuals. The chin region of Individual 21 is broad and tri-lobed and also appears quite massive relative to the median and bilateral forms found among the other individuals in the sample. Ramus height of Individual 21 also greatly exceeds that of the other individuals, but in most other measures this individual does not appear excessively large compared with the rest of the sample.

Mylohyoid bridging was observed in five individuals. It was present bilaterally in Individuals 4, 8, 19, and 27; and occurred only on the right side of Individual 21.

The right ascending ramus of the mandible of Individual 1 is deformed, although it is difficult to determine whether this is a case of atrophy or of some developmental distortion. Perhaps the latter is the more plausible explanation since there seems to be some shifting of the entire facial region as if to help compensate for the irregular jaw action (plate 3).

CHAPTER VII

THE DENTITION

Morphology, Variations, and Anomalies

Incisor Teeth

All permanent maxillary incisor teeth are shovel-shaped. Where attrition is severe, curvature of the dentine indicates that shovelling had been present. Dahlberg (1963) notes an almost 100% incidence of this trait in native American populations, so this very high frequency is not unusual. A number of individuals exhibit double-shovelling, characterized by concave labial surfaces of the incisors. This condition is not extreme, and seems to be evident primarily near the incisive edge of each tooth. Eighteen individuals could be assessed as to the condition of the central incisors; of these, ten have definite double-shovelling, while the remainder exhibit only a light concavity of the labial surface. Fourteen individuals have lateral incisors that could be evaluated. Of these, two have definite double-shovelling, five have only a slight expression of the trait, and seven have none. Two adults, Individuals 4 and 21, could not be examined for double-shovelling because of extreme attrition of the incisive edges of the teeth.

Individual 12 exhibits the only really apparent case of winged central incisors with the distal edges of the erupting teeth protruding in a labial direction (plate 7). Much less obvious but still somewhat apparent evidence of the same condition was noted for adult female 25.

Canine Teeth

No anomalies are recorded for the canines.

Premolars

While no detailed descriptions have been made of the premolars, it was noted that in Individual 25 the maxillary right second premolar is rotated ninety degrees to the usual orientation.

Individual 8 lacks the lower second premolars, as the deciduous molars are still firmly in place even though the individual is nineteen or twenty years old. These remaining deciduous teeth are in an extremely worn state and are carious. Individual 3 also retains the second deciduous molars at twelve years of age. It is impossible to suggest, however, whether this retention would have continued to the same extent as for Individual 8.

Mandibular Molars

All mandibular molars have a Y-type fissure pattern, with five cusps occurring consistently on the first and second molars and either four or five cusps occurring on the third molar. Table VI summarizes the distribution of these cusp patterns.

Two individuals have accessory cusps involving mandibular molars. Both Individuals 8 and 10 have protostylids present bilaterally on the third molars. In both cases the trait is more strongly developed on the right side. The expression of such traits can be quantified (Snyder et al. 1969); and in this case the protostylid on the right side would be assigned a value of three, or the maximum allowable, in both cases. With regards to the left side, Individual 8 has the minimum recognizable expression of the trait (w); while Individual 10 is slightly more developed with an expression value of one. There would thus appear to be a noticeable difference in the expression of this trait between sides of one individual, although Snyder et al.

state that there should be no statistically significant difference. According to Dahlberg (1963), strong development of this trait on third molars is rare among North American Indian groups (0-10%); although slight development in the form of a pit-like structure could be expected more frequently (20-50%). In this case both slight and marked expressions of the trait occur at very low frequencies (less than 5%). Dahlberg also states that the trait is more likely to occur on the second deciduous molar; or on the permanent first or second molar, in that order. None of these teeth, however, show any signs of the trait.

Maxillary Molars

Maxillary molars were examined as to cusp morphology, particularly with regards to hypocone development. Dahlberg (1963) established four numerical categories to express the relative development of this cusp. The categories used here reflect Greene's (1967) modification of Dahlberg's scheme. Table VII illustrates the cusp pattern variation for the maxillary molars and identifies each of the separate categories.

An unusual condition was noted for Individual 12, where the upper left first molar has five well-defined cusps (plate 7). The hypocone is well developed; and there is an additional development of a mesio-buccal cusp with proportions only slightly smaller than those of the hypocone.

Individual 12 also has an accessory cusp, Carabelli's cusp, bilaterally present on the upper first molars. This is found in addition to the fifth cusp already noted for the left molar. No other case of accessory cusps was found for the maxillary dentition. Although Dahlberg (1963) states that Carabelli's cusp rarely achieves large,

CUSP PATTERN	M_1	M_2	M_3
Y-5	30	16	10
Y-4	--	--	4
Number of teeth examined	30	16	14

TABLE VI. Mandibular Molar Morphology (after Dahlberg 1963).

CUSP PATTERN	M_1	M_2	M_3
4	18	--	--
4-	1	8	--
3+	--	4	5
3++	--	2	1
3	--	--	6
Number of teeth examined	20	14	12

4 large hypocone
4- reduced hypocone
3+ hypocone =small cuspule
3++ small hypocone and a supernumerary cusp
3 no hypocone

TABLE VII. Maxillary Molar Morphology (after Greene 1967).

functionally significant dimensions in North American Indian populations, some evidence of the trait tends to occur relatively often on the first molar (as high as 70-90% frequency). However, he also cites a high frequency for this trait on the first molar of American Whites (85%), and this characteristic thus seems of little value for purposes of racial identification. Its almost compete absence in this group is, however, of some interest; and may indicate a sampling error.

One female, Individual 19, exhibited a congenital absence of a third molar. In this case, only the upper right third molar is absent. This observation was verified by X-ray analysis.

Dental Lesions and Age Changes

The most common lesions observed include dental caries, abscesses, periodontal disease, and malocclusions.

Caries

Most individuals had caries of some sort--ranging from small pits to very large areas of decay that in some cases have all but destroyed the afflicted tooth. The molars are the primary sites of tooth decay. Of one hundred and thirteen molars in the adult portion of the sample, twenty-four (21%) are carious. Only two adults, Individuals 24 and 19, are totally free of cavities; two other individuals have one minor cavity each; while a further two each have one cavity of a more serious nature (at least one quarter of the tooth affected). The remaining individuals all have from two to five afflicted teeth.

Among the juveniles, none of the permanent dentition is carious, as might be expected from the young age of most of these individuals. Of the ninety-four remaining deciduous molars which could be examined, fifteen (16%) are carious. Individual 8 is not included in this count since the late retention of the deciduous lower second molars is exceptional. These two teeth are also carious, however.

Abscesses

Two individuals have abscesses. Individual 10 has an apical abscess of the upper left second molar. This tooth is also broken and decayed on the disto-lingual cusp. Indivdual 7 has a large abscess extending from the root tip to the neck region of the left mandibular first molar.

Periodontal Disease

Eight of the twelve adults exhibit some noticeable evidence of periodontal disease; especially affected are individuals who also have other dental problems such as abscesses and/or severe decay. The left maxillary molar region of Individual 10 is considerably affected where the second molar is abscessed. This same individual also has a minor amount of resorption in the area of the anterior mandibular dentition. The left mandibular molar region of Individual 7 is affected, primarily around the abscessed first molar; while the right mandibular molar region of this same individual shows some resorption in the area of a badly decayed first molar. Individual 26 exhibits rather severe resorption along the total molar region of the right mandible where the first molar has all but been destroyed by decay.

More minor cases of alveolar resorption are seen in Individuals 1, 4, 21, 25, and 27 where the problems are less severe but also appear to be more generally distributed in the maxillae and mandibles.

Malocclusions

Relatively minor malocclusions are quite common in this group. A number of individuals exhibit misalignments of the anterior dentition. Individual 3 has maxillary canines forced labially to the extent that they no longer form a functional part of the dental arcade. The mandibular anterior dentition of this individual also appears to be quite crowded, with the right central incisor and right canine forced labially out of position. In addition, the left first premolar is somewhat rotated. Individual 18 shows crowding of the mandibular incisors and premolars. The left central incisor [illegible] labially, with a pronounced discoloration indicating tha[illegible] necrotic. The right first premolar is forced [illegible] buccal direction. Individual 21 [illegible] mandibular first premolars forced buccally; while Individual [illegible] wer lateral incisors moved lingually, and upper lateral [illegible] sors and canines crowded out of alignment.

Much less serious misalignments, involving only very slight crowding (again of the anterior dentition), were observed in five other individuals. Since all of these are of little consequence, they are not described here.

If it is possible to speculate at this point, it could be suggested that some of the immature individuals show signs of what might well have developed into dental misalignments had the individuals survived. This is perhaps most noticeable for Individual 22, where there seems to be little if any space available for the erupting canines. Individuals 5 and 9B would also seem to have large maxillary central incisors that promise to leave little space for future lateral incisors and canines.

Age Changes--Dental Attrition

Dental attrition within this group is not particularly severe. Using the lower first molar as an indicator, Tables VIII and IX reflect the amount of dentine exposure observed. Most of the young to middle-aged adults have relatively little wear on this tooth. The possible exception here is Individual 1, but it is difficult to assess the significance of the more pronounced wear pattern in view of the fact that action of the mandible was probably influenced by the malformation of the ascending ramus. As might be expected, the older individuals do exhibit more wear; yet such attrition is still confined to the individual cusps, with enamel persisting in the areas between them. A noteworthy exception to this pattern occurs in Individual 21, where severe attrition of the lower first molars has resulted in deep pulp exposure on the distal half of each tooth. Attrition of the same part of the upper dentition is less severe--no large pits are present, although there are pronounced areas of attrition on the lingual cusps of the second molars; and, to a lesser extent, on the first molars as well. For both the upper and lower dentitions, wear is more extensive on the right side. Other examples of severe attrition involve the anterior dentitions of Individuals 4 and 21. Individual 4 is marked by considerable wear of the upper and lower incisor teeth. The lingual surfaces of the upper incisors show extreme attrition to the extent that all shovelling has disappeared and the surfaces are highly polished. Individual 21 also shows considerable wear of both the maxillary and mandibular incisors and canines. Here the lower incisors in particular are very much reduced in height.

A somewhat unusual type of molar attrition was observed for

Individual 7. While there were other instances of minor enamel chipping, this individual has a substantial amount on the distal edges of the lower molars. The chips are numerous and small, and restricted to the distal areas of the first and second molars (although the right first molar has some decay and therefore could not be fully evaluated). Some persistent causal activity may be suggested by the regularity of patterning; and it is also interesting that the condition is not present on the upper molars.

Tables VIII and IX help illustrate the kinds of difficulties encountered when attempting to correlate dental attrition with age. Granted, there is a certain amount of regularity, with the oldest individuals exhibiting the most amount of wear. This is the extent of the generalizations, however. Individuals 4 and 10 are separated in age by about nine years, yet the dental wear would suggest roughly equivalent ages. Individual 25 is older still, but shows less wear than either of these. A similar lack of discrimination appears among the younger members of the sample, as most individuals between the ages of nineteen and thirty-five hardly appear to differ from each other. The exception here is Individual 1 who, if he is judged by these standards, would appear to be one of the oldest members of the group. Again, of course, one must consider the problems presented by the occurrence of malocclusions and deformations which may or may not have had significant effects upon attrition rates, but which are difficult to evaluate in this regard from the evidence at hand.

INDIVIDUAL	AGE	DEGREE OF DENTAL ATTRITION OF M_1
24	20	
26	21	
19	36	
10	39	
4	48	
25	56	

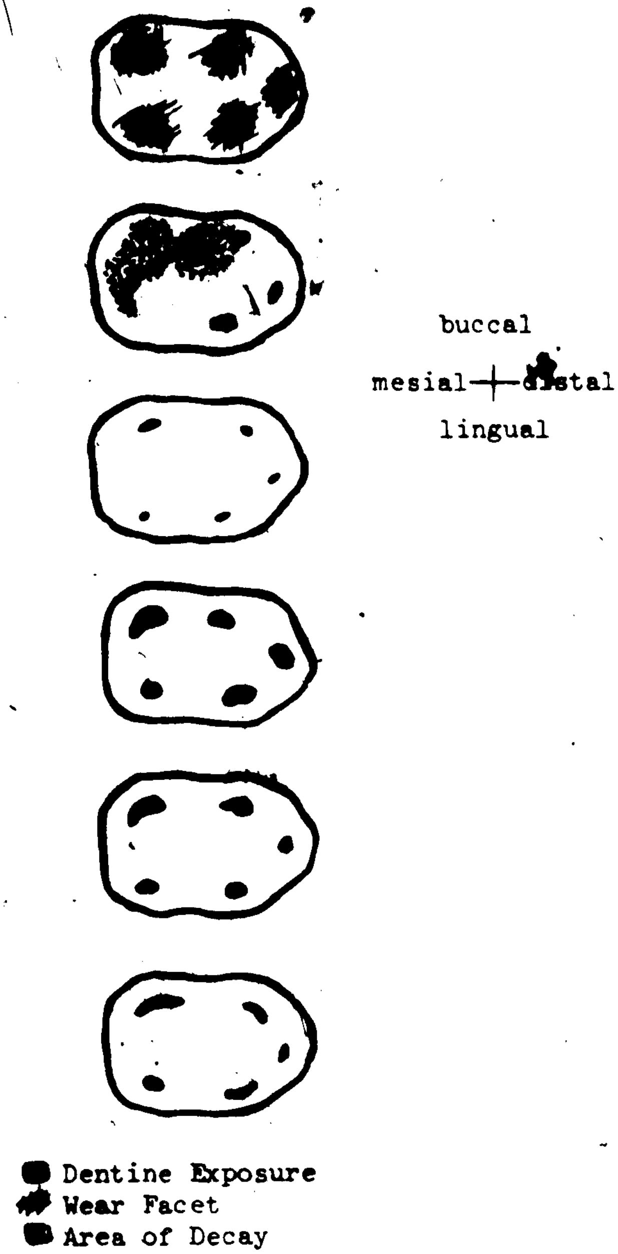
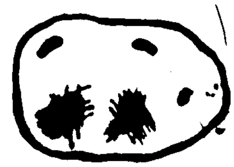
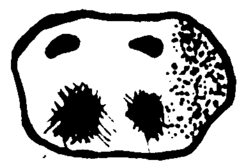
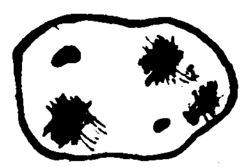
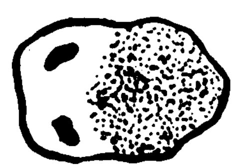


TABLE VIII. Extent of Dental Attrition Among Females

INDIVIDUAL	AGE	DEGREE OF DENTAL ATTRITION OF M_1
8	19	
18	20	
7	25	
1	26	
27	30	
21	36	

buccal
mesial distal
lingual

Dentine Exposure
Wear Facet
Damaged or Decayed Area

TABLE IX. Extent of Dental Attrition Among Males

CHAPTER VIII

THE POSTCRANIAL SKELETON

Upper Limbs

Clavicle

The clavicles of the adults in the sample vary quite considerably in length, from 127.0 mm. to 171.0 mm.. The chapter dealing with sex determination has discussed the difficulty of using this measure as a means of separating males from females as only one female is definitely below the range for males, and only one male is beyond the upper limit of the female range.

Pits were observed in the costal scars of Individuals 26 and, more noticeably, 8 (plate 8). These are deep de[illegible]s extending well into the cancellous tissue.

Humerus

Five individuals have septal foramina although these tend to be very small. Individual 10 has a minute foramen on the left side, Individuals 3 and 9A have them on both sides, and Individuals 17 and 21 each have one on the right side only.

Individuals 8 and 26 have elongated pits in the bicipital grooves of both humeri which extend into the cancellous tissue (plate 9).

Radius and Ulna

No variations or anomalies were observed.

Vertebral Column

The general condition of the vertebral column of most individuals in this sample appears to have been quite good. There are no fusions, malformations, or indications of serious disease. Degenerative changes in older individuals appear to be minimal as only the oldest females, Individuals 25 and 4, have some slight spurring in the vertebral notches, particularly in the thoracic region.

The most outstanding anomaly of the cervical vertebrae is the high incidence of variations of the foramen transversarium, involving twelve of the twenty-five individuals in the sample. Table X summarizes the occurrences of double transverse foramina for cervical vertebrae numbers five through seven. In addition, Individual 22 has an incomplete costal bar on the left side of C-7, producing a notch rather than the usual foramen. Individual 26 has a double transverse foramen on the right side of C-6, but only a partial bridge dividing the foramen on the left side. This same individual has a partial division of the foramen on the right side of C-7, but no indication of the same condition on the left side.

Sacrum and Pelvis

Three individuals possess sacra of six elements rather than the usual five. In all cases the extra element consists of a sacralised first coccyx element. In two cases, Individuals 10 and 18, the first sacral segment in incompletely fused to the rest of the sacral body, both anteriorly in the region of the centrum, and posteriorly where the spinous processes have not formed part of the sacral canal.

Individual 25 likewise has a six-segmented sacrum. The first unit here appears to be completely fused, but the situation is complicated by the presence of spina bifida. The neural canal is exposed at the level of S-1 and to the mid-centrum region of S-2.

INDIVIDUAL	C-5	C-6	C-7
1	-	+	+
6	-	-	left
7	-	+	+
10	-	left	[illegible]
13	-	-	+
17	+	+	+
19	-	-	+
20	left	left	+
21	-	left	left
22	-	right	+
23	-	+	*
26	-	+	*

- absent
+ present on both sides
* other anomaly present

TABLE X. Occurrences of Double Transverse Foramina on Cervical Vertebrae Numbers 5, 6, and 7.

Individuals 18 and 19 also have some indication of spina bifida. In both cases there is a lack of fusion between the two halves of the neural arch, so while the condition is not severe, there was some anomalous formation in this region.

The only other anomaly noted for the sacrum in an extra contact facet in the region of the sacro-iliac articulation of Individual 26, created by a posterior projection of the iliac crest.

Sex differences involving the sacrum are quite minimal. The mean sacral index for males is 111.0 (102.4--117.0); while that for females is 105.4 (94.4--113.0), suggesting only a slightly broader sacrum in the latter group. It has been suggested that in females the centrum of the first sacral element is generally of a lesser width relative to the alae (Anderson 1969). In this case, the sexes are again quite similar with males having centra which occupy from 0.42 to 0.50 of the width of the superior surface of the sacrum, while females vary from 0.43 to 0.49 in this regard.

Very few anomalies were noted for the innominates. Individuals 4 and 25, the two oldest females, have a small amount of spurring in the obturator foramen. Individual 25 has a slight irregularity of the superior margin of the left acetabulum, but this consists of only a small wrinkled pleat. Individual 24 has some small laminar projections extending superiorly from the pubic crest in the region above the acetabulum. Individual 26 has a contact facet on the posterior projection of the ilium which corresponds to a similar facet found on the sacrum.

Some of the differences between sexes involving the innominates are not as well developed as might be expected. Measurement of the sciatic notch is not always conclusive since two of the males fall well within the range represented by the females. Ischial and pubic lengths are in themselves indeterminate, but the ischio-pubic index would seem to offer quite a conclusive indication as to the sex of the individuals. Here the mean for males is 104.8; and that for females is 92.0. There is no overlap in the respective ranges. It should be noted, however, that only four of the males and five of the females could be evaluated with regards to this index.

Female innominates were examined for possible parturition scars in the form of pits located on the dorsal pubic area. Of the six females present, the two youngest, Individuals 24 and 26, have no such scars. Individuals 10 and 25 have some slight pitting, while Individuals 4 and 19 are quite well marked in this regard.

Houghton (1974) has discussed changes in the pre-auricular sulcus which may also result from pregnancy. Here a broad, pitted sulcus is suggested to indicate that the individual has given birth at least once; while a smooth, narrow sulcus is described as the original condition. Of the females in this sample, only Individual 26 has a narrow, smooth sulcus. Individual 19 has a narrow but pitted sulcus, and Individual 24 has a broad but smooth one. The rest are all broad and irregular. Thus four of the individuals do seem to fall into one of Houghton's categories, while two are somewhat ambiguous. It should also be noted that for Individual 26, the sulcus is smooth and narrow only on the left side, but is somewhat broader on the right; indicating that the either-or categorization of this kind of analysis may be somewhat over-simplified.

All of the males have narrow grooves in the appropriate location for the pre-auricular sulcus, and in most cases these are quite well defined. It would appear, therefore, that for this sample at least, presence of the sulcus in not a reliable discriminating trait.

Lower Limbs

Femur

The femora in general show minimal medio-lateral flattening with platymeric indices ranging from 87.1 to 113.5 for females, and from 78.1 to 123.1 for males. Respective means of 99.1 and 97.6 indicate the absence of any pronounced sex differences with regards to this index. Individual 18 is of some interest in that the measurements from different sides result in quite different indices; 123.1 for the right femur, and 104.0 for the left. Both results place this individual in the stenomeric category however.

Tibia

The tibiae of all individuals likewise show very little medio-lateral flattening with the platycnemic index for females ranging from 67.6 to 77.4; and for males, from 75.8 to 88.9. Means are 72.1 and 82.7 respectively. Here there may be some discernible sex difference as only the lowest measure for the males overlaps the range established for the females.

No squatting facets or other anomalies were noted for the tibiae.

Fibula

No variations or anomalies were observed.

Talus and Calcaneus

No squatting facets were observed on any of the tali.

Double superior articular facets were noted on the calcanei of

TABLE XI

PLATYMERIC AND PLAYCNEMIC INDICES

PLATYMERIC INDEX

Hyperplatymeric (HP)	X--74.9
Platymeric (P)	75.0--84.9
Eurymeric (E)	85.0--99.9
Stenomeric (S)	100.0--X

Category	HP	P	E	S	Mean
Number of Females	0	0	3	2	99.1
Number of Males	0	2	1	2	97.6

PLATYCNEMIC INDEX

Hyperplatycnemic (HP)	X--54.9
Platycnemic (P)	55.0--62.9
Mesocnemic (M)	63.0--69.9
Eurycnemic (E)	70.0--X

Category	HP	P	M	E	Mean
Number of Females	0	0	0	4	72.1
Number of Males	0	0	1	4	82.7

three males, Individuals 1, 18, and 27; and of one female, Individual 19.

Pathology of the Lower Limbs

Very few instances of lesions or trauma involving the lower limbs were observed. Individual 25 has periosteitis affecting primarily the left limb and also the right to a lesser extent. The left femur has a definite degeneration of the cortical bone which has resulted in a very weak and porous appearance of this layer. The distal part of the shaft is enlarged due to inflammation. The proximal end of the left tibia and the patella show the same swollen and porous condition, while the head region of the left fibula is affected to a lesser extent. The right tibia is the only bone in that limb with some evidence of the same condition. While interred, bones of the left foot were very badly eroded, but the fragments reveal a very thin layer of cortical bone. If these bones were also weakened by infection, it would help to explain their badly preserved condition, particularly since the same bones of the right foot were in much better condition.

The only other lesions noted for the lower limbs involve the distal phalanges of the feet of Individual 21 where some evidence of generalized infection is suggested by the porous condition of these bones.

CHAPTER IX

SUMMARY AND CONCLUSIONS

The conclusions which have been derived from this study have deliberately been kept to a restricted level, since extrapolating from twelve adult individuals to make generalizations concerning a total population structure can be done only tentatively. Until other samples can be examined and compared with the Sharphead collection, there is no way to assess the closeness with which this group might approximate the overall distribution of traits for Stoney Indians.

Skeletal remains of six males, six females, and thirteen children from the Sharphead burial site have been studied. Adult males range in age from nineteen to thirty-six years; females vary from twenty to fifty-six years. The three oldest individuals in the sample are females. The average stature of the males in 175 cm., and that of the females is 163 cm.. There is considerable variation within each sex in terms of size and robusticity. With the exception of some pelvic features, sex differences are usually not well-defined, even with the application of multivariate statistical analyses.

The crania did not reach extremes in any measurements or proportions, although a great deal of variation was apparent in the measurements and indices which were recorded. Indices rarely fell within any one category for either sex group. Similarly, great ranges of variability were observed in the postcranial skeleton.

Numerous variations and anomalies were recorded for the cranium. Occurring with relatively high frequencies were such features as: deviated nasal septa; pterygoid-spinous bridgings; mylohyoid canals; Foramina of Huschke; accessory palatine foramina; frontal notches or foramina; and absences of the posterior condylar canal. Cranial ossicles are generally absent except at asterion (six individuals); Two cases of an Os Inca were also noted. Extreme variability was observed in the supraorbital notch-foramen. Three individuals have accessory molar cusps, and there is one case of unilateral absence of the third molar. All individuals have shovel-shaped incisor teeth. The incidences of these dental traits are generally consistent with observations made by Dahlberg (1963) as to their frequencies in North American Indian populations, except for Carabelli's cusp which occurs less frequently than expected for either native or American White groups. Postcranial variations include a high incidence of double transverse foramina and other anomalies of the cervical vertebrae. Three individuals have sacra with six elements.

The most frequently observed lesions of the skeletons involved the dentition, with caries, abscesses, periodontal disease, and malocclusions being relatively common. Isolated cases of cranial lesions include: a deformed ascending mandibular ramus and broken nasal bones of one individual; and premature fusion of the sagittal and lambdoid sutures of one juvenile. One female has an osteoma on the left side of the frontal bone. Postcranially, there is one case of extensive osteitis of the lower limb bones. Osteoarthritic changes are slight and infrequent. One individual has definite indications of spina bifida while two others show anomalous fusion in the neural arch of the first sacral element.

As previously indicated, an over-riding consideration which must be borne in mind in any evaluation of the Sharphead burial collection is the restricted nature of the sample. The number of individuals is very small, making it difficult to be certain that metrical features and trait frequencies which have been observed are representative of Alberta Stoney Indians as a population. The group is also a reserve association and individuals may be [illegible] closely related genetically. Therefore, the sample may not [illegible]om. The historical record indicates a high mobility [illegible] reserves (i.e. during hunting trips), and it is possible that the sample is further confused by the inclusion of individuals who were not members of Sharphead's band. The possibility of genetic admixture either with Whites or with other native groups must also be considered, but there is no historical record to indicate if and to what extent this may have occurred.

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APPENDIX I

MEASUREMENTS

FEMALE MEASUREMENTS

INDIVIDUAL	4	10	19	24	25	26
CRANIUM						
MAXIMUM CRANIAL LENGTH	184.0	188.0	180.0	184.0	175.0	169.0
GLABELLAR PROTRUSION	6.0	8.0	5.0	5.0	4.0	3.0
MAXIMUM CRANIAL BREADTH	165.0	140.0	132.0	136.0	136.0	128.0
MAXIMUM FRONTAL BREADTH	101.0	101.0	100.0	108.0	107.0	105.0
MINIMUM FRONTAL BREADTH	89.0	91.0	91.0	94.0	85.0	83.0
BASION-BREGMA	131.0	138.0	124.0	125.0	132.0	124.0
BASION-NASION	103.0	107.0	103.0	102.0	100.0	94.0
BASION-PROSTHION	98.0	102.0	104.0	103.0	96.0	94.0
OPISTHION-FOREHEAD DISTANCE	153.0	151.0	147.0	145.0	146.0	144.0
MASTOID LENGTH	26.0	28.0	28.0	25.0	26.0	26.0
BIAURICULAR BREADTH	129.0	125.0	119.0	121.0	122.0	118.0
BASION-PORION	13.0	14.0	11.0	8.0	6.0	13.0
PORION-NASION	100.0	96.0	97.0	95.0	96.0	87.0
PORION-PROSTHION	101.0	104.0	108.0	104.0	101.0	95.0
PORION-SUBNASALE	88.0	86.0	93.0	90.0	89.0	84.0
BIPORIAL ARC	305.0	307.0	294.0	302.0	292.0	284.0
UPPER CRANIAL FACIAL HEIGHT	69.0	77.0	67.0	66.0	70.0	63.0
BIZYGOMATIC BREADTH	141.0	134.0	134.0	135.0	130.0	129.0
NASAL HEIGHT	51.0	52.0	46.0	48.0	51.0	44.0
MAXIMUM NASAL BREADTH	26.0	28.0	25.0	25.0	28.0	24.0

ORBITAL HEIGHT	35.0	39.0	32.0	34.0	33.0	32.0
ORBITAL BREADTH	40.0	41.0	39.0	42.0	38.0	38.0
BIORBITAL BREADTH	98.0	102.0	98.0	101.0	95.0	92.0
BIDACRYONIC BREADTH	21.0	23.0	23.0	22.0	22.0	21.0
MAXILLO-ALVEOLAR LENGTH	55.0	57.0	56.0	56.0	55.0	51.0
MAXILLO-ALVEOLAR WIDTH	62.0	61.0	64.0	65.0	62.0	61.0
BIMAXILLARY BREADTH	100.0	99.0	100.0	103.0	95.0	94.0
BIFRONTAL DISTANCE	99.0	102.0	98.0	100.0	91.0	90.0
ZYGOMAXILLARY SUBTENSE	24.0	25.0	25.0	22.0	24.0	24.0
ANTERIOR MASSETER LENGTH	35.0	40.0	39.0	43.0	36.0	35.0
DACRYON SUBTENSE	7.0	11.0	11.0	11.0	8.0	9.0
NASION SUBTENSE	17.0	20.0	20.0	20.0	14.0	18.0
BICONDYLAR WIDTH	124.0	120.5	121.0	113.0	116.0	101.0
BIGONIAL WIDTH	98.0	100.5	100.0	99.5	94.5	93.0
FORAMEN MENTALIA BREADTH	47.0	47.0	49.0	46.0	46.0	47.5
MINIMUM RAMUS BREADTH	40.0	38.5	39.0	39.0	37.5	32.5
RAMUS HEIGHT	62.0	61.5	62.5	64.0	64.0	57.0
SYMPHYSEAL HEIGHT	31.5	34.0	34.5	34.0	32.0	30.5
MANDIBULAR LENGTH	90.0	85.0	86.5	85.0	82.0	77.0
MANDIBULAR ANGLE	109.0	116.0	113.0	120.5	125.5	127.0
CRANIAL INDEX	73.4	74.5	73.3	73.9	77.7	75.7
LENGTH-HEIGHT INDEX	71.2	73.4	68.9	67.9	75.4	73.3
BREADTH-HEIGHT INDEX	97.0	98.6	93.9	91.9	97.0	96.9
UPPER FACIAL INDEX	48.9	57.5	50.0	48.9	53.8	48.8
NASAL INDEX	56.2	55.8	49.0	52.9	46.3	43.4
ORBITAL INDEX	87.5	95.1	82.0	81.0	86.8	84.2
MAXILLO-ALVEOLAR INDEX	112.7	107.0	114.3	116.1	112.7	119.6

DENTAL MEASUREMENTS

MAXILLA

M-D I1		8.7	9.0	8.1	8.5	8.0
B-L I1		7.2	7.0	7.4	7.2	6.3
M-D I2	6.9	8.2	7.8	7.7	7.4	6.8
B-L I2	6.0	6.2	6.5	7.4	6.9	6.2
M-D C	7.8	8.0	8.0	8.3	7.8	7.8
B-L C	8.3	8.6	7.5	8.2	8.2	7.6
M-D PM1	6.4	6.7	7.0	6.8	6.2	7.0
B-L PM1	9.4	9.2	9.5	8.6	8.5	8.4
M-D PM2	6.1	7.0	7.3	7.6	6.5	6.9
B-L PM2	8.9	9.4	9.5	9.0	8.4	8.4
M-D M1	9.7	10.5	11.0	11.0	10.0	11.1
B-L M1	11.8	11.8	11.4	11.4	11.2	11.2
M-D M2	9.9	10.3	10.5	10.6	9.9	10.2
B-L M2	11.4	11.5	11.7	11.1	10.7	11.3
M-D M3	7.9	8.2	8.5	9.4	8.7	8.6
B-L M3	10.9	11.0	10.4	10.7	9.5	8.6

MANDIBLE

M-D I1	6.2		5.8	5.4	4.7	5.6
B-L I1	6.4		5.5	5.9	5.7	5.7
M-D I2	7.3	6.7	6.3	6.5	7.0	6.4
B-L I2	6.7	6.5	5.9	6.5	6.3	6.1
M-D C	7.0	7.4	7.0	6.6	6.2	6.9
B-L C	7.5	8.4	7.1	7.6	7.6	7.2
M-D PM1	6.6	7.1	7.0	7.1	6.7	7.3
B-L PM1	7.8	7.9	7.7	8.0	7.5	7.4
M-D PM2	7.0	7.4	7.4	7.1	6.5	7.2
B-L PM2	8.2	8.3	8.8	8.2	7.7	7.8
M-D M1	10.8	11.7	11.5	11.9	11.0	12.0
B-L M1	10.6	10.7	11.4	10.4	11.1	10.8
M-D M2	9.7	11.0	11.6	10.9	11.2	11.2
B-L M2	10.4	10.5	10.7	10.4	9.6	10.4
M-D M3	10.1	11.2	11.8	10.8	9.8	10.2
B-L M3	10.5	10.9	11.2	9.8	9.4	10.2

UPPER LIMBS

HUMERUS

LENGTH	295.0	316.0	313.0	303.0	303.0	294.0
ANTERO-POSTERIOR DIAMETER	15.0	19.0	21.0	21.0	19.0	20.0
MEDIO-LATERAL DIAMETER	21.0	22.0	20.0	18.0	17.0	19.0
MAXIMUM HEAD DIAMETER	41.0	42.0	45.0	44.0	40.0	42.0
PROXIMAL BREADTH	44.0	48.0	50.0	47.0	44.0	47.0
MINIMUM SHAFT CIRCUMFERENCE	60.0	64.0	58.0	59.0	55.0	59.0
EPICONDYLAR WIDTH	56.0	54.0	55.0	54.0	55.0	56.0

RADIUS

LENGTH	230.0	233.0	227.0	223.0	231.0	223.0
ANTERO-POSTERIOR DIAMETER	10.0	11.0	12.0	12.0	11.0	10.0
MEDIO-LATERAL DIAMETER	13.0	14.0	13.0	15.0	12.0	15.0
HEAD DIAMETER	21.0	21.0	20.0	~~20.0~~	19.0	18.0
DISTAL BREADTH		32.0	29.0	32.0	31.0	32.0

ULNA

LENGTH	254.0	256.0	252.0	247.0	249.0	243.0
ANTERO-POSTERIOR DIAMETER	10.0	12.0	11.0	13.0	12.0	12.0
MEDIO-LATERAL DIAMETER	11.0	15.0	15.0	15.0	15.0	15.0
PROXIMAL BREADTH	24.0	22.0	23.0	21.0	21.0	25.0
DISTAL BREADTH	18.0	17.0	17.0	28.0	18.0	16.0

CLAVICLE

LENGTH	146.0	144.0	141.0	136.0	151.0	127.0

SCAPULA

Measurement	1	2	3	4	5	6
MORPHOLOGICAL BREADTH		145.0	152.0	143.0	151.0	142.0
MORPHOLOGICAL LENGTH	98.0	100.0	94.0	87.0	102.0	85.0
BREADTH INFRASPINOUS FOSSA		110.0	112.0	115.0	123.0	110.0
BREADTH SUPRASPINOUS FOSSA	51.0	46.0	55.0	40.0	50.0	42.0

VERTEBRAL COLUMN

LUMBAR VERTEBRAE

Measurement	1	2	3	4	5	6
#1 ANTERIOR HEIGHT OF CENTRUM	23.0	22.0	21.0	25.0	24.0	24.0
#1 POSTERIOR HEIGHT OF CENTRUM	26.0	24.0	24.0	26.0	28.0	26.0
#2 ANTERIOR HEIGHT OF CENTRUM	23.0	25.0	23.0	26.0	28.0	25.0
#2 POSTERIOR HEIGHT OF CENTRUM	26.0	25.0	26.0	27.0	28.0	27.0
#3 ANTERIOR HEIGHT OF CENTRUM	25.0	27.0	25.0	27.0	28.0	26.0
#3 POSTERIOR HEIGHT OF CENTRUM	26.0	26.0	26.0	28.0	27.0	25.0
#4 ANTERIOR HEIGHT OF CENTRUM	26.0	27.0	26.0	28.0	28.0	25.0
#4 POSTERIOR HEIGHT OF CENTRUM	25.0	27.0	27.0	27.0	27.0	24.0
#5 ANTERIOR HEIGHT OF CENTRUM	27.0	29.0	26.0	28.0	30.0	27.0
#5 POSTERIOR HEIGHT OF CENTRUM	23.0	23.0	27.0	23.0	24.0	22.0
LUMBAR INDEX	101.6	96.2	107.4	97.8	97.1	97.6

SACRUM AND PELVIS

ANTERIOR SACRAL LENGTH	122.0	136.0	130.0		129.0	117.0
ANTERIOR SACRAL BREADTH	119.0	122.0	115.0	126.0	122.0	124.0
SACRAL INDEX	102.5	111.5	113.0		105.7	94.4
INNOMINATE HEIGHT	194.0	196.0	197.0	193.0	205.0	189.0
PUBIS LENGTH	84.0	89.0	82.0	81.0	89.0	78.0
ISCHIUM LENGTH		79.0	81.0	74.0	81.0	7[illegible].0
ISCHIO-PUBIC INDEX		112.6	101.2	109.5	109.9	109.9
ANGLE OF SCIATIC NOTCH	87.0	81.0	75.0	93.0	76.0	83.0

LOWER LIMBS

FEMUR

MAXIMUM LENGTH			422.0	426.0	433.0	416.0
BICONDYLAR LENGTH			415.0	417.0	427.0	410.0
ANTERO-POSTERIOR DIAMETER		27.0	29.0	27.0	26.0	28.0
MEDIO-LATERAL DIAMETER		25.0	26.0	24.0	26.0	23.0
SUBTROCHANTERIC ANTERO-POSTERIOR DIAMETER		27.0	29.0	26.0	33.0	30.0
SUBTROCHANTERIC MEDIO-LATERAL DIAMETER		31.0	30.0	30.0	29.0	27.0
MAXIMUM HEAD DIAMETER		46.0	44.0	43.0	46.0	43.0
EPICONDYLAR WIDTH			77.0	75.0	72.0	78.0
PLATYMERIC INDEX		87.1	96.7	86.7	113.8	111.1

TIBIA

MAXIMUM LENGTH	312.0	340.0	371.0	355.0	403.0	337.0
ANTERO-POSTERIOR DIAMETER	29.0	25.0	28.0	26.0	30.0	31.0
MEDIO-LATERAL DIAMETER	20.0	22.0	20.0	21.0	29.0	21.0
ANTERO-POSTERIOR NUTRIENT FORAMEN DIAMETER	32.0	34.0	34.0	31.0	42.0	37.0
MEDIO-LATERAL NUTRIENT FORAMEN DIAMETER	23.0	24.0	25.0	24.0	30.0	25.0
PROXIMAL DIAMETER	69.0		80.0	70.0	86.0	75.0
DISTAL DIAMETER		45.0	48.0	47.0	59.0	51.0
PLATYCNEMIC INDEX	71.9	70.6	73.5	77.4	71.4	67.6

FIBULA

MAXIMUM LENGTH			367.0		402.0	335.0

TALUS

MAXIMUM LENGTH	49.5	49.0	56.0	51.0	60.5	54.0
MAXIMUM WIDTH	38.5	40.0	45.5	42.0	49.5	42.0
BODY HEIGHT	30.0	29.0	33.0	28.5	36.0	32.0
TROCHLEAR WIDTH	29.0	31.0	33.0	31.5	36.5	30.5
TROCHLEAR LENGTH	31.5	29.0	40.5	30.5	37.0	33.0

CALCANEUS

MAXIMUM LENGTH	70.5	72.5	81.0	69.0	86.0	74.5
BODY HEIGHT	40.0	41.0	51.0	38.0	51.5	43.0
LOAD ARM LENGTH	44.5	47.0	53.5	47.0	55.0	46.5
LOAD ARM WIDTH	42.0	39.0	44.5	44.0	48.5	48.0

MALE MEASUREMENTS

INDIVIDUAL

	1	7	8	18	21	27
CRANIUM						
MAXIMUM CRANIAL LENGTH	170.0	174.0	180.0	178.0	193.0	184.0
GLABELLAR PROTRUSION	6.0	5.0	4.0	4.0	9.0	7.0
MAXIMUM CRANIAL BREADTH	138.0	137.0	137.0	143.0	136.0	137.0
MAXIMUM FRONTAL BREADTH	120.0	102.0	113.0	107.0	101.0	112.0
MINIMUM FRONTAL BREADTH	94.0	90.0	90.0	96.0	92.0	92.0
BASION-BREGMA	126.0	126.0	138.0	118.0	136.0	133.0
BASION-NASION	94.0	93.0	102.0	96.0	111.0	103.0
BASION-PROSTHION	92.0	95.0	98.0	100.0	104.0	96.0
OPISTHION-FOREHEAD DISTANCE	149.0	137.0	156.0	149.0	160.0	153.0
MASTOID LENGTH	21.0	28.0	31.0	29.0	34.0	24.0
BIAURICULAR BREADTH	119.0	120.0	126.0	129.0	133.0	127.0
BASION-PORION	9.0	9.0	16.0	3.0	21.0	11.0
PORION-NASION		90.0	92.0	92.0	102.0	96.0
PORION-PROSTHION	91.0	100.0	100.0	99.0	109.0	98.0
PORION-SUBNASALE	77.0	86.0	89.0	87.0	100.0	85.0
BIPORIAL ARC	305.0	307.0	308.0	304.0	292.0	310.0
UPPER CRANIAL FACIAL HEIGHT	70.0	67.0	69.0	69.0	76.0	74.0
BIZYGOMATIC BREADTH	138.0	133.0	134.0	139.0	142.0	139.0
NASAL HEIGHT	48.0	43.0	51.0	51.0	54.0	53.0
MAXIMUM NASAL BREADTH	27.0	24.0	25.0	27.0	25.0	23.0
ORBITAL HEIGHT	34.0	32.0	34.0	34.0	34.0	33.0

ORBITAL BREADTH	37.0	38.0	38.0	42.0	44.0	42.0
BIORBITAL BREADTH	99.0	94.0	95.0	98.0	104.0	102.0
BIDACRYONIC BREADTH		21.0	21.0	19.0	20.0	22.0
MAXILLO-ALVEOLAR LENGTH	50.0	57.0	48.0	54.0	59.0	55.0
MAXILLO-ALVEOLAR WIDTH	61.0	64.0	65.0	64.0	70.0	67.0
BIMAXILLARY BREADTH	96.0	101.0	99.0	99.0	108.0	102.0
BIFRONTAL DISTANCE		94.0	93.0	96.0	102.0	100.0
ZYGOMAXILLARY SUBTENSE	19.0	25.0	19.0	24.0	30.0	24.0
ANTERIOR MASSETER LENGTH	39.0	37.0	38.0	39.0	39.0	36.0
DACRYON SUBTENSE		7.0	8.0	12.0	10.0	12.0
NASION SUBTENSE		16.0	16.0	17.0	23.0	22.0
BICONDYLAR WIDTH		111.5	108.0	121.0	126.5	123.0
BIGONIAL WIDTH		92.0	95.5	99.5	120.0	112.0
FORAMEN MENTALIA BREADTH	44.0	49.0	46.5	43.5	51.0	48.0
MINIMUM RAMUS BREADTH	38.5	35.5	36.5	37.0	38.0	36.0
RAMUS HEIGHT	55.5	63.0	56.0	58.0	71.5	63.5
SYMPHYSEAL HEIGHT	32.0	35.0	33.5	31.5	36.5	37.0
MANDIBULAR LENGTH	82.0	77.0	86.5	77.5	86.0	80.0
MANDIBULAR ANGLE	116.0	122.5	129.0	120.5	117.0	122.0
CRANIAL INDEX	81.2	78.8	76.1	80.3	70.5	74.5
LENGTH-HEIGHT INDEX	74.1	72.4	76.7	66.3	70.5	72.3
BREADTH-HEIGHT INDEX	91.3	92.0	199.0	82.5	100.0	97.0
UPPER FACIAL INDEX	50.7	50.4	51.5	49.6	53.5	53.2
NASAL INDEX	51.0	53.8	56.5	52.1	54.9	54.5
ORBITAL INDEX	91.9	84.2	89.5	80.9	77.3	78.6
MAXILLO-ALVEOLAR INDEX	122.0	112.3	134.4	118.5	118.6	121.8

DENTAL MEASUREMENTS

MAXILLA

M-D I1	8.3	8.4	8.4	9.7	8.2	9.3
B-L I1	7.7	6.5	7.1	7.3	7.0	7.5
M-D I2		7.1	7.4	7.2	5.8	8.2
B-L I2	6.7	6.0	6.0	6.3	5.3	6.8
M-D C	7.9	8.1	8.3	8.2	7.9	7.9
B-L C	8.6	8.7	8.0	8.1	8.0	8.4
M-D PM1	7.2	7.4	7.5	7.9	7.0	7.2
B-L PM1	10.0	9.3	9.2	9.6	8.5	10.0
M-D PM2	6.5	7.0	7.3	7.8	7.2	7.4
B-L PM2	9.3	9.0	9.2	9.9	8.8	10.0
M-D M1	10.4	10.3	11.3	11.3	11.4	10.9
B-L M1	11.9	10.9	12.0	12.9	11.8	12.2
M-D M2	9.7	9.9	11.0	10.6	10.0	10.3
B-L M2	12.1	11.0	11.2	12.0	11.6	8.9
M-D M3	8.4	8.9	9.5	10.5	9.9	11.3
B-L M3	11.0	10.6	11.0	12.0	11.0	11.4

MANDIBLE

M-D I1		5.9	5.3	5.7	4.8	
B-L I1		5.0	5.8	5.4	5.9	6.3
M-D I2	6.0	6.6	6.9	6.4	5.9	6.9
B-L I2	6.2	5.4	5.6	6.0	5.8	6.3
M-D C	7.3	7.3	7.1	8.0	7.4	7.1
B-L C	8.0	6.8	7.9	8.3	7.0	7.7
M-D PM1	6.7	8.0	7.3	7.5	7.0	7.6
B-L PM1	7.9	7.6	7.9	8.0	7.4	8.1
M-D PM2	6.8	7.3		7.4	7.8	7.3
B-L PM2	8.2	8.2		8.6	7.9	8.5
M-D M1	10.9	10.2	12.3	12.3	11.5	12.4
B-L M1	10.6	10.4	11.0	11.8	11.4	11.0
M-D M2	11.0	10.8	11.8	11.7	12.2	11.9
B-L M2	10.8	10.1	10.5	11.0	10.9	10.8
M-D M3	10.4	11.0		10.6	11.2	10.5
B-L M3	10.5	9.3		10.3	11.2	10.5

UPPER LIMBS

HUMERUS

LENGTH					
286.0	280.0	330.0	309.0	365.0	324.0
ANTERO-POSTERIOR DIAMETER					
15.0	17.0	20.0	19.0	24.0	23.0
MEDIO-LATERAL DIAMETER					
20.0	20.0	22.0	20.0	22.0	20.0
MAXIMUM HEAD DIAMETER					
42.0	40.0	44.0	41.0	53.0	45.0
PROXIMAL BREADTH					
46.0	43.0	49.0	45.0	57.0	48.0
MINIMUM SHAFT CIRCUMFERENCE					
58.0	63.0	63.0	59.0	70.0	60.0
EPICONDYLAR WIDTH					
52.0	50.0	61.0	53.0	69.0	56.0

RADIUS

LENGTH					
217.0	224.0	253.0	243.0	284.0	240.0
ANTERO-POSTERIOR DIAMETER					
10.0	10.0	10.0	11.0	15.0	11.0
MEDIO-LATERAL DIAMETER					
12.0	14.0	14.0	12.0	16.0	14.0
HEAD DIAMETER					
18.0	20.0	21.0	19.0	25.0	20.0
DISTAL BREADTH					
28.0	28.0	34.0	28.0	38.0	33.0

ULNA

LENGTH					
237.0	237.0	268.0	262.0	298.0	262.0
ANTERO-POSTERIOR DIAMETER					
10.0	10.0	11.0	11.0	15.0	12.0
MEDIO-LATERAL DIAMETER					
12.0	12.0	11.0	14.0	21.0	16.0
PROXIMAL BREADTH					
		26.0	21.0	30.0	23.0
DISTAL BREADTH					
15.0	17.0	21.0		22.0	18.0

CLAVICLE

LENGTH					
140.0	139.0	146.0	136.0	171.0	152.0

SCAPULA

MORPHOLOGICAL BREADTH					
150.0				184.0	
MORPHOLOGICAL LENGTH					
	98.0	93.0			
BREADTH INFRASPINOUS FOSSA					
		118.0		142.0	
BREADTH SUPRASPINOUS FOSSA					
	51.0	59.0		63.0	

VERTEBRAL COLUMN

LUMBAR VERTEBRAE

#1 ANTERIOR HEIGHT OF CENTRUM					
22.0	23.0	24.0	24.0	27.0	
#1 POSTERIOR HEIGHT OF CENTRUM					
23.0	25.0	25.0	23.0	29.0	28.0
#2 ANTERIOR HEIGHT OF CENTRUM					
24.0	24.0	24.0	23.0	27.0	25.0
#2 POSTERIOR HEIGHT OF CENTRUM					
22.0	26.0	26.0	23.0	29.0	27.0
#3 ANTERIOR HEIGHT OF CENTRUM					
23.0	24.0	25.0	23.0	30.0	27.0
#3 POSTERIOR HEIGHT OF CENTRUM					
23.0	25.0	25.0	23.0	29.0	27.0
#4 ANTERIOR HEIGHT OF CENTRUM					
23.0	23.0	26.0	24.0	29.0	27.0
#4 POSTERIOR HEIGHT OF CENTRUM					
21.0	24.0	23.0	23.0	27.0	26.0
#5 ANTERIOR HEIGHT OF CENTRUM					
23.0	24.0	26.0	26.0	30.0	29.0
#5 POSTERIOR HEIGHT OF CENTRUM					
17.0	21.0	21.0	20.0	27.0	23.0
LUMBAR INDEX					
92.2	102.6	96.0	93.3	98.6	

SACRUM AND PELVIS

ANTERIOR SACRAL LENGTH			117.0	117.0	126.0	
ANTERIOR SACRAL BREADTH	101.0		103.0	100.0	123.0	
SACRAL INDEX			113.6	117.0	102.4	
INNOMINATE HEIGHT	197.0		198.0	193.0	224.0	198.0
PUBIS LENGTH	69.0		71.0		91.0	69.0
ISCHIUM LENGTH	72.0		74.0	77.0	94.0	74.0
ISCHIO-PUBIC INDEX	95.8		96.0		96.8	93.2
ANGLE OF SCIATIC NOTCH	80.0	87.0	70.0	60.0	54.0	58.0

LOWER LIMBS

FEMUR

MAXIMUM LENGTH	409.0	433.0	470.0	442.0	509.0	454.0
BICONDYLAR LENGTH	407.0	427.0	468.0	440.0	501.0	448.0
ANTERO-POSTERIOR DIAMETER	26.0	29.0	26.0	29.0	34.0	30.0
MEDIO-LATERAL DIAMETER	24.0	24.0	24.0	23.0	30.0	24.0
SUBTROCHANTERIC ANTERO-POSTERIOR DIAMETER	25.0	28.0	28.0	32.0	34.0	31.0
SUBTROCHANTERIC MEDIO-LATERAL DIAMETER	32.0	32.0	35.0	26.0	31.0	26.0
MAXIMUM HEAD DIAMETER	43.0	41.0	47.0	44.0	53.0	44.0
EPICONDYLAR WIDTH	75.0	75.0	88.0	78.0	93.0	80.0
PLATYMERIC INDEX	78.1	87.5	80.0	123.1	109.7	119.2

TIBIA

MAXIMUM LENGTH	347.0	327.0	327.0	348.0	324.0
ANTERO-POSTERIOR DIAMETER	27.0	26.0	27.0		29.0
MEDIO-LATERAL DIAMETER	23.0	21.0	24.0		22.0
ANTERO-POSTERIOR NUTRIENT FORAMEN DIAMETER	30.0	31.0	33.0		31.0
MEDIO-LATERAL NUTRIENT FORAMEN DIAMETER	23.0	25.0	23.0		24.0
PROXIMAL DIAMETER	69.0	70.0	73.0	68.0	69.0
DISTAL DIAMETER	50.0	48.0	46.0		48.0
PLATYCNEMIC INDEX	76.7	80.7	70.0		77.4

FIBULA

MAXIMUM LENGTH	367.0	316.0	323.0	339.0	320.0

TALUS

MAXIMUM LENGTH	54.5	48.5	52.5	49.5	50.0
MAXIMUM WIDTH	42.5	39.0	42.0	40.0	42.0
BODY HEIGHT	32.5	29.0	29.5	30.5	30.0
TROCHLEAR WIDTH	34.0	29.5	31.0	30.0	30.0
TROCHLEAR LENGTH	32.5	31.0	31.0	30.0	31.0

CALCANEUS

MAXIMUM LENGTH	72.5	71.5	71.0	67.0	68.5
BODY HEIGHT	43.0	39.0	45.0	43.5	40.0
LOAD ARM LENGTH	49.0	46.0	46.5	47.0	46.0
LOAD ARM WIDTH	39.5	40.5	46.0	39.5	41.0

APPENDIX II

METRICS

VALUES FOR FEMALES APPEAR IN THE FIRST LINE FOLLOWING THE CHARACTER TITLE; VALUES FOR MALES APPEAR IN THE SECOND LINE.

	MEAN	S.D.	S.E.	MAX.	MIN.	N
CRANIUM						
MAXIMUM CRANIAL LENGTH						
	180.0	7.0	2.8	188.0	169.0	6
	180.8	8.4	3.4	193.0	170.0	6
GLABELLAR PROTRUSION						
	5.2	1.7	0.7	8.0	3.0	6
	5.8	1.9	0.8	9.0	4.0	6
MAXIMUM CRANIAL BREADTH						
	134.5	4.1	1.7	140.0	128.0	6
	138.0	2.5	1.0	143.0	136.0	6
MAXIMUM FRONTAL BREADTH						
	103.7	3.4	1.4	108.0	100.0	6
	109.2	7.3	3.0	129.0	101.0	6
MINIMUM FRONTAL BREADTH						
	88.8	4.1	1.7	94.0	83.0	6
	92.3	2.3	1.0	96.0	90.0	6
BASION-BREGMA						
	129.0	5.7	2.3	138.0	124.0	6
	129.5	7.5	3.1	138.0	118.0	6
BASION-NASION						
	101.5	4.3	1.8	107.0	94.0	6
	99.8	6.9	2.8	111.0	93.0	6
BASION-PROSTHION						
	99.5	4.1	1.7	104.0	94.0	6
	97.5	4.2	1.7	104.0	92.0	6
OPISTHION-FOREHEAD DISTANCE						
	147.7	3.6	1.5	153.0	144.0	6
	150.7	7.9	3.2	160.0	137.0	6
MASTOID LENGTH						
	26.7	1.7	0.7	29.0	24.0	6
	27.8	4.7	1.9	34.0	21.0	6
BIAURICULAR BREADTH						
	122.3	4.1	1.7	129.0	118.0	6
	125.7	5.4	2.2	133.0	119.0	6
BASION-PORION						
	10.8	3.2	1.3	14.0	6.0	6
	11.5	6.3	2.6	21.0	3.0	6

PORION-NASION						
	95.2	4.4	1.8	100.0	87.0	6
	94.6	4.8	2.1	102.0	90.0	5
PORION-PROSTHION						
	102.2	4.4	1.8	108.0	95.0	6
	99.5	5.6	2.3	109.0	91.0	6
PORION-SUBNASALE						
	88.3	3.1	1.3	93.0	84.0	6
	87.3	7.4	3.0	100.0	77.0	6
BIPORIAL ARC						
	297.3	8.8	3.6	307.0	284.0	6
	304.3	6.4	2.6	310.0	292.0	6
UPPER CRANIAL FACIAL HEIGHT						
	68.7	4.6	1.9	77.0	63.0	6
	70.8	3.4	1.4	76.0	67.0	6
BIZYGOMATIC BREADTH						
	133.8	4.3	1.7	141.0	129.0	6
	137.5	3.4	1.4	142.0	133.0	6
NASAL HEIGHT						
	48.7	3.2	1.3	52.0	44.0	6
	50.0	4.0	1.6	54.0	43.0	6
MAXIMUM NASAL BREADTH						
	26.0	1.7	0.7	28.0	24.0	6
	25.2	1.6	0.7	27.0	23.0	6
ORBITAL HEIGHT						
	34.2	2.6	1.1	39.0	32.0	6
	33.5	0.8	0.3	34.0	32.0	6
ORBITAL BREADTH						
	39.7	1.6	0.7	42.0	38.0	6
	40.2	2.9	1.2	44.0	37.0	6
BIORBITAL BREADTH						
	97.7	3.7	1.5	102.0	92.0	6
	98.7	3.9	1.6	104.0	94.0	6
BIDACRYONIC BREADTH						
	22.0	0.9	0.4	23.0	21.0	6
	20.6	1.1	0.5	22.0	19.0	5
MAXILLO-ALVEOLAR LENGTH						
	55.0	2.1	0.9	57.0	51.0	6
	53.8	4.2	1.7	59.0	48.0	6
MAXILLO-ALVEOLAR WIDTH						
	62.5	1.6	0.7	65.0	61.0	6
	65.2	3.1	1.2	70.0	61.0	6
BIMAXILLARY BREADTH						
	98.5	3.4	1.4	103.0	94.0	6
	100.8	4.1	1.7	108.0	96.0	6
BIFRONTAL DISTANCE						
	96.7	5.0	2.0	102.0	90.0	6
	97.0	3.9	1.7	102.0	93.0	5
ZYGOMAXILLARY SUBTENSE						
	24.0	1.1	0.4	25.0	22.0	6
	23.5	4.1	1.7	30.0	19.0	6

ANTERIOR MASSETER LENGTH					
38.0	3.2	1.3	43.0	35.0	6
38.0	1.3	0.5	39.0	36.0	6
DACRYON SUBTENSE					
9.5	1.8	0.7	11.0	7.0	6
9.8	2.3	1.0	12.0	[illegible]	5
NASION SUBTENSE					
18.2	2.4	1.0	20.0	14.0	6
18.8	3.4	1.5	23.0	16.0	5
BICONDYLAR WIDTH					
115.9	8.2	3.4	124.0	101.0	6
118.0	7.9	3.5	126.5	108.0	5
BIGONIAL WIDTH					
97.6	3.1	1.3	100.5	93.0	6
103.8	11.8	5.3	120.0	92.0	5
FORAMEN MENTALIA BREADTH					
47.1	1.1	0.5	49.0	46.0	6
47.0	3.0	1.2	51.0	43.5	6
MINIMUM RAMUS BREADTH					
37.9	2.8	1.1	40.0	32.5	6
36.9	1.2	0.5	38.5	35.5	6
RAMUS HEIGHT					
61.8	2.6	1.1	64.0	57.0	6
61.2	6.1	2.5	71.5	55.5	6
SYMPHYSEAL HEIGHT					
32.8	1.6	0.7	34.5	30.5	6
34.2	2.3	0.9	37.0	31.5	6
MANDIBULAR LENGTH					
84.2	4.4	1.8	90.0	77.0	6
81.5	4.1	1.7	86.5	77.0	6
MANDIBULAR ANGLE					
118.5	7.1	2.9	127.0	109.0	6
121.2	4.7	1.9	129.0	116.0	6
CRANIAL INDEX					
76.9	3.7	1.5	81.2	70.5	6
74.8	1.5	0.6	77.7	73.3	6
LENGTH-HEIGHT INDEX					
71.7	2.6	1.1	75.4	67.9	6
72.0	3.2	1.3	76.7	66.3	6
BREADTH-HEIGHT INDEX					
95.9	2.3	0.9	97.0	91.9	6
93.8	6.1	2.5	100.0	82.5	6
UPPER FACIAL INDEX					
51.3	3.6	1.5	57.8	48.8	6
51.5	1.4	0.6	53.5	49.6	6
NASAL INDEX					
53.8	1.8	0.7	56.5	51.0	6
50.6	4.8	1.9	56.2	43.4	6
ORBITAL INDEX					
86.1	4.7	1.9	95.1	81.0	6
83.7	5.4	2.2	91.9	77.3	6
MAXILLO-ALVEOLAR INDEX					
113.7	3.8	1.6	119.6	107.0	6
121.3	6.7	2.7	134.4	112.3	6

DENTAL MEASUREMENTS

MAXILLA

M-D I1	8.8	0.5	0.2	9.4	8.0	6
	8.7	0.6	0.3	9.7	8.2	6
B-L I1	6.9	0.4	0.2	7.2	6.3	4
	7.2	0.4	0.2	7.7	6.5	6
M-D I2	7.4	0.6	0.3	8.2	6.8	5
	7.1	0.9	0.4	8.2	5.8	5
B-L I2	6.4	0.4	0.2	6.9	6.0	5
	6.2	0.5	0.2	6.8	5.3	6
M-D C	6.4	0.4	0.2	6.9	6.0	5
	8.0	3.2	0.1	8.3	7.9	6
B-L C	8.0	0.5	0.2	8.6	7.5	5
	8.3	0.3	0.1	8.7	8.0	6
M-D PM1	6.7	0.4	0.2	7.0	6.2	5
	7.4	0.3	0.1	7.9	7.0	6
B-L PM1	9.0	0.5	0.2	9.5	8.4	5
	9.4	0.6	0.2	10.0	8.5	6
M-D PM2	6.8	0.5	0.2	7.3	6.1	6
	7.2	0.4	0.2	7.8	6.5	6
B-L PM2	8.9	0.5	0.2	9.5	8.4	5
	9.4	0.5	0.2	10.0	8.8	6
M-D M1	10.4	0.6	0.3	11.1	9.7	5
	10.9	0.5	0.2	11.4	10.3	6
B-L M1	11.5	0.3	0.1	11.8	11.2	5
	11.9	0.6	0.3	12.9	10.9	6
M-D M2	10.2	0.3	0.1	10.5	9.9	5
	10.2	0.5	0.2	11.0	9.7	6
B-L M2	11.3	0.4	0.2	11.7	10.7	5
	11.1	1.2	0.5	12.1	8.9	6
M-D M3	8.3	0.3	0.1	8.7	7.9	6
	9.8	1.1	0.4	11.3	8.4	6
B-L M3	10.2	0.9	0.4	11.0	8.6	6
	11.2	0.5	0.2	12.0	10.6	6

MANDIBLE

M-D I1	5.3	0.4	0.2	5.8	4.7	5
	5.4	0.5	0.2	5.9	4.8	4
B-L I1	5.7	0.2	0.1	5.9	5.5	5
	5.7	0.5	0.2	6.3	5.0	5
M-D I2	6.6	0.2	0.1	7.0	6.3	6
	6.4	0.4	0.2	6.9	5.9	6
B-L I2	6.2	0.2	0.1	6.5	5.9	6
	5.9	0.3	0.1	6.3	5.4	6
M-D C	6.8	0.4	0.2	7.4	6.2	6
	7.4	0.3	0.1	8.0	7.1	6
B-L C	7.6	0.5	0.2	8.4	7.1	6
	7.6	0.6	0.2	8.3	6.8	6
M-D PM1	7.0	0.3	0.1	7.3	6.6	6
	7.4	0.5	0.2	8.0	6.7	6
B-L PM1	7.7	0.2	0.1	8.0	7.4	6
	7.8	0.3	0.1	8.1	7.4	6
M-D PM2	7.1	0.3	0.1	7.4	6.5	6
	7.3	0.4	0.2	7.8	6.8	5
B-L PM2	8.2	0.4	0.2	8.8	7.7	6
	8.3	0.3	0.1	8.6	7.9	5
M-D M1	11.4	0.5	0.2	12.0	10.8	6
	11.6	0.9	0.4	12.4	10.2	6
B-L M1	10.8	0.4	0.2	11.4	10.4	6
	11.0	0.5	0.2	11.8	10.4	6
M-D M2	10.9	0.6	0.3	11.6	9.7	6
	11.6	0.5	0.2	12.2	10.8	6
B-L M2	10.3	0.4	0.2	10.7	9.6	6
	10.7	0.3	0.1	11.0	10.1	6
M-D M3	10.6	0.8	0.3	11.8	9.8	6

UPPER LIMBS

HUMERUS

LENGTH					
304.0	9.0	3.7	316.0	294.0	6
315.7	31.3	12.8	365.0	280.0	6
ANTERO-POSTERIOR DIAMETER					
19.2	2.2	0.9	21.0	15.0	6
19.7	3.4	1.4	24.0	15.0	6
MEDIO-LATERAL DIAMETER					
19.5	1.9	0.8	22.0	17.0	6
20.7	1.0	0.4	22.0	20.0	6
MAXIMUM HEAD DIAMETER					
42.3	1.9	0.8	45.0	40.0	6
44.2	4.7	1.9	53.0	40.0	6
PROXIMAL BREADTH					
46.7	2.3	1.0	50.0	44.0	6
48.0	4.9	2.0	57.0	43.0	6
MINIMUM SHAFT CIRCUMFERENCE					
59.2	2.9	1.2	64.0	55.0	6
62.2	4.4	1.8	70.0	58.0	6
EPICONDYLAR WIDTH					
55.0	0.9	0.4	56.0	54.0	6
56.8	7.1	2.9	69.0	50.0	6

RADIUS

LENGTH					
227.8	4.2	1.7	233.0	223.0	6
243.5	23.8	9.7	284.0	217.0	6
ANTERO-POSTERIOR DIAMETER					
11.0	0.9	0.4	12.0	10.0	6
11.2	1.9	0.8	15.0	10.0	6
MEDIO-LATERAL DIAMETER					
13.7	1.2	0.5	15.0	12.0	6
13.7	1.5	0.6	16.0	12.0	6
HEAD DIAMETER					
19.8	1.7	0.5	21.0	18.0	6
20.5	2.4	1.0	25.0	18.0	6
DISTAL BREADTH					
31.2	1.3	0.6	32.0	29.0	5
31.5	4.2	1.7	38.0	28.0	6

ULNA

LENGTH						
	250.2	4.8	2.0	256.0	243.0	6
	260.7	22.7	9.3	298.0	237.0	6
ANTERO-POSTERIOR DIAMETER						
	11.7	1.0	0.4	13.0	10.0	6
	11.5	1.9	0.8	15.0	10.0	6
MEDIO-LATERAL DIAMETER						
	14.3	1.6	0.7	15.0	11.0	6
	14.3	3.7	1.5	21.0	11.0	6
PROXIMAL BREADTH						
	22.7	1.6	0.7	25.0	21.0	6
	25.0	3.9	2.0	30.0	21.0	4
DISTAL BREADTH						
	19.0	4.5	1.8	28.0	16.0	6
	18.6	2.9	1.3	22.0	15.0	5

CLAVICLE

LENGTH						
	140.8	8.4	3.4	151.0	127.0	6
	147.3	12.9	5.3	171.0	136.0	6

SCAPULA

MORPHOLOGICAL BREADTH						
	146.6	4.6	2.1	152.0	142.0	5
	166.3	17.0	9.8	184.0	150.0	3
MORPHOLOGICAL LENGTH						
	94.3	7.0	2.9	102.0	85.0	6
	94.0	1.4	1.0	95.0	93.0	2
BREADTH INFRASPINOUS FOSSA						
	114.0	5.4	2.4	123.0	110.0	5
	130.0	17.0	12.0	142.0	118.0	2
BREADTH SUPRASPINOUS FOSSA						
	47.3	5.7	2.3	55.0	40.0	6
	59.7	3.1	1.8	63.0	57.0	3

VERTEBRAL COLUMN

LUMBAR VERTEBRAE

#1 ANTERIOR HEIGHT OF CENTRUM					
23.2	1.5	0.6	25.0	21.0	6
24.0	1.9	0.8	27.0	22.0	5
#1 POSTERIOR HEIGHT OF CENTRUM					
25.7	1.5	0.6	28.0	24.0	6
25.5	2.5	1.0	29.0	23.0	6
#2 ANTERIOR HEIGHT OF CENTRUM					
25.0	1.9	0.8	28.0	23.0	6
24.5	1.4	0.6	27.0	23.0	6
#2 POSTERIOR HEIGHT OF CENTRUM					
26.5	1.0	0.4	28.0	25.0	6
25.5	2.6	1.1	29.0	22.0	6
#3 ANTERIOR HEIGHT OF CENTRUM					
26.3	1.2	0.5	28.0	25.0	6
25.3	2.7	1.1	30.0	23.0	6
#3 POSTERIOR HEIGHT OF CENTRUM					
26.3	2.0	0.4	28.0	25.0	6
25.3	2.3	1.0	29.0	23.0	6
#4 ANTERIOR HEIGHT OF CENTRUM					
26.7	1.2	0.5	28.0	25.0	6
25.3	2.4	1.0	29.0	23.0	6
#4 POSTERIOR HEIGHT OF CENTRUM					
26.2	1.3	0.5	27.0	24.0	6
24.0	2.2	0.9	27.0	21.0	6
#5 ANTERIOR HEIGHT OF CENTRUM					
27.8	1.5	0.6	30.0	26.0	6
26.3	2.7	1.1	30.0	23.0	6
#5 POSTERIOR HEIGHT OF CENTRUM					
23.7	1.8	0.7	27.0	22.0	6
21.5	3.3	1.4	27.0	17.0	6
LUMBAR INDEX					
99.7	3.9	1.6	107.4	96.2	6
96.5	5.7	2.5	102.6	92.2	5

SACRUM AND PELVIS

ANTERIOR SACRAL LENGTH						
	126.8	7.4	3.3	136.0	117.0	5
	120.0	4.2	2.5	126.0	117.0	3
ANTERIOR SACRAL BREADTH						
	121.3	3.9	1.6	126.0	115.0	6
	107.2	9.5	4.2	123.0	100.0	5
SACRAL INDEX						
	105.4	10.1	4.5	94.4	113.3	5
	111.0	6.2	3.6	117.0	102.4	3
INNOMINATE HEIGHT						
	195.7	5.4	2.2	205.0	189.0	6
	202.0	12.5	5.6	224.0	193.0	5
PUBIS LENGTH						
	82.8	3.7	1.5	89.0	78.0	6
	76.0	10.4	5.2	91.0	69.0	4
ISCHIUM LENGTH						
	77.0	4.0	1.6	81.0	71.0	6
	79.4	8.7	3.9	94.0	72.0	5
ISCHIO-PUBIC INDEX						
	108.6	3.9	1.7	112.6	101.2	5
	95.4	1.4	0.7	96.8	93.2	4
ANGLE OF SCIATIC NOTCH						
	82.5	6.8	2.8	93.0	75.0	6
	66.8	11.1	4.5	80.0	54.0	6

LOWER LIMBS

FEMUR

MAXIMUM LENGTH						
	424.0	7.1	3.6	433.0	416.0	4
	452.8	34.3	14.0	509.0	409.0	6
BICONDYLAR LENGTH						
	417.2	7.1	3.6	427.0	410.0	4
	448.5	32.8	13.4	501.0	407.0	6
ANTERO-POSTERIOR DIAMETER						
	27.4	1.1	0.5	29.0	26.0	5
	29.0	3.0	1.2	34.0	26.0	6
MEDIO-LATERAL DIAMETER						
	24.8	1.3	0.6	26.0	23.0	5
	24.8	2.6	1.0	30.0	23.0	6
SUBTROCHANTERIC ANTERO-POSTERIOR DIAMETER						
	29.0	2.7	1.2	33.0	26.0	5
	29.7	3.3	1.3	34.0	25.0	6
SUBTROCHANTERIC MEDIO-LATERAL DIAMETER						
	29.4	1.5	0.7	31.0	27.0	5
	30.3	3.6	1.5	35.0	26.0	6
MAXIMUM HEAD DIAMETER						
	44.4	1.5	0.7	46.0	43.0	5
	45.3	4.2	1.7	53.0	41.0	6
EPICONDYLAR WIDTH						
	75.5	2.6	1.3	78.0	72.0	4
	81.5	7.4	3.0	93.0	75.0	6
PLATYMERIC INDEX						
	99.1	10.5	4.7	111.1	86.7	5
	99.6	18.4	7.5	123.1	80.0	6

TIBIA

MAXIMUM LENGTH

	334.6	11.8	5.3	348.0	324.0	5
	353.0	31.4	12.8	403.0	312.0	6
ANTERO-POSTERIOR DIAMETER						
	27.2	1.3	0.6	29.0	26.0	4
	28.2	2.3	0.9	31.0	25.0	6
MEDIO-LATERAL DIAMETER						
	22.5	1.3	0.6	24.0	21.0	4
	22.2	3.4	1.4	29.0	20.0	6
ANTERO-POSTERIOR NUTRIENT FORAMEN DIAMETER						
	31.2	1.3	0.6	33.0	30.0	4
	35.0	4.0	1.6	42.0	31.0	6
MEDIO-LATERAL NUTRIENT FORAMEN DIAMETER						
	23.8	1.0	0.5	25.0	23.0	4
	25.2	2.5	1.0	30.0	23.0	6
PROXIMAL DIAMETER						
	69.2	0.8	0.4	70.0	68.0	5
	76.0	7.1	3.2	86.0	69.0	5
DISTAL DIAMETER						
	48.0	1.6	0.8	50.0	46.0	4
	50.0	5.5	2.4	59.0	45.0	5
PLATYCNEMIC INDEX						
	76.2	3.9	2.0	80.7	70.0	4
	72.1	3.3	1.2	77.4	67.6	6

FIBULA

MAXIMUM LENGTH

	324.5	10.1	5.0	339.0	316.0	4
	368.0	33.5	19.3	402.0	335.0	3

TALUS

MAXIMUM LENGTH					
51.0	2.5	1.1	54.5	48.5	5
53.3	4.4	1.8	60.5	49.0	6
MAXIMUM WIDTH					
41.1	1.5	0.7	42.5	39.0	5
42.9	4.0	1.6	49.5	38.5	6
BODY HEIGHT					
30.3	1.4	0.6	32.5	29.0	5
31.4	2.8	1.2	36.0	28.5	6
TROCHLEAR WIDTH					
30.9	1.8	0.8	34.0	29.5	5
31.9	2.6	1.0	36.5	29.0	6
TROCHLEAR LENGTH					
31.1	0.9	0.4	32.5	30.0	5
33.6	4.4	1.8	40.5	29.0	6

CALCANEUS

MAXIMUM LENGTH					
70.1	2.3	1.0	72.5	67.0	5
75.6	6.6	2.7	86.0	69.0	6
BODY HEIGHT					
42.1	2.5	1.1	45.0	39.0	5
44.5	5.7	2.3	51.5	38.5	6
LOAD ARM LENGTH					
46.9	1.2	0.6	49.0	46.0	5
48.9	4.3	1.7	55.0	44.5	6
LOAD ARM WIDTH					
41.3	2.7	1.2	46.0	39.5	5
44.3	3.6	1.5	48.5	39.0	6

APPENDIX III

DISCONTINUOUS CRANIAL TRAITS

ADULTS

INDIVIDUALS	1	4	7	8	10	18	19	21	24	25	26	27
Ossicle at Lambda	-	-	-	-	-	-	-	-	-	-	-	-
Ossicle at Asterion	-	-	-	-	-	-	-	-	-	-	-	-
Parietal Foramen	-	+	R	+	R	+	R	+	R	R	L	-
Mastoid Foramen Absent	R	-	-	L	-	R	-	-	+	-	-	+
Mastoid Foramen Exsutural	[illegible]	-	-	-	-	-	-	+	-	R	R	-
Double Condylar Facet	-	-	-	-	-	-	-	-	-	+	-	-
Precondylar Tubercle	-	-	-	-	-	-	-	-	-	-	-	-
Posterior Condylar Canal Absent	R	-	-	L	-	R	-	-	-	L	-	-
Foramen Ovale Incomplete	-	-	-	-	-	-	-	-	-	-	-	-
Foramen Spinosum Open	-	-	-	-	-	-	-	R	-	-	-	-
Pterygoid-spinous Bridge	-	+	-	+	-	L R	R	-	+	-	-	+
Accessory Lesser Palatine Foramen	-	-	-	-	-	+	R	-	R	-	-	-
Zygomatico-facial Foramen Absent	-	L	-	L	L	R	-	-	-	-	-	-
Supraorbital Foramen Complete	Considerable variation, see text for discussion											
Accessory Infra-orbital Foramen	-	-	-	-	L	-	L	-	-	-	-	-

INDIVIDUALS	1	4	7	8	10	18	19	21	24	25	26	27
Frontal Notch or Foramen Present	-	+	+	+	+	-	-	-	P	-	-	R
Foramen of Huschke	-	-	-	-	-	+	-	-	-	-	+	+
Double Anterior Condylar Canal	-	-	L	R	-	R	-	-	-	-	-	-
Exsutural Anterior Ethmoid Foramen	-	+	+	+	-	P	-	-	+	-	-	+
Mylohyoid Bridge	-	+	-	+	-	-	+	R	-	-	-	+

- Absent

+ Present both sides

R Right side only

L Left side only

P Partial expression of trait

DISCONTINUOUS CRANIAL TRAITS

JUVENILES

INDIVIDUALS	2	3	5	6	9A	9B	12	13	17	20	22	23
Ossicle at Lambda	-	+	-	-	-	X	-	-	-	+	-	-
Ossicle at Asterion	-	+	-	-	-	X	-	-	-	-	-	R
Parietal Foramen	-	R	R	[illegible]	+	+	+	-	R	-	R	-
Mastoid Foramen Absent	-	-	+	+	-	X	-	-	-	-	+	-
Mastoid Foramen Exsutural	+	-	-	[illegible]	-	X	+	-	+	-	-	L
Double Condylar Facet	Trait not observable due to the young ages of the individuals											
Precondylar Tubercle	-	-	-	-	-	-	[illegible]	-	[illegible]	-	-	-
Posterior Condylar Canal Absent	-	-	-	-	R	-	X	-	[illegible]	-	L	-
Foramen Ovale Incomplete	-	-	-	+	-	X	-	-	-	-	-	+
Foramen Spinosum Open	-	L	-	-	-	X	L	-	L	L	-	-
Pterygoid-spinous Bridge	P	-	L P	P	-	X	X	R	L	-	-	R P
Accessory Lesser Palatine Foramen	-	-	L	-	L	+	-	-	-	-	-	R
Zygomatico-facial Foramen Absent	R	+	-	-	L	X	+	-	R	-	-	-
Supraorbital Foramen Complete	Considerable variation, see text for discussion											
Accessory Infra-orbital Foramen	-	-	-	-	-	-	-	-	-	-	R	-

INDIVIDUALS	2	3	5	6	9A	9B	12	13	17	20	22	23
Frontal Notch or Foramen Present	-	P	-	-	+	R	-	-	+	R	-	+
Foramen of Huschke	Trait not observable due to the young ages of the individuals.											
Double Anterior Condylar Canal	-	-	+	-	-	-	X	-	-	-	-	-
Exsutural Anterior Ethmoid Foramen	+	-	L	-	+	X	-	L	+	+	+	L
Mylohyoid Bridge	-	-	-	-	-	-	-	-	-	-	-	-

- Absent

+ Present both sides

R Right side only

L Left side only

P Partial expression of trait

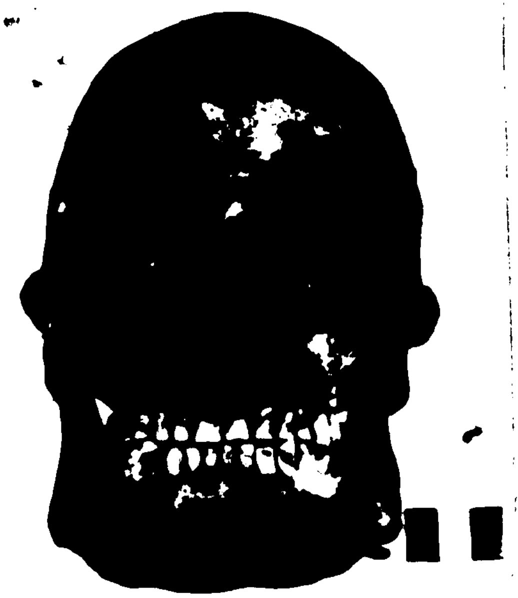
X Unable to make observations because of damage to the cranium.

PLATE 1. Variation in Male Crania.

A and B: Frontal and lateral views of Individual 21.

C and D: Frontal and lateral views of Individual 8.

A



B

C

D

PLATE 2. Variation in Female Crania.

A and B: Frontal and lateral views of Individual 10.

C and D: Frontal and lateral views of Individual 25.

A

B

C

D

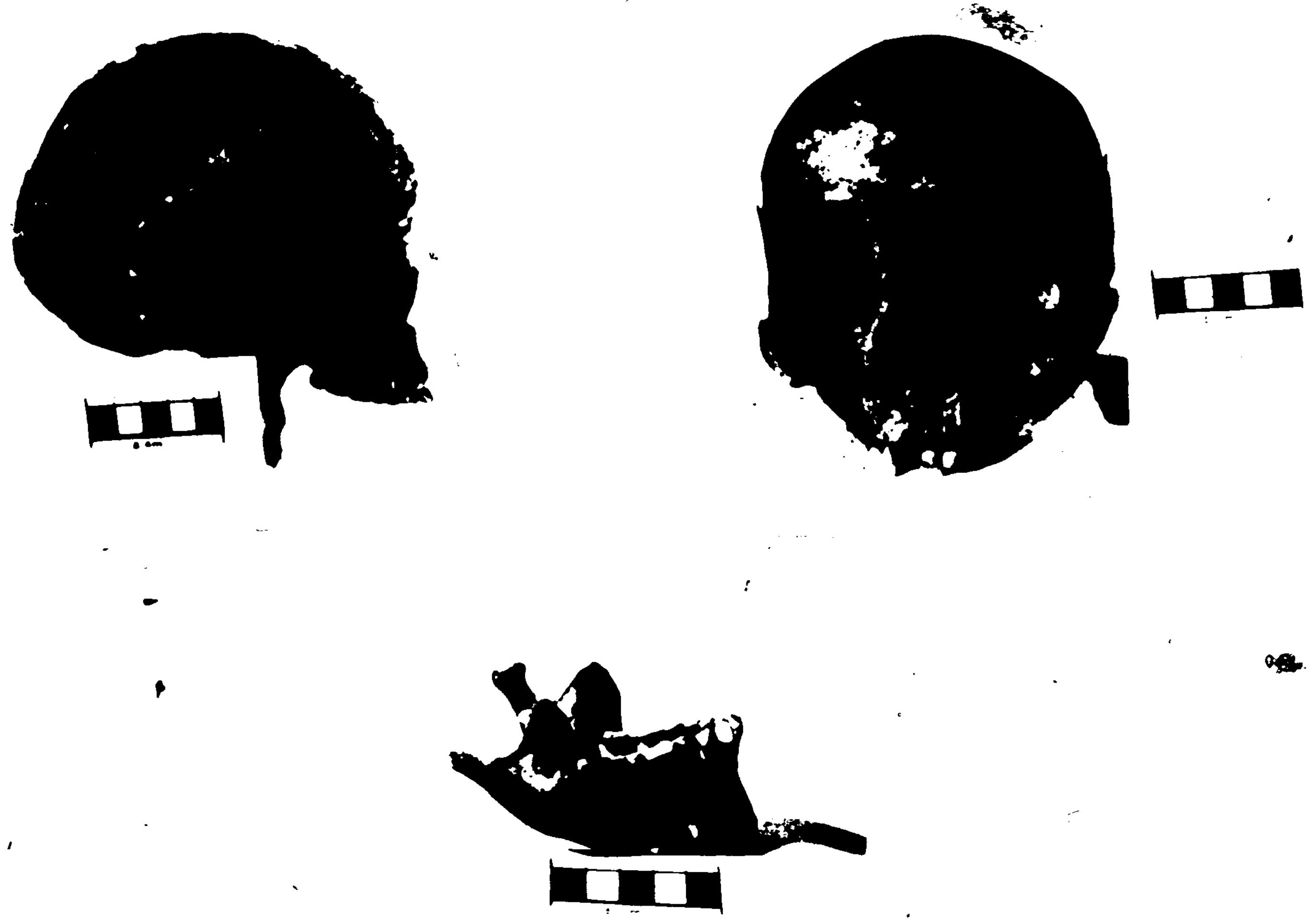
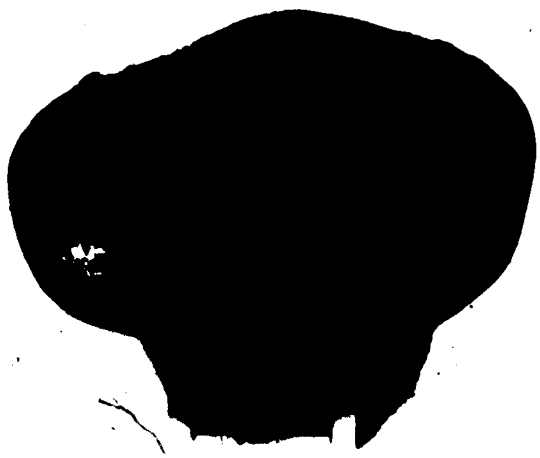


PLATE 3. Individual 1: Cranial distortion and deformed ascending ramus of the mandible.

A



B

PLATE 4. Juvenile 9B: Premature suture closure.

A. Vertical view

B. Occipital view

PLATE 5. Individual 3: Os Incae.

PLATE 6. Individual 21: Supra-orbital bone structure.

PLATE 7. Dental Variations

A. Individual 7: Unusual chipping of distal edges of the first and second mandibular molars. An abscess of the first molar is also apparent.

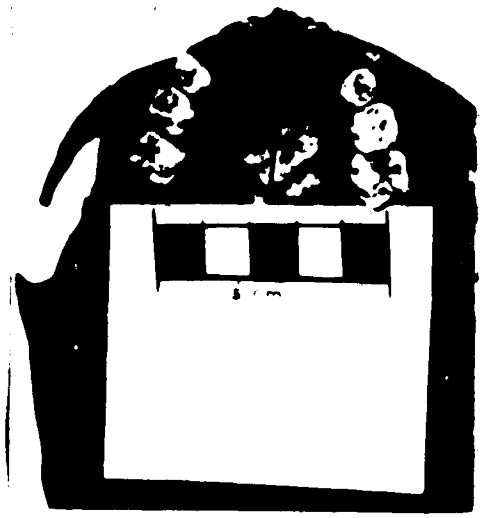
B. Individual 12: Winged incisors are in the process of erupting. There is a five-cusped upper left first molar.

C. Individual 8: Retention of the mandibular second deciduous molars.

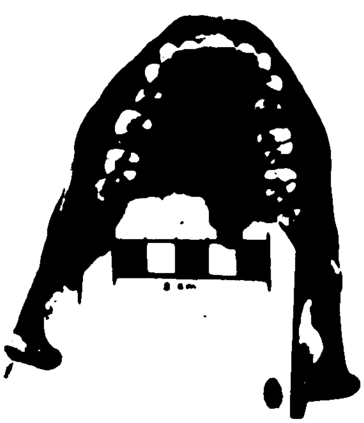
D. Individual 21: Crowding of the anterior dentition is apparent. The first molars have been worn to the extent that large, smooth pits have formed.

A

B



C



D

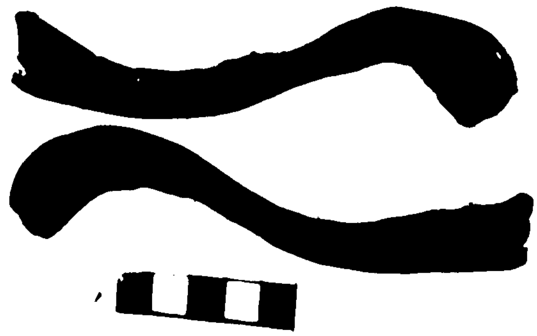


PLATE 8. Individual 8: Anomalous pitting of clavicles.

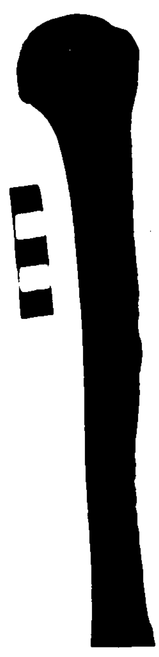


PLATE 9. Individual 26: Anomalous pitting of the humerus.

PLATE 10. Six-Segmented Sacra

A. Individual 18: Incomplete fusion of the two halves of the neural arch of S-1.

B. Individual 25: Spina bifida.

C. Individual 10: Incomplete fusion of S-1.

A

B

C

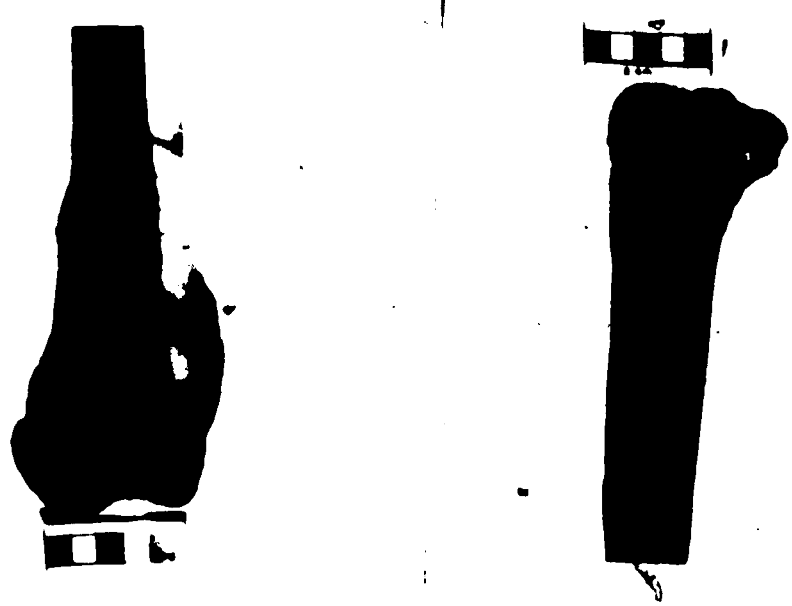


PLATE 11. Individual 25: Periosteitis of the distal portion of the femur and the proximal portion of the tibia.