AN ANALYSIS OF THE SKELETAL MATERIAL FROM SUGAR CREEK OSSUARY (23PL58)

by

Martin K. Nickels
A.B., University of Kansas, 1969

Submitted to the Department
of Anthropology and the Faculty
of the Graduate School of the
University of Kansas in partial
fulfillment of the requirements
for the degree of Master of Arts.

TABLE OF CONTENTS

LIST OF TABLES

TABLE

ACKNOWLEDGEMENTS

As is usual in an endeavor such as this there are a number of people who have generously contributed to its fruition. Initial thanks must certainly go to Mr. R.B. Aker (who excavated the site) and Mr. Mett Shippee through whose combined generosity and cooperation the Sugar Creek skeletal remains were sent to the University of Kansas for study. Mr. Francis C. Lees gave very generously of both his knowledge and time in photographing the specimens and his handiwork may be seen in Appendix B. The members of my Master's Committee are due special thanks for their cooperation and encouragement during this study: Dr. Alfred E. Johnson, who secured the skeletal material for study and helped me understand the archaeology of the site; Dr. Ellis R. Kerley, who diagnosed most of the non-dental pathological conditions discussed in Chapter 6; and Dr. Thomas W. McKern, the chairman of the committee and my principal advisor who surely gave more generously of his time, knowledge, and library than I really deserved. I also wish to thank my wife Donna for lovingly and smilingly putting up with an idiosyncratic and oftentimes grouchy thesis-writing husband.

My heartfelt gratitude is extended to all of these individuals for their cooperation and assistance and for not asking me too many times how my thesis was progressing. I sincerely hope that this work is worthy of their efforts and sacrifices.

INTRODUCTION

The purpose of this study is essentially twofold: first, to record and present the osteological data from the skeletal material recovered at the Sugar Creek Ossuary (23PL58) and, second, to assess this material's affinities with other skeletal series having similar cultural, geographical, and temporal associations. In regard to the first, and principal, objective, this writer developed osteometric data sheets especially for this study. There were specific reasons for doing this. It was felt that by having to organize his own list of observations to be made, measurements to be taken, and indices to be calculated, the author would gain a greater understanding of, and appreciation for, the whys and hows of basic human osteometric procedure than if he were to simply use others' check lists. This is not to say that the author can now be considered a master practitioner of human osteometric analysis but, rather, that he has certainly become more familiar with the knowledge and techniques involved in such analysis, as well as becoming more aware of the problems and difficulties encountered in such studies.

Also, it was apparent that the skeletal material from this site warranted a slightly different treatment than is usually accorded individual burial remains. Because the Sugar Creek site is an ossuary in which the human skeletal remains were entirely comingled, it was thought that a study which analyzed both individual

and miscellaneous remains, i.e. unassignable to any one individual, would be most appropriate. Consequently, the organization of the osteometric data sheets allowed for the treatment of both recognizable individual's remains and those remains which could not be designated as belonging to either one individual or another. Post-cranial bones were the most frequently-encountered miscellaneous remains. Separate burial numbers and laboratory numbers were assigned to recognizable individuals, while only laboratory numbers were assigned to miscellaneous bones.

An important consideration must be mentioned here regarding the total number of individuals represented in this sample. There are at least 25 adult individuals present from the count of whole or nearly complete crania and mandibles. Consequently, its small sample size relegates this skeletal series to relative statistical insignificance. A relevant quotation from D. R. Brothwell both underscores and tempers this conclusion:

> In later man, where it is necessary to study less outstanding differences between groups, series of at least forty or fifty skeletons of the same sex are needed before reliable statistical analyses are possible. Thus, if only one or two dated skeletons are excavated, sex, age, disease and measurement may be noted but deductions as to the morphological affinities of these individuals with other peoples of the period could only be very tentative, if they are possible at all. The value of reports on one or two skeletons is not to serve as the basis of any theory of morphological relationships, but to provide standardized data which may eventually be built into a general picture of population at one period or through time (1965:109).

Thus, while the present sample size of 25 adult individuals obviously falls far short of Brothwell's recommended figure of

80-100 in order to obtain statistical reliability, the present series is also much larger than "only one or two skeletons."

Therefore, while the Sugar Creek material can certainly contribute a great deal of "standardized data which may eventually be built into a general picture of population at one period or through time," this series, of itself, will not provide the statistical significance that a much larger series would. With this in mind, then, the limited statistical analysis performed in this study must be regarded as just that: limited, in both scope and significance.

Consequently, the greatest contribution this exercise in morphological description and osteometry can make to our knowledge and understanding of the American Indian population living in the Missouri River Valley area some 800 years ago is to provide a stepping-stone (hopefully, a firm one) to be utilized by another researcher who at some later date may eventually build a general picture of that population. So it is as a stepping-stone that this study can achieve real significance because without such work, no advance in our general knowledge or understanding is possible.

CHAPTER 1

NATURE OF THE SITE AND ITS CULTURAL AFFILIATIONS

The information about the nature of this site, 23PL58, was obtained from an interview with its excavator, Mr. R. B. Aker. Mr. Aker is a well-known and very knowledgable archaeologist in the Kansas City area and has had a great deal of experience in excavating sites in this area. The interview took place on Sunday, April 11, 1971 at Mr. Aker's home in Parkville, Missouri.

Mr. Aker and a companion excavated this site in 1960. It is located in Platte County, Missouri on the eastern bluff of the Missouri River just east of Atchison, Kansas and its topographic coordinates are Northeast 1/4, Section 2, Township 54N, Range 37 W. It is situated on a high ridge overlooking an extremely large village site, 23PL44. Mr. Aker described 23PL58 as being a pit some 15 by 25 feet in size and 40 inches deep.

Some 120 comingled human burials were observed and recorded during the course of excavation. Unfortunately, most of the burials were in too poor a condition to permit recovery. Cultural artifacts included over 1300 potsherds which were found in a scattered fashion throughout the pit and were freely mingled with the skeletal material. Mr. Aker diagnosed these potsherds as being representative of two principal cultures: The Nebraska regional variant of the Central Plains tradition (after Krause 1969:95), constituting approximately

60-70% of the total number of sherds and the Middle Mississippi tradition, constituting the remaining 30-40% of the potsherds.

Mr. Aker noted that this site occurs in an area which is somewhat transitional between an area further north in which only Nebraska regional variant remains are found and an area to the south in which Middle Mississippi artifacts are plentiful. He also noted that the village site 23PL44 showed an approximately similar percentage breakdown of the potsherds recovered from it during a brief surface collection excursion. Because of the cultural affiliations of the village site and the ossuary pit, Mr. Aker estimates that they were both utilized between 1200 and 1400 A.D.

In regard to these cultural affiliations, two important questions must be asked at this point: What is the nature of both the Nebraska and Middle Mississippi cultures? And just what is the nature and extent of their relationship to each other?

The Nebraska culture people are described by Waldo R. Wedel as being the bearers of a tradition which is essentially a regional variant of a larger cultural tradition: the Central Plains phase, which existed along the Missouri River Valley after 1000 A.D. (1961:92-4). These were a sedentary people whose sunken earthlodge villages or hamlets were located on both the tops of ridges and bluffs and on lower terraces. There is evidence for garden cultivation, hunting, and fishing. Pottery is relatively plentiful and their artifact inventory is more extensive and varied than the earlier Woodland people that preceded them in this region (Wedel 1961:94). Wedel has this to say about how they cared for their dead:

> The burial practices of the Nebraska culture peoples are not very well known; but it appears likely that they...exposed the corpses and afterwards placed the bones in haphazard fashion in or under low mounds, or in small natural elevations. (1961:97)

Whereas Wedel sees these people as gradually, and somewhat mysteriously, disappearing by 1500 A.D. (1961:100), George E. Hyde sees both the Nebraska regional variant and the Glenwood "aspect" (the name for the Nebraska variant in western Iowa) as the archaeological manifestation of Indians later called the Pawnee by the French (Hyde 1962:241).

The Middle Mississippi people inhabited settlements along the east side of the Missouri River above Kansas City at a time broadly contemporaneous with the Nebraska regional variant people. These people were also cultivators and hunters and inhabited earth-lodge villages. They seem to have been the possessors of more advanced ceramic techniques than the Central Plains people employed. Wedel states that these Middle Mississippi people's "ultimate relationships were with the builders of Cahokia and other well-known mounds near St. Louis" (1961:97). Unlike the people of the Nebraska regional variant, these people intered their dead in large mounds and hilltop cemeteries (Wedel 1961:97).

The Steed-Kisker site on the Platte River near Kansas City is certainly the best known Middle Mississippi village in this area and a cemetery containing the remains of at least 83 individuals is associated with it. Excavated by Wedel around 1940, this site provides important information about the relationship these people had with

the Nebraska regional variant people further north along the Missouri River. That there was a mutual exchange of ideas and cultural practices is fairly certain.

For example, the only house unit fully excavated at Steed-Kisker is very different from typical Middle Mississippi house construction and, instead, is "essentially identical with the prehistoric earthlodge sites of the Nebraska culture farther up the Missouri" (Wedel 1943:210). Likewise, the Nebraska regional variant peoples (especially of southeastern Nebraska and northeastern Kansas) apparently adopted the Middle Mississippi techniques of manufacturing shell-tempered, incised pottery. Also, "such Nebraska culture items as human effigy heads of clay, pottery trowels, effigy clay pipes, grooved and polished deer jaw objects, and perhaps also musselshell hoes are strongly reminiscent of Middle Mississippi types" (Wedel 1943:214). Moreover, these influences seem to be centered in, if not limited to, an area extending only a relatively short distance west of the Missouri River.

Consequently, Wedel concludes that:

> The accumulating evidence makes it clear that the prehistoric earth-lodge dwellers of the Central Plains were in contact with alien peoples with whom they doubtless traded and intermarried, and from whom they certainly borrowed ideas. (1961:97)

Therefore, the presence of mixed Nebraska regional variant-Middle Mississippi pottery types in the Sugar Creek Ossuary is not only possible but exceedingly probable in view of the proximity of these two "culture areas" to one another and because such mixtures occur elsewhere in the same general area.

It is also probable that this ossuarial pit represents a secondary burial as described earlier by Wedel. Such a burial custom is well-documented for the Upper Republican, which is also a regional variant of the Central Plains "phase" located in western Kansas and Nebraska (Wedel 1961:94). Also, in 1952, Marvin F. Kivett published a report on the Woodruff Ossuary (14PH4) in Phillips County, Kansas. A large secondary burial pit with at least 61 individuals represented, this ossuary is earlier in time than either the Upper Republican or Nebraska regional variants of the Central Plains tradition and was assigned to the Keith focus of the Plains Woodland by Kivett in 1952 (p. 134). In 1956, Wedel and Kivett published a Carbon 14 date of 611±240 years for the Woodruff Ossuary (pp. 414-15). The important point is that secondary, mass burial pits in the general Kansas-Missouri area are known to have existed both prior to and contemporaneous with the Nebraska regional variant. So, it would appear that the Sugar Creek Ossuary might very well represent definite evidence for this kind of burial practice having existed among what is most probably a predominantly Nebraska regional variant population.

An interesting feature of the Sugar Creek Ossuary is the presence of a later, slab-covered pit which was dug into the northeast quarter of the original pit. This secondary pit is some four feet in diameter, about 40 inches in depth, and contained the remains of 16 individuals. It is Mr. Aker's judgment that this secondary pit represents another deposition of burials by the same village inhabitants

a few years after the original, larger pit was dug and used. He discounts any notion of this secondary pit being a much later intrusion.

In conclusion, then, the Sugar Creek Ossuary appears to be a secondary burial of and by people who possessed a culture which is essentially that of the Nebraska regional variant of the Central Plains tradition but with certain Middle Mississippi influences. Future excavation of the village site 23PL44 would certainly be valuable in substantiating or disproving this conclusion.

CHAPTER 2

OSTEOMETRIC TECHNIQUES AND PROCEDURES

The osteometric data sheets employed in this study are reproduced in their entirety on the following three pages. Please note that these represent the revised sheets used in this analysis. This reproduction simply represents standard operating procedure in a study such as this in order to permit the reader to better understand the methodology involved. The procedures utilized in taking the measurements listed are summarized on the data sheets in this manner: In the blank following each measurement, the initials of the anthropometric/osteometric instrument used in taking the measurement appear in capital letters according to the following key:

Sliding Caliper	SC
Hinge Caliper	HC
Osteometric Board	OB
Western Reserve Head Spanner	WRHS
Internal-External Sliding Caliper	IESC

As is also usual and appropriate in a study such as this, the identification of osteometric measurements and indices is set forth for the reader in Table 1. Note that these are only the ones which are <u>not</u> found in M.F. Ashley Montagu's <u>A Handbook of Anthropometry</u> (1960). References for the non-metric observations made in this study are cited later in this report when the observations are discussed in detail.

OSTEOMETRIC DATA SHEET

Martin K. Nickels
Spring, 1971

Site _____ Burial _____
Site No. _____ Sex _____
Square _____ Age _____
Feature _____ Date _____

MATERIAL PRESENT:

Cranium ____
Calvarium (only) ____
Calotte (only) ____
Mandible ____

General Condition of Material:

Good ____ Fragmentary ____
Fair ____ Some breakage ____
Poor ____ Complete ____

	R	L		R	L			
Scapula	____	____	Innominate	____	____	Sternum	____	
Clavicle	____	____	Femur	____	____	Vertebrae-	No.	Which ones
Humerus	____	____	Patella	____	____	Cervical	____	_____
Radius	____	____	Tibia	____	____	Thoracic	____	_____
Ulna	____	____	Fibula	____	____	Lumbar	____	_____
Wrist	____	____	Ankle	____	____	Sacrum	____	
Hand	____	____	Foot	____	____			
Ribs	____	____						

SEX:

Pelvis-
- Subpubic arch ____
- Obturator foramen ____
- Greater sciatic notch ____
- Preauricular sulcus ____
- Superior inlet ____

Cranium-
- Slope & ht. of forehead ____
- Sup. border of orbit ____
- Ext. occip. protuberance ____
- Muscle markings:
  - nuchal & temporal ____
- Mastoid process ____
- General size ____

Mandible-
- Gonial angle ____
- Chin form ____
- Gen. size ____

AGE:

Pubic symphysis ____
Epiphyses ____
Tooth eruption ____
Cranial sutures ____

PATHOLOGICAL CONDITIONS:

- thickened cranial bones _____
  - measurements _____
- bone injuries _____
- osteomyelitis _____
- arthritis _____
- mastoiditis _____
- ear exostoses _____
- atrophy _____
- endocranial
  - pacchionian bodies _____
- destructive processes _____
- ankylosis & fusion _____
- deformity _____
- soft tissue ossification _____
- other _____

Cranial Deformation:
- absent ____
- frontal ____
- fronto-occip. ____
- occipital ____
- asymmetrical ____

Notes:

TEETH:

←---------R							
M3	M2	M1	PM2	PM1	C	LI	CI

L----------→							
CI	LI	C	PM1	PM2	M1	M2	M3

X=tooth present,non-car.
-=tooth missing, ante-mort.
O=tooth missing, post-mort.
BM=bone missing
A=abscess
A-=abscess, tooth missing
C=carious
P=pinpoint caries
T=tartar
UE=unerupted
CR=in crypt
Tooth mutilation:

crowding_____
occlusion_____
supernumerary_____
interprox. groov._____
hypodontia_____
pyorrhea_____
shovel shaping_____

NON-METRIC OBSERVATIONS:

Mandible-

Chin form:	median	____
	bilateral	
Mandibular torus:	Yes	____
	No	
Cranial-		
Metopic suture:	Yes	____
	No	

Pterion articulation:		R	L
	Fron.-Temp.	___	___
	Par.-Sphn.	___	___
Other-			___
Wormian bones:			
epipteric.....		___	___
lambdoid ossicle (Lat.)....		___	___
lambdoid ossicle (Med.)....		___	___
Inca bone.....		___	___
parietal notch bone.....		___	___
asterion ossicle.....		___	___
mastoid ossicle.....		___	___
coronal ossicle.....		___	___
sagittal ossicle.....		___	___
bregmatic ossicle.....			
Dehiscences tympanic element	Yes	___	___
	No		___
Palatal torus-	Yes	___	
	No		
Pharyngeal fossa-	Yes	___	
	No		

		R	L
Mylohyoid bridge:	Yes	___	___
	No	___	___
Accessory mental formina:	Yes	___	___
	No	___	___
Gonial angle eversion:	None	___	___
	Some	___	___
	Pronounced		___
Foramina:		R	L
Lesser palatine-	single	___	___
	multiple		___
Supraorbital-notch-	Yes	___	___
	No		___
Frontal-	Yes	___	___
	No		___
Accessory infraorbital-	Yes	___	___
	No		___
Parietal-	Yes	___	___
	No		___
Mastoid-	Yes	___	___
	No		___
Mastoid, exsutural-	Yes	___	___
	No		___
Suture into infra-orbital foramen	Yes	___	___
	No		___

Notes:

MEASUREMENTS:

Cranial-

Max. length..... HC
Max. breadth..... HC
Basion-bregma..... HC
Endoba.-nasion..... HC
Endoba.-alv/pros... HC
Endoba.-gnathion... HC
Min. frontal..... HC
Bizygomatic dia.... HC
Nasion-prosthion... SC
Nasion-gnathion.... SC
Nasal height..... SC
Nasal breadth..... SC

L orbital ht..... SC
L orbital br..... SC
Interorb. br..... SC
Palatal length... IESC
Palatal br..... IESC

Auricular ht..... WRHS
Porion-nasion.... WRHS
Po.-subnasale.... WRHS
Po.-prosthion.... WRHS
Po.-gnathion..... WRHS

Mandible-

Bigonial diam..... SC
Coronoid height... OB
Bicondylar width.. OB
Length..... OB
Symphyseal ht..... SC

Indices-

Cranial index..... ____
Cranial module.... ____
Length-height..... ____
Breadth-height.... ____
Upper facial..... ____
Total facial..... ____
Nasal index..... ____
Orbital index..... ____
Stature..... ____

Post-Cranial-(Osteometric Board except where noted)

HUMERUS

Max. length..... ____
Ant.-post. diam., midshaft. SC
Med.-lat. diam., midshaft.. SC
Circumference, midshaft.... TAPE
Max. diam., head..... SC
Perfor., olecranon fossa... IESC
Robusticity index..... ____
Humero-femoral index..... ____

RADIUS

Max. length..... ____
Radio-humeral index..... ____

ULNA

Max. length..... ____

CLAVICLE

Max. length..... ____
Claviculo-humeral index.... ____

SACRUM

Anterior height..... SC
Anterior breadth..... SC

INNOMINATE

Height..... ____

FEMUR

Max. length..... ____
Physiological length..... ____
Dia., femoral head..... SC
Subtroch. ant.-post. dia.... SC
Subtroch. med.-lat. dia..... SC
Ant.-post. dia., midshaft... SC
Med.-lat. dia., midshaft.... SC
Platymeric index..... ____
Pilastric index..... ____
Robusticity index..... ____

TIBIA

Max. length..... ____
Ant.-post. dia., nut. for... SC
Med.-lat. dia., nut. for.... SC
Tibio-femoral index..... ____

FIBULA

Max. length..... ____

Notes:

TABLE 1

Measurements and Indices, Not from Montagu, 1960

Monaco Agreement (as quoted in Hrdlicka 1929:131-32)-
- Orbital Height
- Orbital Breadth

Hrdlicka 1929-
- Endobasion-Nasion: p. 130
- Endobasion-Prosthion: p. 130
- Maximum Length, Clavicle: p. 159
- Claviculo-humeral Index: p. 159

Snodgrasse 1951:448-51-
- Auricular Height
- Porion-Nasion
- Porion-Subnasale
- Porion-Prosthion
- Porion-Gnathion

Anderson 1962:103-
- Cranial Module

Krogman 1962:200-
- Humero-Femoral Index
- Radio-Humeral Index
- Tibio-Femoral Index

Brothwell 1965-
- Palatal Length: p. 81
- Palatal Breadth: p. 81
- Mandibular Length: p. 84
- Maximum Length, Fibula: p. 85

Olivier 1969-
- Robusticity Index, Humerus: p. 227
- Robusticity Index, Femur: p. 262

There are several explanatory comments regarding the procedures of classification, sexing, and ageing employed in the individual laboratory descriptions which are found in Appendix A.

All of the remains were assigned laboratory numbers during the course of examination and, where applicable in this study, the burial numbers assigned by the archaeologist appear with the laboratory number. Crania associated with mandibles were assigned single laboratory numbers. Miscellaneous bones having no burial number designations and from the same grid square were assigned a single laboratory number but with letters, so as to identify them individually. Thus, Lab 38a and Lab 38b are both from square 30R9 but the former is an atlas cervical vertebra and the latter is a lumbar vertebra. This classificatory scheme was utilized simply because there was no way to know if, for example, the atlas and lumbar vertebrae belonged to the same individual.

The sexing of the bones was based on the standard characters of sexual distinction as found in the following authors:

Stewart 1952:128-134;
Montagu 1960:76;
Anderson 1962:141-142;
Krogman 1962:115-116, 124-125;
Brothwell 1965:51-55.

While many authors (McKern and Stewart 1957:37; Montagu 1960: 55; Krogman 1962:89; Brothwell 1965:38) have duly noted the general unreliability of skeletal age estimations which are based upon the degree of cranial suture closure, there are times when such estimations are of great value. As Krogman notes: "If the skull is the

only part present then this sort of age evaluation is the best one can do, and the statement is then diagnostic" (1962:89). Brothwell adds: "It is evident that in skulls with the facial region missing, closed or partially closed sutures at least show that the individual was adult" (1965:38).

Consequently, in a study such as this in which there are virtually no post-cranial associations with any of the cranial material, age estimations utilizing the degree of suture closure, and not epiphyseal union, are practically unavoidable and even valuable. The reference for determining the ages associated with particular degrees of suture closure can be found in Table 17 on page 81 of Krogman's classic tome The Human Skeleton in Forensic Medicine (1962). This is a summary table of the work done by T.W. Todd and D.W. Lyon, Jr. in 1924-1925.

Two liberties were taken in the utilization of this table: first, the figures for Whites rather than Negroes were used and, second, the figures were applied to both male and female crania, even though the specific work of Todd and Lyon only dealt with males. The only rationale for taking the first liberty is that since there was no such data available for American Indians or Mongoloids, the Whites were felt to have closer affinities with the Mongoloids than were the Negroes. The employment of the term "felt" here can not be too strongly emphasized. The justification for taking the second liberty is simply that there was no alternative, except, of course, that of simply not trying to age the female crania by

this techniques at all. But, in this regard, the reader is certainly free to disregard the ages of the female crania when they are based upon the application of this technique (which is generally the case).

The general procedure followed in this study to determine the age at death of individuals represented solely by cranial remains was to first determine whether the basilar synchondrosis (if present) was open or closed. If closed, then the individual was judged to be a minimum of 21 years of age (McKern and Stewart 1957:37), and, if open, not yet 21 years of age. Second, the pattern and degree of closure observed in the various cranial sutures was used to provide a broad range of years in which the individual can quite possibly be placed with a certain tenuous degree of reliability. If teeth were present, then the state of their eruption pattern was also noted using Schour and Massler's chart (1944) and Montagu's simplified diagram (1960:54-5). In fact, even though the great range of variation observed in tooth eruption is rivaled only by the range noted for suture closure, the teeth were often accorded more reliance in determining age than were the sutures. As Brothwell notes: "In abandoning the sutures as method of ageing, few features of the skull except the dentition are of much use for our purpose" (1965:57).

There are two other important reasons for using the teeth for age identification in this study. First, the stage of tooth eruption was usually easier to ascertain than was the degree of suture closure; and second, the experience of this writer is more extensive in calculating age from tooth eruption than it is in

calculating age from the degree of either endocranial or ectocranial suture closure. In any case, the reader is urged to consider all of the age calculations in this study with a considerable degree of caution, since none of the post-cranial (and more reliable) criteria were able to be utilized consistently.

CHAPTER 3

INVENTORY OF SKELETAL MATERIAL

Tables II and III show the inventories of the cranial and post-cranial remains respectively. They are classified according to adult or subadult, male or female.

Of the 19 adult crania, 14 were associated with mandibles and there were 6 lone adult mandibles. Both subadult "crania" were associated with mandibles and, in addition, there was a lone subadult mandible. Thus, from a count of the 19 cranial remains (with or without any mandible association) and the 6 lone mandibles, it can be ascertained that there are at least 25 adult individuals represented in this skeletal series. A similar count of the subadult material indicates a total of at least 3 individuals.

The association of post-cranial remains with cranial remains is extremely small. A total of 6 adult individuals are represented as having such an association and this ranges from a nearly complete skeleton (Lab 18) to 3 cases of cranial remains associated with vertebrae only (two of those involving only the atlas cervical vertebra), and one case of a mandible associated only with a left humerus (Lab 2). Needless to say, this is a most unfortunate situation in view of the numerous post-cranial remains in this series which cannot be associated with the skulls which are present,

TABLE II

Inventory of Cranial Skeletal Material

	Adult	Subadult
*Cranium-		
Male:	12	0
Female:	7	0
Indeterminate:	0	2
TOTAL:	19	2
Mandible (only)-		
Male:	3	0
Female:	2	0
Indeterminate:	1	1
TOTAL:	6	1
Cranium plus Mandible-		
Male:	8	1(?)
Female:	6	0
Indeterminate:	0	1
TOTAL:	14	2
Cranial and Post-Cranial Associations-		
Male:	4	0
Female:	2	0
Indeterminate:	0	1
TOTAL:	6	1

*Includes all cranial/facial remains, broken or complete, excluding the mandible.

TABLE III

Inventory of Post-Cranial Skeletal Remains*

	ADULT			SUBADULT		
	Right		Left	Right		Left
Scapula	0		2	1		0
Clavicle	1		1	0		0
Humerus	2		5	1		1
Radius	2		2	1		0
Ulna	3		2	0		1
Wrist	0		0	0		0
Hand	0		0	0		0
Sternum	-	0	-	-	0	-
Ribs	-	6	-	-	10	-
Vertebra-						
Cervical	-	10	-	-	4	-
Thoracic	-	20	-	-	3	-
Lumbar	-	10	-	-	6	-
Sacrum						
Innominate-				0		1
Male	1		1	-		-
Female	2		2	-		-
Femur	8		7	3		2
Patella	0		1	0		0
Tibia	3		3	0		1
Fibula	2		2	1		1
Ankle	0		1	0		0
Foot	0		0	0		0

*These include all bones which could be identified and sided, regardless of the condition of the bone.

Indeed, some of the cranial-post-cranial associations cited must certainly be regarded as tenuous at best, if not downright dubious, simply because of the comingled nature of remains from an ossuary such as this site represents.

Because of this lack of cranial and post-cranial associations, certain indices usually calculated from the long bones of a single individual are rendered useless simply because the bones necessary to calculate them are not present. Consequently, such indices as Humero-femoral, Radio-humeral, Clavicuio-humeral, Tibio-femoral, as well as the calculation of stature utilizing more than one bone are missing from this report. This is as equally unfortunate as the lack of cranial-post-cranial associations for more precise sex and age identification because this percental relation of two measurements or dimensions "is of much utility for the prompt conveyance of a notion as to the shape or relative size of parts" (Stewart 1952:210). Several of the cranial indices are available, however, and these do appear in this work.

The final inventory of remains present in this series is presented in Table IV below which lists the number and kinds of teeth present in this skeletal collection.

TABLE IV

Inventory of Teeth

ADULT: 331 total teeth

MAXILLA-	Incisors :	33	MANDIBLE-	Incisors :	37
	Canines :	19		Canines :	26
	Premolars:	39		Premolars:	50
	Molars :	54		Molars :	73
	Total:	145		Total:	186

Table IV cont.

SUBADULT: 13 total teeth

MAXILLA-	Incisors:	0	MANDIBLE-	Incisors:	0
	Canines :	1		Canines :	0
	Molars :	5		Molars :	7
	Total:	6		Total:	7

CHAPTER 4

SKELETAL DIMENSIONS

Tables V and VI list the cranial and post-cranial measurements and indices, respectively. The standard deviations of these various dimensions are not listed because it was not felt that it would add meaningfully to the comprehension of the quantitative relationships present since the sample size is so small for all of the calculations (never exceeding 9 for any one measurement or index).

There are several interesting features about the Sugar Creek skulls which the table of measurements and indices makes apparent. First, while the male skulls average nearly 16mm longer and over 11mm higher than the females, the males are only 1.5mm wider, on the average. Second, the Cranial Indices are completely contrary to the expected sexual dimorphism in which the males are usually larger than the females; not so in this sample. Granted that the sample of 7 males and 4 females is extremely small, nevertheless the females' Cranial Indices average nearly 7 points higher than the males'! And the reason is that there is a female specimen (Lab 12) which has a Cranial Index of 94.31 (length=159mm, width=150mm) which is 5 points higher than any other specimen's Cranial Index (male or female). But, the fact that only 4 specimens comprise the female sample for this index should certainly make one cautious

TABLE V

Tabulation of Adult Cranial Measurements and Indices

		No.	Range	Mean
Maximum Length:				
	Male	9	170-187	180.11
	Female	4	159-168	164.25
Maximum Breadth:				
	Male	8	140-159	144.75
	Female	4	137-150	143.25
Basion-Bregma:				
	Male	5	130-142	136.40
	Female	2	124,126	125.00
Endobasion-Nasion:				
	Male	5	102-109	105.80
	Female	2	95,100	97.50
Endobasion-Alveolare/Prosthion:				
	Male (only)	5	102-109	105.80
Endobasion-Gnathion:				
	Male (only)	3	117-123	119.66
Minimum Frontal:				
	Male	9	88-103	93.66
	Female	4	86-95	89.25
Bizygomatic Diameter:				
	Male	5	132-149	141.00
	Female	4	121-134	128.75
Upper Facial Height:				
	Male	6	69-74.5	72.50
	Female	3	61-70	64.33
Total Facial Height:				
	Male	4	116-120	118.00
	Female	1	104	104.00
Nasal Height:				
	Male	6	50-55	51.66
	Female	4	45-50	48.00
Nasal Breadth:				
	Male	6	24-29	26.83
	Female	4	25 (all)	25.00

Table V. continued

		No.	Range	Mean
Left Orbital Breadth:				
	Male	6	40-43	41.75
	Female	1	36	36.00
Left Orbital Height:				
	Male	6	33-38	35.33
	Female	1	39	39.00
Right Orbital Breadth:				
	Male	6	40.5-43	42.08
	Female	2	40,42	41.00
Right Orbital Height:				
	Male	6	33-38	34.83
	Female	2	33.5,35	34.25
Palatal Length:				
	Male	7	47-54	51.14
	Female	3	39-47	42.66
Palatal Breadth:				
	Male	7	37-42	40.00
	Female	5	37.5-48	40.40
Auricular Height:				
	Male	6	123-132	126.33
	Female	4	114-128	119.75
Porion-Nasion:				
	Male	6	96-104	99.33
	Female	4	87-97	92.50
Porion-Subnasale:				
	Male	6	95-106	99.83
	Female	4	85-94	90.00
Porion-Prosthion:				
	Male	6	103-116	108.66
	Female	3	88-99	95.00
Porion-Gnathion:				
	Male	4	123-126	124.25
	Female	1	114	114.00
Bigonial Diameter:				
	Male	7	98-115	104.00
	Female	5	94-102	99.60
Left Coronoid Height:				
	Male	7	64.5-70	66.29
	Female	5	54-66	58.80

Table V, continued

		No.	Range	Mean
Bicondylar Width:				
	Male	7	111-135	124.29
	Female	3	118-127	122.33
Mandibular Length:				
	Male	8	100-112	106.75
	Female	4	80-107	97.75
Symphyseal Height:				
	Male	8	31-41	36.13
	Female	6	27-36	32.50
Cranial Index:				
	Male	7	74.87-89.83	80.91
	Female	4	83.03-94.31	87.29
Cranial Module:				
	Male	5	150-158.34	154.07
	Female	2	142.67,144	143.34
Length-Height Index:				
	Male	5	69.52-80.00	76.47
	Female	2	73.80,76.36	75.08
Breadth-Height Index:				
	Male	5	86.79-95.30	92.77
	Female	2	88.57,91.97	90.27
Upper Facial Index:				
	Male	5	48.98-54.54	51.23
	Female	2	52.23,63.85	58.04
Total Facial Index:				
	Male (only)	3	78.91-86.13	83.11
Nasal Index:				
	Male	6	45.45-58.00	51.94
	Female	3	50.00-55.55	52.36
Left Orbital Index:				
	Male	6	81.39-88.88	84.63
	Female	1	92.30	92.30
Right Orbital Index:				
	Male	6	80.49-88.37	82.74
	Female	2	79.76,87.50	83.63

TABLE VI

Tabulation of Adult Post-Cranial Measurements (in mm) and Indices

	No.	Range	Mean
RIGHT CLAVICLE:			
Maximum Length	1	143	143.00
LEFT CLAVICLE:			
Maximum Length	1	160	160.00
RIGHT HUMERUS:			
Maximum Length	1	302	302.00
Maximum Diameter, Head	1	39	39.00
Midshaft, Ant.-post. Diameter	1	24	24.00
Midshaft, Med.-lat. Diameter	1	20	20.00
Midshaft, Circumference	1	63	63.00
Robusticity Index	1	20.86	20.86
LEFT HUMERUS:			
Maximum Length	4	291-332	311.50
Maximum Diameter, Head	5	36-46	40.25
Midshaft, Ant.-post. Diameter	5	18-21	19.60
Midshaft, Med.-lat. Diameter	4	16-21	19.20
Midshaft, Circumference	4	65-66	65.50
Robusticity Index	4	19.88-21.00	20.32
RIGHT RADIUS:			
Maximum Length	1	252	252.00
LEFT RADIUS:			
Maximum Length	2	236,248	242.00
RIGHT ULNA:	0	---	---
LEFT ULNA:			
Maximum Length	1	256	256.00
RIGHT FEMUR:			
Maximum Length	5	418-480	444.00
Physiological Length	5	415-478	440.40
Maximum Diameter, Head	7	41-48	44.14
Subtrochanter, Ant.-post. Diam.	7	24-33	28.13
Subtrochanter, Med.-lat. Diam.	7	27-34	30.13
Midshaft, Ant.-post. Diameter	7	27-33	30.14
Midshaft, Med.-lat. Diameter	7	22-28	26.00
Platymeric Index	8	70.59-103.23	95.31
Pilastric Index	7	100.00-123.08	116.27
Robusticity Index	5	11.63-13.98	12.91

Table VI, continued

	No.	Range	Mean
LEFT FEMUR:			
Maximum Length	6	420-485	448.83
Physiological Length	6	415-479	444.83
Maximum Diameter, Head	5	41-48	44.60
Subtrochanter, Ant.-post. Diam.	7	24-29	26.71
Subtrochanter, Med.-lat. Diam.	7	28-35	31.86
Midshaft, Ant.-post. Diameter	7	26-34	30.00
Midshaft, Med.-lat. Diameter	7	24-29	26.57
Platymeric Index	7	70.59-100.00	84.32
Pilastric Index	7	104.00-119.23	112.75
Robusticity Index	6	11.71-14.58	12.96
RIGHT TIBIA:			
Maximum Length	3	368-415	394.33
Nutrient Foramen, Ant.-post. Diameter	3	32-39	35.33
Nutrient Foramen, Med.-lat. Diameter	3	25-27	25.67
LEFT TIBIA:			
Maximum Length	2	368,393	380.50
Nutrient Foramen, Ant.-post. Diameter	2	35,40	37.50
Nutrient Formane, Med.-lat. Diameter	2	22,24	23.00

in projecting this figure into the entire female portion of the population represented by these very few remains from the Sugar Creek Ossuary.

Third, the Upper Facial, Nasal, and both Left and Right Orbital Indices are all higher for the females than for the males. Again, the anticipated sexual dimorphism in which males are larger than females is not upheld by the figures. But, just as the female sample size of four specimens for the Cranial Index casts doubt on the validity of that average holding true for all the females in the population, so too does the small female sample size for each of these indices (2, 3, 1, and 2 respectively) cast equal doubt on

the projected validity of these averages holding true for all the females of the Sugar Creek population.

The following breakdown lists the classification for both sexes which the figures in Table V suggest. The classifications are according to Montagu (1960:53-4) and the figures in parentheses are the sample sizes on which the indices are based.

Index	Male		Female	
Cranial	Brachycranic	(7)	Hyperbrachycranic	(4)
Length-Height	Hypsicranic	(5)	Hypsicranic	(2)
Breadth-Height	Metriocranic	(5)	Tapeinocranic	(2)
Upper Facial	Mesene	(5)	Leptene	(2)
Total Facial	Euryprosopic	(3)	-------	(0)
Nasal	Chamaerrhine	(6)	Chamaerrhine	(3)
Orbital (Left)	Mesoconch	(6)	Hypsiconch	(1)
Orbital (Right)	Mesoconch	(6)	Mesoconch	(2)

The range evident here suggests a wide variety of extremes with some medium proportions also present. Again, there is the near certainty that the extremely small sample size for both sexes strongly influences the wide variety of proportions evidenced here.

CHAPTER 5

NON-METRIC OBSERVATIONS AND ANOMALIES

This chapter deals with those skeletal features and variations which are variously referred to as being discontinuous, discrete, epigenetic, or anomalous. All of these features have two important things in common: first, they are "the types of variations which are not expressible in measurements" (Sullivan 1922:207), and second, they represent "essentially normal variation" (Berry 1968:103). The first criterion distinguishes these features from the actual taking of measurements and calculation of indices and ratios, while the second criterion distinguishes them from that which is abnormal or pathological.

A number of observations which are classified by some (ex., Anderson 1962 and 1968) as being qualitative, morphological, or continuous traits, i.e. those "that are present in all skulls, but with varying amounts of expression" (Anderson 1962:116), are included in this chapter. They constitute such things as the form of pterion articulation, chin form, accessory supraorbital and mental foramina. In addition to these, however, there are other non-metric and anomalous features which essentially consist of other accessory foramina and variations in the "normal" development and form of bones. In D.R. Brothwell's words, they are those features which are "in most cases either clearly present or absent" (1965:93).

The non-metric observations made during the course of this skeletal anlysis are found on the second page of the Osteometric Data Sheet. These features are identified and discussed below and their frequency of occurrence in this series is noted.

Tooth Crowding

This is simply seen as some sort of disruption of the normal alignment of the dental arcade. It generally refers to the slight rotation of a tooth in its position as a result of pressure being applied from adjoining teeth which press in upon it. Only two examples of such crowding were observed in this series: Lab 18 (young adult male), in the maxillary incisors, and Lab 32 (young adult male), in the anterior teeth of the mandible. In the latter case, the canines are slightly rotated and the incisors tend to overlap each other.

Shovel-Shaping

This refers to the condition in which the lingual surface of the tooth has pronounced, or built-up, mesial and distal ridges, resulting in a fossa or concavity. Restricted to the incisors, the frequency is great enough in Mongoloid groups to warrant being used as a criterion of distinction for that group (Stewart 1952:159; Anderson 1962:92; Brothwell 1965:117-9).

There are three examples of "shoveling" in this series and all three display it in both the upper central and lateral incisors. Lab 4 (child, 6-7) exhibits shoveling in the two adult mandibular central incisors and in the two maxillary lateral ones. All four

teeth are visible in their crypts. Even though the maxillary central incisors are missing post-mortem, it is likely that they too displayed shoveling because the lateral ones do.

Lab 8 (female?, child, c. 12) exhibits the shovel-shaped effect in all four of the maxillary permanent incisors. There is no shoveling in the mandibular teeth. Lab 24 (male, c. 23) displays "one-time" shoveling in an interesting fashion: Although the crowns of all four maxillary incisors have been worn down, the exposed dentine reveals that the crowns were once U-shaped, i.e. in the shovel-shaped form. There is no evidence of shoveling in the mandibular teeth.

Thus, 12 out of 70 observable adult incisors display the shovel-shaping often considered characteristic of American Indians and/or Mongoloids. This represents 17% of the observable adult incisors in this series.

Enamel "Pearls"

These are separate nodules of enamel which are located on the surface of the tooth's root (Brothwell 1965:119). There are 344 teeth (331 adult, 13 deciduous) present in this skeletal collection. And of this total, there are two with enamel pearls: Lab 26 (child, 8-9) and Lab 35 (young adult male). Both are located on the lateral surfaces of permanent molars, right M^1 and left M_3, respectively. The nodule on Lab 35 is about three times the size of the other, in terms of volume. The frequency of occurrence of this anomalous enamel development is a microscopic .0059%.

Accessory Mental Foramen

This is an additional or extra foramen in the immediate vicinity of the mental foramen of the mandible. There are four cases in this skeletal sample which display such a foramen: Lab 3 (female, 18-20), Lab 18 (male, 23-25), Lab 20 (female, 18-21), and Lab 27 (male, 30-40). Both of the designated female specimens have double mental foramina on the right side of the mandible. Lab 18 also has two on the right side, while Lab 27 has a double pair bilaterally. The five affected sides represent approximately 11% of the 44 such mandibular halves in this sample.

Pterion Articulation

The variation with which the frontal, parietal, temporal, and sphenoid bones articulate at pterion on the lateral side of the cranium has been well-noted by a number of researchers: Sullivan 1922:219-23; Stewart 1952:158; Anderson 1962:111; Brothwell 1965:95; and Olivier 1969:168. In only six of the crania present in this series could the pterion articulation be observed, and only five of the six could be examined for it bilaterally. In all, six right sides, and five left sides were examined. Only one, Lab 24 (male, 23) had the frontal-temporal articulation in the so-called K-shaped form (Anderson 1962:111; Olivier 1969:168). The parietal-sphenoid or H-shaped form is the most common in this regard (Sullivan 1922:219).

Dehiscence, Tympanic Element

Sullivan states that this perforation "is undoubtedly a maldevelopment and due to a retardation of growth" (1922:229).

Of the 27 adult and 2 subadult tympanic elements examined in this series, only one, Lab 26 (child, 8-9), displays this developmental anomaly. It is only in the right element and not bilaterally as Sullivan states is usually the case (1922:229). Thus, this feature is located in exactly 50% of the examined subadult specimens, 0% of the adult, but in less than 3% of the total subadult and adult specimens.

Accessory Infraorbital Foramen

This is an "extra" foramen which lies immediately adjacent to the infraorbital foramen (Berry and Berry 1967:370; Wood-Jones 1931:186). There are 4 cases of such a foramen in this skeletal sample. Lab 3 (female, 18-20) and Lab 8 (child, 12) both have double foramina on the left side. Lab 17 (male, 35-45) has a double foramina on the right side. Only Lab 25 (male, 40-45) has a bilateral occurence of double foramina. These 5 occurrences in 4 specimens represent approximately 21% of the 24 infraorbital regions observed in this analysis.

Supraorbital Foramen

The form of this foramen above the eye orbit is best described by Berry and Berry: "The supraorbital foramen...is frequently incomplete (or open). In this case it is often described as a 'supraorbital notch'" (1967:369). Two observations were made regarding this foramen: First, if there were multiple foramina and second, if the opening was indeed a notch.

There are 15 examples of supraorbital foramina out of the 28 supraorbital regions observed in this series. This represents 54% of the total. There are 5 specimens with notches instead of foramina. Two of the specimens, Lab 26 (child, 8-9) and Lab 27 (male, 30-40) have bilateral occurrences of the notch form, while in the remaining 3 cases, there are 2 on the right side and 1 on the left. These 7 occurrences represent 25% of the total 28 supraorbital regions observable.

Mastoid Foramen

This foramen usually lies posterior to the mastoid process in the temporal-occipital suture and, less frequently, lies outside of the suture, i.e. exsutural (Berry and Berry 1967:368). There are 28 mastoid processes near which the foramen is visible in this skeletal series. Of these, 13 (46%) possess exsutural foramina and, of these 13, 6 exhibit multiple foramina. Lab 15 (male, 25-35) and Lab 27 (male, 30-40) both display a bilateral occurrence of double exsutural foramina.

There are also 2 occurrences of multiple mastoid sutural foramina. Lab 17 (male, 35-45) has 3 on the right side and Lab 24 (male, c. 23) has 2 on the left side. The 13 exsutural foramina observed are on 10 crania (6 adult males, 3 adult females, and 1 subadult). The 6 cases of multiple exsutural foramina are on 4 crania (all adult males).

Parietal Foramen

"This pierces the parietal bone near the sagittal suture a few centimeters in front of the lambda. It transmits a small

emissary vein, and sometimes a small branch of the occipital artery" (Berry and Berry 1967:366). Five such foramina were observed in 4 specimens (25% of the crania). All were single foramina. Lab 11 (female, 30-40) has 1 on the right side, while both Lab 13 (male, 40-50) and Lab 17 (male, 35-45) have them on the left sides. Only one specimen, Lab 26 (child, 8-9) displays a bilateral occurrence of these foramina.

Pharyngeal Fossa

"The fossa pharyngea, fovea bursea, or medio-basial fossa is a small oval depression on the ventral surface of the basilar part of the occipital bone...The function or purpose of the fossa is not altogether clear" (Sullivan 1922:224). Only 9 basilar portions of the occipital out of 16 crania were available for proper assessment of this feature in this skeletal sample. There are 2 very definite and clear occurrences of this fossa: Lab 24 (male, c. 23) and Lab 27 (male, 30-40), which represent some 22% of the basilar portions observed. There is also one case, Lab 14 (male, 35-45) which can be classified as a "maybe" for this feature. Instead of the definite fossa visible on the other 2 specimens, this one has 2 very slight depressions lateral to the sagittal plane.

Chin Form

In this study, the form of the anterior part of the mandible is classified as being either median or bilateral (Anderson 1962:114). Of the 23 mandibles (18 adult, 5 subadult) available for examination

in this skeletal series, there are 7 examples (5 adult, 2 subadult) of a median chin form. This represents 28% of the adult mandibles and 40% of the subadult specimens, or 30% of the overall total.

Since the form of the chin was also used as one of the criteria in sex determination, it is of some interest that the above breakdown of adult chin forms into either median or bilateral does not divide clearly into females, supposedly represented by median chin forms, and males, supposedly represented by bilateral chin forms (Stewart 1952:130; Krogman 1962:115). Rather, of the 5 adult median chin forms, 4 are diagnosed as females and 1 as a male. More significantly, of the 13 mandibles with bilateral chin forms, only 9 are diagnosed as being males while 4 are diagnosed as being females.

Assuming that both the determinations of the sexual affiliations of these mandibles and the classification of their chin forms are correct, then the truth of the statement made by Stewart is borne out: "aside from the sexual organs proper, the characteristics of the 2 sexes, whether in soft parts or the skeleton, are not completely distinct, but overlap or interdigitate under even the most normal conditions" (1952:127).

Wormian Bones

Quite briefly, these are simply small additional, or extra, bones located in the cranial sutures. Three kinds of wormian bones are present in the 16 crania of this series: Lambdoidal ossicles, coronal ossicles, and the Inca bone.

There are 2 cases of lambdoidal wormian bones and both exhibit them bilaterally: Lab 16 (female, 20-25) and Lab 26 (child, 8-9). The single occurrence of a coronal ossicle (15 x 7mm) also occurs in Lab 26.

Sullivan identifies the Inca bone in the following way:

> The os inca is the term used to designate the upper or supra occipital portion of the occipital bone when this is separated from the rest of the bone by a suture. This bone manifests itself in a variety of forms, but is properly called the inca bone only when it is of considerable size and includes that portion of the occipital bone above the torus or inion. (1922:236)

There is a beautiful example of such a bone in Lab 23 (male, 35-45) measuring 92mm along the base and 60mm from base to apex. The specimen can be seen in Plate 1.

On the basis of the 16 crania with observable sutures, the frequency of occurrence for the wormian bones just described is as follows: Lambdoidal ossicles: in 2 of 16 crania (12%);

Coronal ossicles: in 1 of 16 crania (6%);

Inca bones: in 1 of 16 crania (6%).

Mylohyoid Bridge

J.E. Anderson describes the formation of this "bridge" as resulting from an "overgrowth of bone into areas of soft tissue (which) may convert...the mylohyoid groove into a canal" (1968:136). The "bridge", then, is simply the bony overgrowth which encloses the groove.

Out of the 23 mandibles present in this skeletal series, there are some 44 observable mylohyoid grooves. Of these, there are 9 occurrences of full bridges (just over 20%) and 3 examples of

"incipient" bridges (6%), i.e. where the bony overgrowth is clearly visible on both sides of the groove but has not united over the middle to completely enclose the groove. The 9 complete bridges occur on 6 mandibles (3 male and 3 female). Of these 6, 3 exhibit a bilateral occurrence (2 female, 1 male) and the remaining 3 (2 male, 1 female) all have bridges on the left side only.

Septal Aperture

J.E. Anderson describes the septal aperture (the foramen connecting the coronoid and olecranon fossa of the humerus) as being a result of "arrested ossification" (1968:136). There are two cases of this anomalous ossification present in the seven adult humeri (2 right, 5 left) in this skeletal series. The two humeri can be seen in Plate 2. Thus, the two represent 29% of the total humeri present. Lab 2 (male, 24+) displays a perforation measuring 8.3mm across and 3.7mm high in the left humerus. Lab 7 (female, 25+) displays a 6.1mm wide and 3.7mm high perforation in the right humerus. Thus, 50% of the adult right and 20% of the adult left humeri display this particular developmental anomaly. The reader is alerted to the low degree of reliability such figures denote about the population represented by these few specimens.

Pyriform Aperture

Louis R. Sullivan described four forms of the lower border of the nasal aperture. One is described thus:

> Naso-alveolar sulcus, or oxygmocraspedote form. The lateral marginal edge is lost on the front of the lateral

> incisor alveoli. In consequence of this obliteration the floor of the nose is continued forward without any line of demarcation, from the facial surface of the alveolar process. (Sullivan 1922:215)

Lab 23 (male, 35-45) displays just such a pyriform aperture. There is simply no "sill" present and the nasal floor continues uninterrupted into the alveolar regions of the maxillae. It is the only such occurrence in the 14 pyriform apertures observable in this series.

Cranial Deformation

Of the 16 crania present in this series which can be observed for any sort of cranial deformation, 8 of them display such deformation. Of these 8, 2 (both female) display symmetrical occipital flattening, i.e. the pressure was applied directly perpendicular to the sagittal plane. The other 6 display asymmetrical occipital flattening, i.e. the pressure was applied to either the right or left side of the occipital.

Five of the 6 (4 male, 1 female) appear to have had the pressure applied to the right side and 1 (male) to the left. There is no indication that the deformation is a result of either "precocious union of the cranial bones" (Montagu 1960:63), pathology, or post-mortem soil pressure. Rather, as E.A. Hooton noted (1920:89) for the Middle Mississippi crania from Madisonville, Ohio and T.D. Stewart noted for the Steed-Kisker crania (1943:255), the pressure seems to have been nothing more than the unintentional resting of the infant's head to one side or the other of a hard cradle board.

Because there is bilateral asymmetry present in this series, the probability that such pressure was indeed unintentional seems greater than the liklihood that such deformation was deliberately induced as a result of some kind of cultural practice of these people.

Finally, all of the following features were listed on the check sheet of observations but were simply not present on any of the specimens from Sugar Creek:

Mandibular torus (Anderson 1962:118; Brothwell 1965:97-100),

Metopic suture (Sullivan 1922:231-5),

Palatal torus (Anderson 1962:118; Brothwell 1965:100).

Suture into Infraorbital Foramen

Supernumerary teeth (Brothwell 1965:116),

Interproximal grooving (Ubelaker et. al. 1969:145-9), and

Any other wormian bones (Brothwell 1965:98).

CHAPTER 6

SKELETAL PATHOLOGY

In contrast to the previous chapter, this one deals with what is essentially abnormal variation, i.e. disease or congenital developmental errors (Brothwell 1965:133). Only a very few of the diseases and disorders Brothwell discusses are present in this skeletal collection. And most of these are centered in and around the teeth: caries, periodontal disease (pyorrhea), abscesses, and tartar (calculus) deposits. No hypodontia was observed in this series.

In addition, there are at least three cases of arthritis (two rheumatoid and one case of osteoarthritis) and one example of a healed fracture. There are two "angiomatous cavities" and, finally, there are two examples of abnormal or irregular ossification. Each of these is discussed more fully below.

Caries

Cavities resulting from tooth decay are very much in evidence throughout the dentition of this skeletal series. The following breakdown lists the number of adult teeth present with the figures in parentheses indicating the number of carious teeth and the percentage frequency of occurrence.

Tooth	Maxillary	Mandibular
Incisors	33 (1,3%)	37 (0,0%)

Canines	19 (0,0%)	26 (0,0%)
Premolars	39 (1,3%)	50 (0,0%)
Molars	54 (13,24%)	73 (49,64%)

The size of these cavities runs from pinpoint-type holes to nearly entire crowns being obliterated. Of the 331 adult teeth present, 64 of them (just over 19%) show some carious activity. In addition, 3 molars of the 13 total deciduous teeth present also display various degrees of caries cavities. Thus, some 23% of the deciduous teeth are carious.

Periodontal Disease

The alveolar resorption and reactive osteoporosis characteristic of periodontal disease (Anderson 1962:96-8; Brothwell 1965:147-9) is widespread throughout this series. In fact, 16 of the 25 recognizable adult individuals display one or both of these "symptoms" in one or both jaws. Some of the specimens display almost complete destruction and degeneration of the alveolar bone with resultant tooth evulsion. Some of these more extreme cases have extensive degrees of palatal osteoporosis, as well. Most cases are not this extreme, however, and only show slight alveolar resorption around teeth which are still well-rooted in their bony matrix.

Some indication of the kind of fairly extensive periodontal disease visible in this series can be seen in Plates 5 and 6.

Abscessing

D.R. Brothwell's definition of an abscess as "a collection of pus, surrounded by denser tissue, and within a cavity of the body"

(1965:149) is used in this study. There are at least 30 such abscesses (.09%) visible in the dentition of this skeletal series. They are confined almost exclusively to the premolar-molar area. Some specimens still retain the tooth with the "burrowed out" abscess cavity clearly visible. Again, Plates 5 and 6 clearly depict this activity in what can almost be termed a "classic" example.

A number of these abscesses are associated with widespread periodontal disease throughout the oral cavity. Others appear as isolated afflictions with the remaining teeth in relatively healthy condition. Still others have affected adjoining teeth in a chain reaction effect, ex., the left PM^2 of Lab 12 (Plates 5 and 6).

Tartar (Calculus)

These calcium deposits which form at the margin of the gums and teeth (Brothwell 1965:153) are visible in 8 specimens of this skeletal series. The amount of deposition ranges from very slight to very heavy. Lab 18 (male, 23-25) exhibits extremely heavy tartar deposits in the mandibular molars.

Bone Fractures

There is only one example of a healed bone fracture in this collection: Lab 12 (female, c. 20) which displays a fracture at the anterior edge of the two nasal bones. Plate 6 is a left lateral view of the specimen. The fracture line which is still partially present is not really visible in this photograph but the warping which resulted from the injury is visible at the very tip of the nasal bridge.

Arthritis

Evidence of arthritis in bones is discussed by both Anderson (1962:156-7) and Brothwell (1965:143-5) and their comments were utilized in assessing the symptoms visible in at least 3 specimens of this skeletal series. Lab 7 (female, 25+) displays the most extensive affliction in that at least 5 or 6 vertebrae, the sacral articulations on both innominates, and the right pubic symphysis exhibit varying degrees of rheumatoid arthritic change and distortion. Plate 7 is a view of the right pubic symphysis and the bony eburnations are quite visible.

Lab 15 (male, 25-35) also displays rheumatoid arthritic destruction in both tympanic elements and Lab 31a (an adult right femur) displays extensive osteoarthritis in the form of osteophytosis along the margins of both distal articular surfaces. This "lipping" is visible in Plate 8.

"Angiomatous Cavities"

The term "angiomatous cavity" is this writer's description of the 2 fossae evident on the Lab 2 and Lab 33 mandibles. Plate numbers 3 and 5 are photographs of the 2 specimens. Lab 2 (male, 24+) displays a fossa some 8.05mm long and 3.8mm wide immediately below the mylohyoid groove in the right internal ramus. Lab 33 (female, adult) displays a highly similar concavity 7.6mm long and 6.2mm wide in the left internal ramus just posterior to the third molar. Both fossae have smooth and uniform inner surfaces with small foramina present.

X-rays failed to disclose any definite indications of abscessing in either specimen. Barring any pathological cause of these fossae, it would appear that they were caused by angiomas in the inferior alveolar blood vessels near which both fossae occur. These angiomas probably exerted sufficient pressure on their surrounding bony matrices to "punch" into the mandible, leaving the present cavities as the osteological evidence of their former existence. Such an explanation of the cause of these fossae must be regarded as highly tenuous (but hopefully not too fanciful) since this writer's knowledge of such abnormal anatomical happenings is extremely limited. And certainly, the possibility persists that these interesting fossae are the result of undetected abscesses (especially in Lab 33).

Irregular Ossification

This term is used to describe 2 interesting specimens present in this collection: Lab 15 (male, 25-35) and Lab 19 (female, 25-30). As seen in Plate 9, Lab 15 exhibits an enlarged external occipital protuberance which apparently reflects some occipital bone ossification into the tendinous attachments connected to the protuberance.

Lab 19 displays some ossified material in the upper left maxillary sinus. This ossification can be seen in Plate 10. X-rays of the specimen did not disclose any evidence of this ossification being merely a cystic tooth.

In addition to the conditions described above, there is also a case of 2 impacted mandibular incisors: Lab 27 (male, 30-40).

The teeth were located by X-rays and are lodged in nearly vertical positions just to the right of the symphysis of the mandible. The teeth appear to be fully developed but never managed to erupt into the dental arcade. It is not known if this impaction caused any pain to the individual but the fact that the 2 teeth did not force their way out through any portion of the bone may indicate that they did not trouble the individual.

CHAPTER 7

COMPARISON AND CONCLUSIONS

Now that these skeletal remains from the Sugar Creek Ossuary have been examined, measured, catalogued, and described it is both appropriate and necessary to provide some sort of meaningful perspective for them. Such a perspective should focus on the nature and extent of the relationship that exists between these remains and others with either similar cultural affiliations, or having geographical and temporal proximity to the Sugar Creek site. Three skeletal series were chosen which have some or all of these things in common with the Sugar Creek Ossuary. Hopefully, they will constitute a valid comparative group to provide a meaningful perspective for the Sugar Creek remains.

1. The Madisonville, Ohio series: 84 sexually-diagnostic crania (53-4 male, 29-30 female) associated with a "pure" Middle Mississippi cultural tradition from about 1550-1700 A.D. (E.A. Hooton 1920).

2. The Steed-Kisker remains: 11 crania (9 male, 2 female) from the already-mentioned Middle Mississippi village near Kansas City which exhibits some Nebraska regional variant influence (T.D. Stewart 1943).

3. The 43 adult male crania examined by W.M. Bass in 1964. These 43 crania have Central Plains tradition affiliations (encompassing the Nebraska, the Upper Republican, and the Smoky Hill regional variants) with the largest single group of them coming from a Nebraska regional variant ossuary in extreme northeastern Nebraska (Bass 1964:86-8).[1]

[1]This author feels justified in using this mixed Central Plains sample, rather than a "pure" Nebraska regional variant sample, for two reasons:

So in order to compare the Sugar Creek skeletal remains, which have both Nebraska regional variant and Middle Mississippi affiliations, three samples have been chosen: one having only Middle Mississippi affiliations (Madisonville), one having only Central Plains (Nebraska regional variant) affiliations, and one having essentially Middle Mississippi affinities but with some probable Nebraska regional variant influence (Steed-Kisker). It is hoped that this selection of samples will provide a meaningful and proper perspective for the Sugar Creek remains.

Table VII is a comparison of selected male measurements and indices from the three series just described and the male specimens from Sugar Creek.

TABLE VII

Comparison of Selected Male Cranial Dimensions
(Numbers in parentheses indicate sample sizes)

	Madison-ville*	Steed-Kisker*	Sugar Creek	Central Plains
Max. Length (mm)	177 (52)	170 (5)	180.11 (9)	174.73 (37)
Max. Breadth (mm)	146 (52)	153 (5)	144.75 (8)	143.73 (36)
Basion-Bregma (mm)	137 (42)	134 (1)	136.40 (5)	137.70 (20)
Ba-Nasion (mm)	105 (28)	103 (1)	105.80 (5)	----
Bizygomatic (mm)	141 (16)	146 (2)	141.00 (5)	139.00 (16)
Upper Facial Ht. (mm)	72 (29)	75 (3)	72.50 (6)	71.59 (27)
Cranial Index**	82.5(52)	89.7(5)	80.91 (7)	82.57 (33)
Cranial Module	154 (37)	154 (1)	154.07 (5)	152.04 (18)
Nasal Index	51.5(33)	52.2(3)	51.94 (6)	51.96 (29)

First, Bass examined the 43 crania from 11 Nebraska sites having both Upper Republican and Nebraska regional variant affiliations and, in his own words, "found no meaningful differences" between them, combining them into one sample for his own comparative study (1964:72). Second, there are no published reports of any well-documented Nebraska regional variant skeletal remains available for use in this study. (There is a brief report by C.W.M. Poynter (1915) on some crania from Omaha, Nebraska, but he only gives four measurements and two or three indices.) Consequently the Central Plains sample employed by Bass appears to be well-suited to this study's needs.

In an effort to assess the extent of the relationships existing between the Sugar Creek specimens and the other three groups, this author will employ a unique (to his knowledge) method of expression and evaluation: For each of the nine measurements and indices listed in Table VII the group that most closely approaches the dimensions of the Sugar Creek crania will be given a value of 3 points, i.e. a "value of affinity." The group coming second closest will be given 2 points and the third group, 1 point. When totaled up, then, these groups will be ranked or graded in terms of their affinity to the Sugar Creek specimens.

Thus, the group having the highest total of assigned points presumably demonstrates the closest morphological affinity to the Sugar Creek sample. Hopefully, then, this technique will provide the reader with an easy-to-grasp means of expression for assessing the degree or the extent of the relationship that presumably exists between the dimensions of the Sugar Creek male crania and the male crania of the other three series.

No attempt is made here to assess the validity such a shorthand method of expression possesses in regard to the real, biological ties that may or may not have existed among these four groups of prehistoric American Indians. Likewise, no claim is really made that these "values of affinity" numerically express the degree of

---

* These figures are from Stewart's Table 18 (1943:270) but have been converted from centimeters to millimeters for this study.

** Stewart (1943:257) gives an average Cranial Index of 85.2 for the 26 "Nebraska Culture" crania examined by Poynter (1915).

of actual biological relationships existing among these groups. Rather, it is only hoped that this method of expression may aid the reader in grasping a little better the relationship that exists among these four groups in regard to the dimensions listed in Table VII.

Table VIII lists the measurements, groups of specimens, "values of affinity", and total points assigned to each group.

TABLE VIII

Values of Affinity

	Madisonville	Steed-Kisker	Central Plains
Max. Length	3	1	2
Max. Breadth	3	1	2
Basion-Bregma	3	1	2
Basion-Gnathion*	-	-	-
Bizygomatic	3	1	2
Upper Facial Ht.	3	1	2
Cranial Index	3	1	2
Cranial Module**	3	3	1
Nasal Index	2	1	3
TOTAL	23	10	16

From these figures it is quite apparent that, with the single exception of the Cranial Module, the geographically-closest group to the Sugar Creek Ossuary, Steed-Kisker, is really least like the Sugar Creek series in terms of morphological dimensions. Similarly, the presumably-closest cultural group to the Sugar Creek population,

---

* No values are assigned to this measurement because no dimensions are listed for the Central Plains group.

** Equal values are assigned to Madisonville and Steed-Kisker here because they have identical dimensions.

the Central Plains series, although approximating more closely to the Sugar Creek specimens than does Steed-Kisker, still appears less morphologically similar to Sugar Creek than does the third group. And certainly, the most surprising degree of similarity to Sugar Creek is that attributed to the series of Madisonville crania. This notwithstanding the fact that these are the furthest away from Sugar Creek in terms of temporal and geographical distance (150-200 years and several hundred miles) and cultural affinities.

What has been demonstrated by this attempt to express the relationships that exist between these four groups in terms of the limited number of morphological dimensions considered here? It is difficult to say at this point. But, certainly several points are well-worth keeping in mind. First, the sample sizes of the four groups are almost all too small by Brothwell's standards (1965:109) to convey statistical reliability. Second, there is no attempt made here to "weigh" the six measurements and three indices in terms of their taxonomic significance. That is to say, no account is taken of the differences that may exist between the shape of the cranium and the shape of the pyriform aperture in assessing the morphological or biological affinities of one group to another: They are assumed to be equal in this regard.

Third, in terms of their actual measurements, some of the dimensions compared here show a great deal of similarity among all four groups. For example, the average Basion-Bregma height varies less than four millimeters among all of the groups. Basion-Nasion

and Upper Facial Height also average very nearly the same in all four groups. Likewise, both the Cranial Module and Nasal Index reflect a high degree of similarity among the groups (with all four Nasal Indices being classified as Chamaerrhine). So, in one sense, all of these groups are very similar to each other in terms of actual morphological dimensions and the "value of affinity" expression does not really reflect this similarity.

Finally, there is something else of importance here in regard to the affinities of the Sugar Creek crania and those from Bass' Central Plains sample that needs to be stressed more than the "values of affinity" are able to do. And that is that with the exception of the 6mm difference in their Cranial Length measurements, these two groups display a high degree of similarity in their cranial dimensions. In other words, these two groups, presumably possessing similar cultural traditions, exhibiting geographical proximity to each other, and being closely contemporaneous in time, do seem to reflect to some extent these common ties in their morphological dimensions.

With these reservations, then, the "values of affinity" may or may not be helpful to the reader in better understanding the relationships that exist here. But this author can truthfully say that is was an honest effort on his part to provide an aid for the reader and not to mislead him.

Non-Metric Features

What kind of relationship between these four groups is reflected in the frequencies of occurrence of such things as Inca

bones or dehiscences of the tympanic element of the temporal? Table IX lists a selected number of these features and the frequency of occurrence for the different skeletal series as noted by their chroniclers. There are really very few features listed because of the inconsistency of their presence in the various reports from which these frequencies are gleaned.

TABLE IX

Frequency of Occurrence of
Selected Non-Metric Features

	Madison-ville	Steed-Kisker	Sugar Creek	Central Plains
Pterion, K	98%	NA*	91%	100%
Pterion, H	2%	NA	9%	0%
Dehiscence, tympanic element	18%	10.2%	0%	22.6%
Mylohyoid Bridge	NA	NA	20%	23.4%
Pharyngeal Fossa	NA	NA	22%	20%
Inca Bone	0%	NA	6%	4.6%
Occipital Flattening	73.5%	56%	50%	NA
Septal Aperture	5.7%	0%	29%	NA

What are the relationships that are reflected in the figures listed in Table IX? Only that the Sugar Creek crania are very similar to Bass' Central Plains sample in nearly every feature for which figures are available (except in the frequency of dehiscences in the tympanic element). The really misleading aspect of this

* This means that the frequency of occurrence of this feature is not available in the skeletal report on this series.

similarity, however, is the lack of comparative data from the other two groups. Consequently, it is difficult to accurately assess the degree of similarity between the two Central Plains tradition groups without knowing if the other two groups would display an equal degree of similarity.

Pathology

Finally, what kind of similarities are there between these four comparative groups in regard to the pathological conditions found in Chapter 6? To begin with, none of the conditions are discussed by Bass.

Caries cavities were noted by Hooton to occur in 17 out of 49 adult crania (34.7%) in the Madisonville series (1920:109) while Stewart observed caries to be "not uncommon in the molars of the Steed-Kisker series and is the principal cause of tooth loss" (1943:254). Caries occur in 19% of all the adult teeth from Sugar Creek. It is difficult to relate these groups in the incidence of caries because of the incompatability in the methods of recording this phenomenon.

Hooton lists the presence of alveolar abscessing in 19 of 49 crania (38.77%) from Madisonville compared to 30 out of 331 teeth (.09%) from Sugar Creek. Stewart does not list the number of abscesses from Steed-Kisker. Again, the incompatability of the method of recording prevents a realistic comparison of this condition.

Neither Hooton nor Stewart records the incidence of periodontal disease or tartar deposits in their skeletal samples. Arthritic

changes were noted by Hooton according to the different parts of the skeleton in which they occurred (1920:130-1). He notes that 8.8% of all adult skeletons examined displayed arthritic changes in the pelvic bones. In the 6 adult innominates recovered from Sugar Creek, 2 (33%) show such changes. Stewart notes no occurrence of arthritis in the Steed-Kisker series, but does state that they "seem to have been afflicted with syphilis" (1934:261). Hooton "does not feel qualified to make a positive decision" (1930: 133) regarding the presence of syphilis in the Madisonville series and this writer echoes Hooton's hesitancy in diagnosing this disease in the Sugar Creek remains.

Conclusions

What can we conclude about the over-all affinities of these four groups to each other? First of all, the morphological dimensions of the Sugar Creek male crania are very similar to Bass' Central Plains sample and least similar to the nearby, but culturally-different, Steed-Kisker population. Where the Steed-Kisker crania are Hyperbrachycranic (like the Sugar Creek female crania), the Sugar Creek crania are just barely Brachycranic, and, as mentioned earlier, both groups have Chamaerrhine Nasal Indices. The greatest differences between the two groups appear in the individual measurements.

It would appear, then, that while the Steed-Kisker people and the nearby Nebraska regional variant people exchanged their cultural techniques and ideas, they did not so readily exchange their genes (assuming, of course, that there are genetic bases for the differences in morphological dimensions and that such differences

are accurately and adequately represented by the dimensions examined here). There also appears to be more similarity between the two Central Plains groups than there is between the two Middle Mississippi samples.

But, undoubtedly, the most puzzling aspect of this entire comparison shows up in the high degree of similarity between the Madisonville, Ohio crania and those from the Sugar Creek Ossuary. The author does not intend to assess or determine the significance of that similarity in this report. But such an attempt by someone in the future would certainly prove to be interesting and beneficial.

In conclusion, it can be stated that while there is a definite similarity between the Sugar Creek specimens and those of the Central Plains sample, there is markedly-less similarity between Steed-Kisker and Sugar Creek. Whether or not the similarity between the two essentially Nebraska regional variant samples is due to the broad commonality of their cultural traditions is difficult to determine. A difficulty which is heightened in view of the surprisingly high degree of similarity between the Sugar Creek and Madisonville series; a similarity in which there is neither a common cultural tradition connecting them nor geographical nor temporal proximity to explain it. Certainly there is a need for a more exhaustive and detailed analysis of this intriguing situation than can be attempted here.

APPENDIX A

INDIVIDUAL LABORATORY DESCRIPTIONS

This appendix briefly describes the individual laboratory specimens. More detailed descriptions and discussion of the various non-metric, anomalous, and pathological features listed here can be found in Chapters 5 and 6.

LAB 1 (Burial 3)
Sex: Indeterminate Square: 25R9
Age: 10-14 Depth: 16"

Specimen: a mandible with the right verticle ramus broken off. The only teeth present include both M_1s (erupted) and both M_3s (in crypt).

Notable features: 6-8 pinhole-size caries cavities on the occlusal surfaces of the two first molars.

LAB 2 (Burial 5)
Sex: Male (?) Square: 25R9
Age: 24 Depth: 23"

Specimen: a nearly complete mandible with 6 teeth and a left humerus.

Notable features: Periodontal disease coupled with the loss of all three molars bilaterally and the incomplete resorption of their alveoli. Three abscesses: right PM_1, PM_2 and left PM_2. Fossa in right internal ramus (See Chapter 6 and Plate 3). Septal aperture (8.3 x 3.7mm).

LAB 3 (Burial 12)
Sex: Female (?) Square: 30R9
Age: 18-20 Depth: 19"

Specimen: both zygomatic bones and maxillae (with 10 teeth) are represented from the cranium, and there is the right half of the mandible.

Notable features: Periodontal disease, a very large caries cavity along the lateral edge of the right M_1, 2 left infraorbital and 2 right mental foramina.

LAB 4 (Burial 13)
Sex: Indeterminate Square: 30R9
Age: 6-7 Depth: 18"

Specimen: 2 partial maxillae (with 5 deciduous and 5 permanent teeth) and a broken mandible (with 2 deciduous and 3 permanent teeth). The adult teeth are in various stages of eruption.

Notable features: several caries cavities are visible in both sets of teeth. The 4 permanent incisors visible (all I2s and all in their crypts) display "shovel-shaping".

LAB 5 (Burial 15)
Sex: Male Square: 30R9
Age: 18+ Depth: 26"

Specimen: a broken frontal, right temporal, right zygomatic, and right maxilla (with 3 teeth). There is also a broken right half of the mandible with 5 teeth present.

Notable features: Marked tooth wear with a great deal of secondary dentin visible on the lower teeth. Very slight thinning of the alveolus of the mandible, most probably as a result of low-grade periodontal affliction.

LAB 6 (Burial 16)
Sex: Male Square: 30R9
Age: 35-45 Depth: 26"

Specimen: a calvarium lacking the left temporal, the basilar, and part of the squamosal portions of the occipital.

Aside from an extensive post-mortem fracture of the left parietal and into the occipital, there are really no notable features in this specimen.

LAB 7 (Burial 19)
Sex: Female Square: 30R9
Age: 25 Depth: 26"

Specimen: a right innominate, an eroded left innominate which is missing the pubis and the interior ischial border of the obturator foramen, 8 thoracic and 4 lumbar vertebrae, and a right humerus.

Notable features: evidence of rheumatoid arthritis in the articular facets of several of the vertebrae as well as associated changes in the sacral articular facets of both innominates and the right pubic symphysis (See Plate 7). There is a septal aperture (6.1 x 3.7mm) in the humerus.

LAB 8 (Burial 21)
Sex: Female (?) Square: 30R8
Age: c. 12 Depth: 24"

Specimen: a broken mandible, both maxillae, the left zygomatic and at least 5 cervical vertebrae. There are 14 maxillary and 12 mandibular teeth.

Notable features: 3 tiny caries cavities, low-grade periodontal affliction, double left infraorbital foramina, and shovel-shaping in the 4 maxillary incisors.

LAB 9a-g
Sex: Indeterminate Square: 30R8
Age: Adult Depth: ---

Specimens: 9a - a right femur measuring 471mm in length whose outer compact layer of cortical substance is literally "flaking off" as a result of post-excavation dehydration.

9b - a left femur measuring 466mm in length with the medial edge of the linea aspera well-marked.

9c - a left femur smaller (c. 420mm in length) than either of the above.

9d - a right tibia measuring 400mm length with no notable features.

9e - a left tibia measuring 393mm in length and displaying the same flaking as in 9a. There is an 80mm-long line of gnaw marks on the posterior-medial side at the proximal end.

9f - a right fibula missing the proximal end from post-mortem destruction.

9g - a left fibula missing both ends. There is a 95mm-long line of gnaw marks extending along the posterior distal portion of the bone and animal chewing is probably the cause of the missing distal portion of the bone.

(There is no Lab 10.)

LAB 11 (Burial 24)
Sex: Female Square: 30R8
Age: 30-40 Depth: 32"

Specimen: a broken cranium and an essentially-complete mandible. There are 2 maxillary and 6 mandibular teeth still present. The cranium is missing a considerable portion of the facial region as a result of post-mortem destruction.

Notable features: the remaining teeth are all worn to the point of exposing secondary dentin buildups, the mandibular molars are completely resorbed bilaterally, 2 maxillary abscesses are visible

on the right side in the region of PM^2 and M^2, and there are double right supraorbital foramina. There is also a parietal foramen on the right side, a left mylohyoid bridge, and asymmetrical cranial flattening with the pressure applied to the right occipital-temporal suture.

LAB 12 (Burial 26)
Sex: Female Square: 30R8
Age: c. 20 Depth: 29"

Specimen: a broken cranium and mandible. The only teeth missing are the left PM^2 and M^1 and the mandibular central incisors.

Notable features: broken and partially-healed nasal bones (See Plate 6) and 5 abscesses (4 maxillary and 1 mandibular). Slight occipital flattening has resulted in a slight bulging of the parietals.

LAB 13 (Burial 30)
Sex: Male Square: 30R7
Age: 40-50 Depth: 30"

Specimen: a broken calvarium and the first cervical vertebra. The calvarium is broken in numerous places and is badly distorted and crushed as a result of post-mortem warping.

Notable features: single left parietal foramen, a slight sagittal-keel effect, triple right supraorbital foramina, and both a left supraorbital foramen and notch.

LAB 14 (Burial 36)
Sex: Male Square: 35R7
Age: 35-45 Depth: 39"

Specimen: an essentially-complete cranium with 24 teeth still remaining.

Notable features: a great deal of resorption in the dentition with tartar deposits present on a number of the remaining teeth. There are 2 right supraorbital foramina and some slight asymmetrical occipital flattening.

LAB 15 (Burial 39)
Sex: Male Square: 25R7
Age: 25-35 Depth: 18-40"

Specimen: a virtually-complete cranium with 13 remaining teeth.

Notable features: an extremely prominent external occipital protuberance (See Plate 9), evidence of arthritic changes in the tympanic elements, and extensive periodontal disease coupled with at least 3 abscesses and various degrees of alveolar resorption visible.

Lab 16 (Burial 50)
Sex: Female (?) Square: 35R8
Age: 20-25 Depth: 28"

Specimen: a virtually-complete cranium and mandible with 12 maxillary and 13 mandibular teeth present.

Notable features: 5 small caries cavities and tartar deposits on most of the teeth. There is a very slight flattening of the occipital and numerous gnaw marks around the left side of the facial region.

LAB 17 (Burial 63)
Sex: Male Square: 30R9
Age: 35-45 Depth: 30"

Specimen: a badly-broken cranium and a poorly-preserved mandible. No teeth were preserved.

Notable features: extreme alveolar resorption and palatal osteoporosis due to extensive periodontal disease. There are also 3 exsutural mastoid foramina on the right side and 2 right infraorbital foramina.

LAB 18 (Burial 68)
Sex: Male Square: 30R10
Age: 23-25 Depth: 35"

Specimen: the most complete burial of the entire series with a nearly complete cranium, complete mandible, left scapula, clavicle, humerus, radius, ulna, 6 ribs, innominate, and patella. There are also 24 vertebrae and a nearly-complete sacrum.

Notable features: slight periodontal disease coupled with some alveolar resorption and an extensive abscess on the right side of the maxilla, as well as in the right M_2-M_3 region. There is some tooth crowding and fairly heavy tartar deposits in the mandibular teeth. There are bilateral mylohyoid bridges, double left mental foramina, and double right supraorbital foramina.

LAB 19 (Burial 73)
Sex: Female Square: 35R9
Age: 25-30 Depth: 28"

Specimen: a cranium which has been badly damaged by animal gnawing around the facial region. Only 4 teeth (molars) still remain.

Notable features: considerable periodontal disease coupled with alveolar resorption and palatal osteoporosis. There is also the calcification of some (possibly) caseous material which has already been discussed (See Plate 10).

LAB 20 (Burial 76a)
Sex: Female (?) Square: 35R9
Age: 18-21 Depth: 32"

Specimen: a badly-crushed cranium and a well-preserved mandible. A total of 28 teeth still remain.

Notable features: 12 tiny caries cavities and some very slight tartar deposits. There are also double right mental foramina.

LAB 21a-h
Sex: Indeterminate Square: 35R9
Age: Subadult, Adult Depth: 32"

Specimens: 21a - an adult left femur measuring 450mm in length.

21b - an adult right femur, smaller than 21a, measures only 420mm long.

21c - the diaphysis of a subadult femur.

21d - the proximal one-third of an adult right femur. There is a very interesting pattern of animal gnaw marks on the lower portion of the bone and such gnawing activity resulted in the loss of the distal portion of the bone.

21e - a nearly complete adult left humerus measuring 291mm in length.

21f - a nearly complete adult left humerus, measures 300mm in length.

21g - a broken adult right ulna with an exaggerated lateral-inferior curve of the distal part.

21h - the superior half of an adult left scapula.

LAB 22 (Burial 76b)
Sex: Indeterminate Square: 35R9
Age: Subadult Depth: 32"

Specimen: a broken right femoral diaphysis and the diaphysis of a left tibia. There are no notable features present.

LAB 23 (Burial 80)
Sex: Male Square: 35R10
Age: 35-45 Depth: 34"

Specimen: an almost totally complete cranium and mandible with all of the teeth present.

Notable features: periodontal disease evidenced by alveolar resorption and osteoporosis and palatal osteoporosis. There are 2 extensive abscesses: one in each of the maxillary first molars. There are a few very small caries cavities and tartar deposits visible. There is a left mylohyoid bridge and no nasal sill. There is an Inca bone present which can be seen in Plate 1.

LAB 24 (Burial 84)
Sex: Male Square: 30R12
Age: c. 23 Depth: 36"

Specimen: a nearly complete cranium and mandible with all but 3 teeth still present.

Notable features: abscessed right M^1 and low-grade periodontal disease. Shovel-shaped maxillary incisors, 2 left supraorbital foramina, and 2 left exsutural mastoid foramina. There is some asymmetrical occipital flattening.

LAB 25 (Burial 90)
Sex: Male Square: 30R12
Age: 40-45 Depth: 36"

Specimen: a nearly complete cranium and a complete mandible. Only 5 maxillary and 6 mandibular teeth still remain.

Notable features: extensive alveolar resorption following tooth evulsion is visible in both jaws. There are at least 3

abscesses still visible and a bilateral occurrence of double infra-orbital foramina. There is some slight occipital flattening.

LAB 26 (Burial 92)
Sex: Male (?) Square: 25R7
Age: 8-9 Depth: 38"

Specimen: a calvarium, 2 broken maxillary fragments, and a broken mandible. Mixed deciduous (4-5 teeth) and permanet (13 teeth) dentition.

Notable features: 5-6 very small occlusal caries cavities on the mandibular grinding teeth. There is an enamel pearl on the right M^1, 4 wormian bones visible in the coronal and lambdoidal sutures, bilateral parietal foramina, and a dehiscence in the right tympanic element. There is a 65mm-long line of gnaw marks along the right horizontal ramus of the mandible.

LAB 27 (Burial 95)
Sex: Male Square: 25R7
Age: 30-40 Depth: 18-40"

Specimen: a nearly-complete cranium and mandible with a number of teeth missing ante- and post-mortem.

Notable features: 3 abscesses, evulsion and resorption of several teeth. Two impacted mandibular incisors which were discovered by X-raying the specimen. There are also bilateral double mental foramina, a left mylohyoid bridge, bilateral double exsutural foramina, and some asymmetrical cranial deformation.

LAB 28
Sex: Indeterminate Square: Not Available
Age: Birth-1 Depth: Not Available

Specimen: a largely-complete skeleton missing all epiphyses and secondary ossification centers. There are no notable features.

(There is no Lab 29.)

LAB 30a-d
Sex: Male (?) Square: 20R6
Age: Adult Depth: Not Available

Specimens: 30a - a right femur with a morphological length of 480mm.

30b - a left femur with a morphological length of 485mm.

30c - a right tibia with a morphological length of 415mm.

30d - a right fibula with no proximal end.

LAB 31a-1
Sex: Indeterminate Square: 15R10
Age: Adult Depth: Not Available

Specimens: 31a - a right femur with a morphological length of 418mm. There is evidence of extensive osteoarthritis in the osteophytic lipping present around the distal articular surfaces.

31b - a right femur measuring 431mm in length.

31c - a left femur measuring 434mm in length.

31d - a right tibia measuring 368mm long. There are animal gnaw marks measuring 21mm in length along the anterior edge.

31e - a left tibia measuring 368mm.

31f - a left fibula.

31g - a right humerus measuring 302mm in length.

31h - a left humerus with a 58mm-long line of gnaw marks along the lateral ridge of the bicipital groove.

31i - a right ulna lacking both ends as a result of post-mortem destruction.

31j - a right radius.

31k - a complete left ulna measuring 256mm in length.

311 - a complete left radius measuring 236mm in length and very possibly a mate to 31k.

LAB 32
Sex: Male (?) Square: 30R10
Age: 19-23 Depth: Not Available

Specimen: a lone mandible missing only the left M_1.

Notable features: 5-6 tiny caries cavities and slight tartar deposits. Some crowding in the anterior teeth. An "incipient" mylohyoid groove.

LAB 33
Sex: Female (?) Square: 20R8
Age: Adult Depth: Not Availble

Specimen: a mandible with only the right M_1 still present.

Notable features: extreme tooth evulsion and alveolar resorption. A fossa in the left internal horizontal ramus (See Chapter 6 and Plate 4). Bilateral mylohyoid bridges and numerous animal gnaw marks.

LAB 34
Sex: Indeterminate Square: 25R9
Age: Adult (Old) Depth: Not Available

Specimen: a mandible with the right M_3 still present.

Notable features: extensive alveolar resorption and atrophy. Abscess in left molar region.

LAB 35
Sex: Male Square: 30R12
Age: Young Adult Depth: Not Available

Specimen: a mandible with 6 teeth.

Notable features: extensive tooth evulsion and alveolar resorption. Tartar deposits on the 4 remaining molars. An enamel pearl on the left M_3.

LAB 36
Sex: Female Square: 30R8
Age: 15 (12-18) Depth: Not Available

Specimen: a mandible with 3 teeth still present.

Notable features: 3-4 occlusal caries cavities visible on all 3 molars. There are bilateral mylohyoid bridges and some animal gnaw marks on the left vertical ramus.

LAB 37
Sex: Male Square: 35R7
Age: 12-14 Depth: Not Available

Specimen: a mandible with both M_1 and M_2 present bilaterally and with the M_3s visible in their crypts.

Notable features: 3 small caries cavities on the M_2s. Animal gnaw marks are quite plentiful on the specimen and the left condyle has been chewed off.

LAB 38a-1
Sex: Indeterminate Square: 30R9
Age: Subadult, Adult Depth: Not Available

Specimens: 38a - an atlas vertebra, adult.

38b - a lumbar vertebra, adult.

38c - a right innominate, probably belonging to a female aged 22-24 years of age.

38d - a left innominate, probably belonging to an adult female.

38e - an adult right femur, lacks the distal end but is small enough to suggest that it belonged to a female.

38f - an adult right femur with a 20mm-long line of animal gnaw marks along the distal portion of the linea aspera.

38g - a large left femur with a pronounced anterior curvature of the shaft.

38h - a badly-broken adult left femur.

38i - a right subadult femur lacking all epiphyses.

38j - an adult left tibia which has had its distal quarter chewed off by animals.

38k - the distal half of an adult left radius with numerous animal gnaw marks.

38l - a nearly complete adult right radius.

APPENDIX B

PLATES

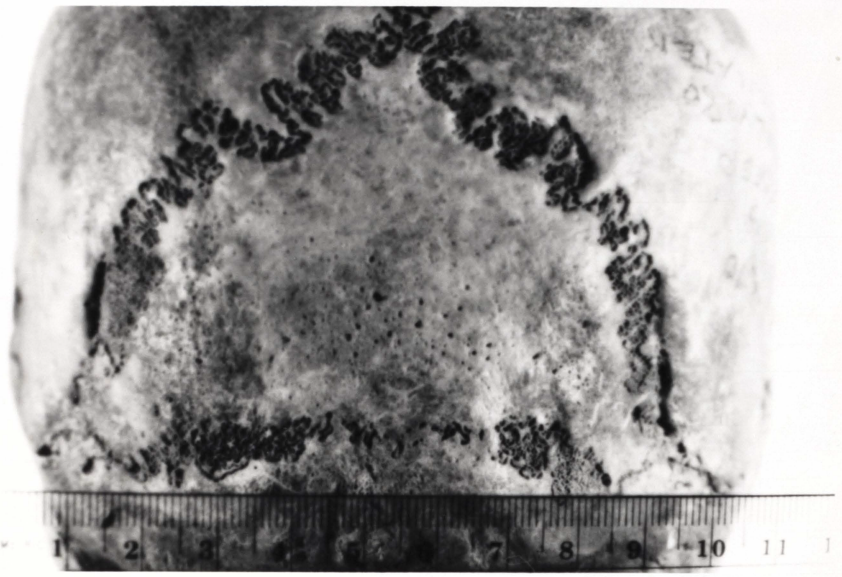

Plate 1. Lab 23 (male, 35-45). A good example of an Inca bone. It measures 90mm across the base and 60mm from base to apex.

Plate 2. Two examples of septal foramina. The right humerus is from Lab 7 (female, 25+) and the perforation measures 6.1mm across and 3.7mm in height. The left humerus is from Lab 2 (male, 24+) with the perforation measuring 8.3mm by 3.7mm.

Plate 3. Lab 2 (male, 24). The fossa is in the right internal ramus and is believed to be the result of a developmental angioma in the inferior alveolar blood vessels which pass through the mylohyoid groove just above the fossa. The fossa measures 8.05mm high and 3.8mm wide.

Plate 4. Lab 33 (female, adult). A fossa very similar to that seen in Plate 3. This one measures 7.6mm long and 6.2mm high. It is very possibly the result of a developmental anomaly but may be the result of abscessing.

Plate 5. Lab 12 (female, c. 20). Note the osteoporosis and resorption attributed to periodontal disease (pyorrhea) around the alveolar margins of the teeth. Also visible is a "typical" abscess cavity in the root area of M_1 and a destroyed PM_2.

Plate 6. Also Lab 12. Note the warping which resulted from a healed fracture of the nasal bones. The abscess and destroyed PM_2 is also clearly visible.

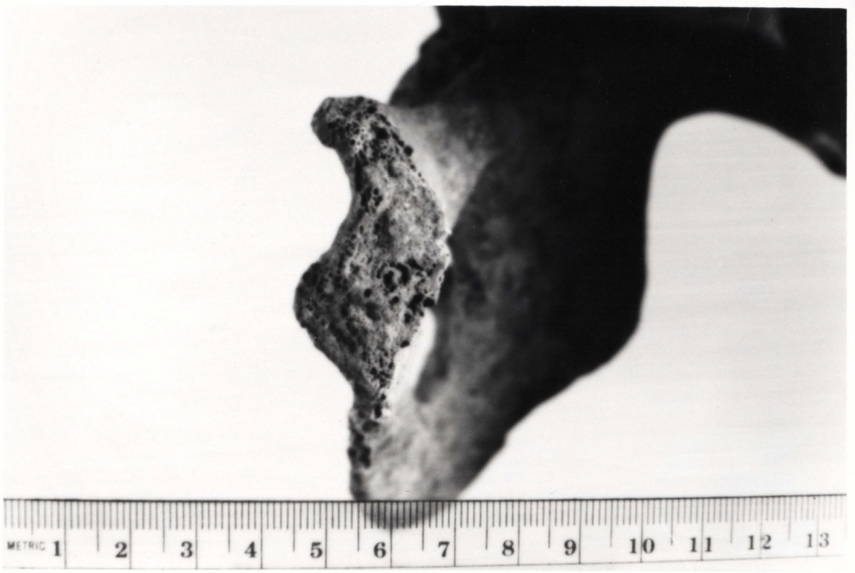

Plate 7. Lab 7 (female, 25). In this view of the right pubic symphysis the destruction of the bone as a result of rheumatoid arthritis is plainly visible.

Plate 8. Lab 31a (adult). The osteophytosis present around the articular surfaces of this right distal femur is very clearly represented in this photograph. This bony "lipping" is believed to be the result of osteoarthritis.

Plate 9. Lab 15 (male, 25-35). This photograph of the external occipital protuberance highlights the unusual development evident in this specimen. It is probably the result of the occipital bone ossifying "out into" the cartilage attached to the protuberance.

Plate 10. Lab 19 (female, 25-30). A view of what was very probably caseous material which ossified and became lodged inside the left maxillary sinus just under the eye orbit. The material is visible inside the hole just lateral to the nasal aperture.

BIBLIOGRAPHY

ANDERSON, JAMES E.

1962 The human skeleton: a manual for archaeologists. Ottawa, National Museum of Canada.

1963 The people of Fairty: an osteological analysis of an Iroquois ossuary. Bulletin No. 193, Contributions to Anthropology, 1961-2, Part 1. Ottawa, National Museum of Canada.

1968 Skeletal "anomalies" as genetic indicators. In The skeletal biology of earlier human populations. Don R. Brothwell, ed. Oxford, Pergamon Press. pp. 135-47.

BASS, WILLIAM M.

1961 The laboratory excavation of a Woodland type ossuary. Plains Anthropologist 6:60.

1964 The variation in physical types of the prehistoric Plains Indians. Plains Anthropologist 9, Memoir I, pp. 65-145.

BERRY, A. CAROLINE and R.J. BERRY

1967 Epigenetic variation in the human cranium. Journal of Anatomy 101:361-79.

BERRY, R.J.

1968 The biology of non-metrical variation in mice and men. In The skeletal biology of earlier human populations. Don R. Brothwell, ed. Oxford, Pergamon Press. pp. 103-33.

BROTHWELL, DON R.

1965 Digging up bones. London, British Museum (Natural History).

GRAY, HENRY

1959 Anatomy of the human body. 27th edition. Charles Mayo Goss, ed. Philadelphia, Lea and Febiger.

HOOTON, E.A.

1920 Indian village site and cemetery near Madisonville, Ohio. Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University. Vol. 8, No. 1:1-137.

HRDLICKA, ALES
1939 Practical anthropometry. Philadelphia, The Wistar Institute.

1952 Practical anthropometry. 4th edition. T.D. Stewart, ed. Philadelphia, The Wistar Institute.

HYDE, GEORGE E.
1962 Indians of the Woodlands: from prehistoric times to 1725. Norman, University of Oklahoma Press.

KIVETT, MARVIN F.
1952 The Woodruff ossuary, a prehistoric burial site in Phillips County, Kansas. Bureau of American Ethnology Bulletin 154. Washington, The Smithsonian Institution. pp. 103-41.

KRAUSE, RICHARD A.
1969 Correlation of phases in Central Plains prehistory. In Two house sites in the Central Plains: an experiment in archaeology. W. Raymond Wood, ed. Plains Anthropologist, Memoir 6 (Vol. 14, No. 44, Part 2). pp. 82-96.

KROGMAN, WILTON MARION
1962 The human skeleton in forensic medicine. Springfield, Charles C. Thomas.

McKERN, THOMAS W. and T.D. STEWART
1957 Skeletal age changes in young American males. Technical Report EP-45. Natick, Massachusetts, Headquarters, Quartermaster Research and Development Command.

MONTAGU, M.F. ASHLEY
1960 A handbook of anthropometry. Springfield, Charles C. Thomas.

OLIVIER, GEORGES
1969 Practical anthropology. M.A. MacConaill, trans. Springfield, Charles C. Thomas.

OLSON, ALAN P.
1966 A mass secondary burial from Northern Arizona. American Antiquity 31:822-6.

POYNTER, C.W.M.
1915 A study of Nebraska crania. American Anthropologist 17:509-24.

SCHOUR, I. and M. MOSSLER
1944 Development of the human dentition. Chicago, American Dental Association.

SNODGRASSE, RICHARD M.
1951 Toward measurement of the face in space and time. Dental Digest, October:448-51.

SOBOTTA, JOHANNES and J. PLAYFAIR McMURRICH
1906 Atlas and textbook of human anatomy. Volume 1: Bones, ligaments, joints, and muscles. Philadelphia, W.B. Saunders Company.

STEWART, T. DALE
1943 Skeletal remains from Platte and Clay Counties, Missouri. In Archeological investigations in Platte and Clay Counties, Missouri. Waldo R. Wedel. U.S. National Museum Bulletin 183. Washington, The Smithsonian Institution. pp. 245-73.

SULLIVAN, LOUIS R.
1922 The frequency and distribution of some anatomical variations in American crania. Anthropological Papers of the American Museum of Natural History (1925) 23:203-58.

UBELAKER, DOUGLAS H., T.W. PHENICE, and WILLIAM M. BASS
1969 Artificial interproximal grooving of the teeth in American Indians. American Journal of Physical Anthropology 30:145-9.

VALLOIS, H.V.
1965 Anthropometric techniques. Current Anthropology 6:127-43.

WEDEL, WALDO R.
1943 Archeological investigations in Platte and Clay Counties, Missouri. U.S. National Museum Bulletin 183. Washington, The Smithsonian Institution. pp. 1-244.

1959 An introduction to Kansas archeology. Bureau of American Ethnology Bulletin 174. Washington, The Smithsonian Institution.

1961 Prehistoric man on the Great Plains. Norman, University of Oklahoma Press.

WEDEL, WALDO R. and MARVIN F. KIVETT
1956 Additional data on the Woodruff Ossuary, Kansas. American Antiquity 21:414-6.

WOOD-JONES, FREDERICK
1929 Measurements and landmarks in physical anthropology. Bulletin 63. Honolulu, Bernice P. Bishop Museum.

1931 The non-metrical morphological characters of the skull as criteria for racial diagnosis, Part I: General discussion of the morphological characters employed in racial diagnosis. Journal of Anatomy 65:179-95.