THE PALEOINDIAN SKELETAL MATERIAL
FROM HORN SHELTER, NUMBER 2, IN CENTRAL TEXAS
AN ANALYSIS AND PERSPECTIVE

A Thesis
by
DIANE ELIZABETH YOUNG

Submitted to the Graduate College of
Texas A & M University
in partial fulfillment of the requirements for the degree of

MASTER OF ARTS

May 1986

Major Subject: Anthropology
THE PALEOINDIAN SKELETAL MATERIAL
FROM HORN SHELTER, NUMBER 2 IN CENTRAL TEXAS
AN ANALYSIS AND PERSPECTIVE

A Thesis
by
DIANE ELIZABETH YOUNG

Approved as to style and content by:

D. Gentry Steele
(Chair of Committee)

Harry J. Shahan
(member)

Merrill Sweet
(member)

Vaughn M. Bryant
(Head of Department)

May 1986
ABSTRACT

The Paleoindian Skeletal Material from Horn Shelter, Number 2 in Central Texas - An Analysis and Perspective (May, 1986)
Diane Elizabeth Young, B.A., Michigan State University;
Chair of Advisory Committee: Dr. D. Gentry Steele

In 1970, a Paleoindian double burial, an adult and child, was recovered from Horn Shelter, Number 2 (41BQ46) in central Texas. Radiocarbon dates on both charcoal and shell suggest these human remains are between 9,000 and 10,000 years old. The burial was accompanied by grave goods, including marine shell beads and red ochre. Both skeletons are fairly complete but have suffered some post-mortem damage. The adult is a male, probably in his mid 30's to early 40's at the time of death. The subadult is estimated to have been approximately 12 years old and probably male. With the exception of a healed fractured metatarsal on the adult, there is no evidence of traumatic injury on either individual. The adult's dentition exhibits heavy attrition. The dentition of both individuals are relatively free of caries.

To place the Horn skeletons into an interpretable context, nineteen North American sites with alleged Paleoindian skeletons were examined. Only five of these sites were found to have both sufficient documentation as being at least 8,000 years old and skeletal remains intact enough to have comparative value. Theories on Paleoindian population affinities are then examined to extract testable hypotheses on Paleoindian skeletal features and their Old World origins. Early racial typological approaches offer little aside from suggesting that early
populations were typically dolichocephalic. At present, Turner (1971, 1979, 1983) and Turner and Bird's (1981) approach offers the most promise in specifying origins. On the basis of dental traits, they suggest there were three migrations into North America, with the Paleoindians having their origins in the Lena River basin in northeast Siberia.

Finally, the Horn Shelter remains are compared to both regional and temporal samples. On the basis of cranial, post-cranial, and discrete trait comparisons, there are no significant differences between the Horn skeletal material and later central Texas populations. Discussion of the temporal sample is limited due to small sample size and incomplete descriptions. Though early writers, notably Hrdlička, claimed that the "modern" appearance of human skeletal material disproved geological antiquity, this study concludes the opposite; that the geological or archaeological context must prove the antiquity of the remains.
ACKNOWLEDGEMENTS

There are many people to thank. I would like first to thank Albert J. Redder of Waco, Texas, who not only graciously loaned the Horn Shelter skeletal material to the Anthropology Department at Texas A & M, but also had the patience to wait for this analysis. Thanks for time and technical assistance go to Dr. C.B. Goswick and Tina Orozco at the TAMU student health center who provided x-rays; to Paul Storch of the Materials Conservation Laboratory, Texas Memorial Museum, and Carolyn Rose of the Smithsonian Institution who provided advice on the conservation of the bones; and to J. Lawrence Angel, Douglas H. Ubelaker, Agnes Stix, and Jennifer Kelley for their time spent with me during the summer of 1984 at the Smithsonian Institution.

I also thank my committee, D. Gentry Steele, Harry J. Shafer, and Merrill Sweet, for both academic guidance and a relatively painless defense. Gentry Steele deserves special mention for years of detailed, conscientious editing. Hopefully, his efforts have been reflected in this thesis. Harry Shafer (and the 1980 and 1981 archaeological field schools) are thanked for irrevocably altering my life's direction, enabling me to re-write "Stuck in Lodi".

Very special thanks go to my "cheer-up squad", Gentry and Patty Steele, Gary B. DeMarcay, Gary Frost, Jean Christiansen, and Vance T. Holliday, who kept me on track during the spring and summer of 1985. Finally, I would like to thank my parents, Loran and Arlene Young, who have waited 34 years to see what their daughter wanted to do when she grew up.
TABLE OF CONTENTS

Page

ABSTRACT.................................................................iii
ACKNOWLEDGEMENTS.......................................................v
TABLE OF CONTENTS......................................................vi
LIST OF TABLES...........................................................viii
LIST OF FIGURES..........................................................ix
CHAPTER I. INTRODUCTION................................................1
The Paleoindians - A Problem in Definition.........................2
CHAPTER II. THE HORN SHELTER, NUMBER 2 SITE (41BQ46).............8
Site Description...........................................................8
History of Excavations...................................................11
The Burial........................................................................16
The Paleoindian Presence in Central Texas............................19
CHAPTER III. DESCRIPTION AND ANALYSIS OF BURIAL ONE...........22
Introduction......................................................................22
Inventory and Description of the Skeletal Remains...............22
Estimation of Sex...........................................................63
Estimation of Age...........................................................65
Estimation of Stature.......................................................75
Inferences on Health.......................................................76
CHAPTER IV. DESCRIPTION AND ANALYSIS OF BURIAL TWO...........84
Introduction......................................................................84
Inventory and Description of the Skeletal Remains...............84
Estimation of Age...........................................................114
Estimation of Sex...........................................................118
Inferences on Health.......................................................121
CHAPTER V. A HISTORY OF PALEOINDIAN SKELETAL DISCOVERIES IN
NORTH AMERICA..............................................................122
Introduction......................................................................122
The Sites.........................................................................127
Summary..........................................................................140
CHAPTER VI. THEORIES ON THE ORIGINS OF THE FIRST AMERICANS..144
Introduction......................................................................144
Early Racial Typological Approaches.................................146
An Evolutionary Framework.............................................156
Population Genetics.........................................................161
Discrete Trait Analysis....................................................164
Applications.....................................................................170
## LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Radiocarbon dates from Horn Shelter</td>
<td>15</td>
</tr>
<tr>
<td>3.1 Measurements and indices of Burial One</td>
<td>23</td>
</tr>
<tr>
<td>4.1 Estimates of age based on long bone lengths from four Amerindian populations (after Ubelaker, 1978)</td>
<td>117</td>
</tr>
<tr>
<td>7.1 Mean cranial measurements of central Texas males and the Horn Shelter adult</td>
<td>179</td>
</tr>
<tr>
<td>7.2 Male cranial measurements from separate central Texas sites</td>
<td>179</td>
</tr>
<tr>
<td>7.3 T-tests on the Paleoindian and central Texas cranial measurements</td>
<td>181</td>
</tr>
<tr>
<td>7.4 Maximum lengths of long bones in centimeters: Texas areal samples and the Horn Shelter adult (after Doran, 1975)</td>
<td>182</td>
</tr>
<tr>
<td>7.5 Differences in centimeters between Horn Shelter maximum lengths and the means from areal subsamples in Texas</td>
<td>184</td>
</tr>
<tr>
<td>7.6 Discrete trait frequencies in central Texas and Horn Shelter samples</td>
<td>189</td>
</tr>
<tr>
<td>7.7 Paleoindian cranial measurements</td>
<td>192</td>
</tr>
<tr>
<td>7.8 Paleoindian post-cranial measurements</td>
<td>193</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Location map of Horn Shelter on the Brazos River in central Texas</td>
<td>10</td>
</tr>
<tr>
<td>2.2</td>
<td>East-west profile of Horn Shelter deposits (from Redder, 1985)</td>
<td>14</td>
</tr>
<tr>
<td>2.3</td>
<td>The Paleoindian double burial from Horn Shelter (from Redder, 1985)</td>
<td>18</td>
</tr>
<tr>
<td>3.1A</td>
<td>Frontal view of Burial One's cranium</td>
<td>26</td>
</tr>
<tr>
<td>3.1B</td>
<td>Left lateral view of Burial One's cranium</td>
<td>26</td>
</tr>
<tr>
<td>3.1C</td>
<td>Superior view of Burial One's cranium</td>
<td>26</td>
</tr>
<tr>
<td>3.1D</td>
<td>Right lateral view of Burial One's cranium</td>
<td>26</td>
</tr>
<tr>
<td>3.2A</td>
<td>Posterior view of Burial One's cranium</td>
<td>29</td>
</tr>
<tr>
<td>3.2B</td>
<td>Basilar view of Burial One's cranium</td>
<td>29</td>
</tr>
<tr>
<td>3.3A</td>
<td>Frontal view of Burial One's maxillae</td>
<td>32</td>
</tr>
<tr>
<td>3.3B</td>
<td>Superior view of Burial One's maxillae with odontome circled</td>
<td>32</td>
</tr>
<tr>
<td>3.4A</td>
<td>Right lateral view of Burial One's mandible</td>
<td>36</td>
</tr>
<tr>
<td>3.4B</td>
<td>Left lateral view of Burial One's mandible</td>
<td>36</td>
</tr>
<tr>
<td>3.5A</td>
<td>Sciatic notch of Burial One's right ilium</td>
<td>40</td>
</tr>
<tr>
<td>3.5B</td>
<td>Auricular surface of Burial One's right ilium</td>
<td>40</td>
</tr>
<tr>
<td>3.6A</td>
<td>Anterior view of Burial One's left humerus</td>
<td>44</td>
</tr>
<tr>
<td>3.6B</td>
<td>Posterior view of Burial One's left humerus</td>
<td>44</td>
</tr>
<tr>
<td>3.6C</td>
<td>Anterior view of Burial One's right humerus</td>
<td>44</td>
</tr>
<tr>
<td>3.6D</td>
<td>Posterior view of Burial One's right humerus</td>
<td>44</td>
</tr>
<tr>
<td>3.7A</td>
<td>Anterior/medial view of Burial One's right radius</td>
<td>47</td>
</tr>
<tr>
<td>3.7B</td>
<td>Posterior/lateral view of Burial One's right radius</td>
<td>47</td>
</tr>
<tr>
<td>3.7C</td>
<td>Medial view of Burial One's right ulna</td>
<td>47</td>
</tr>
<tr>
<td>3.7D</td>
<td>Lateral view of Burial One's right ulna</td>
<td>47</td>
</tr>
<tr>
<td>3.7E</td>
<td>Lateral view of Burial One's left radius and ulna</td>
<td>47</td>
</tr>
<tr>
<td>3.8A</td>
<td>Anterior view of Burial One's left femur</td>
<td>50</td>
</tr>
<tr>
<td>3.8B</td>
<td>Posterior view of Burial One's left femur</td>
<td>50</td>
</tr>
<tr>
<td>3.8C</td>
<td>Anterior view of Burial One's right femur</td>
<td>50</td>
</tr>
<tr>
<td>3.8D</td>
<td>Posterior view of Burial One's right femur</td>
<td>50</td>
</tr>
<tr>
<td>3.9A</td>
<td>Anterior view of Burial One's left tibia</td>
<td>53</td>
</tr>
<tr>
<td>3.9B</td>
<td>Posterior view of Burial One's left tibia</td>
<td>53</td>
</tr>
<tr>
<td>3.9C</td>
<td>Anterior view of Burial One's right tibia</td>
<td>53</td>
</tr>
<tr>
<td>3.9D</td>
<td>Posterior view of Burial One's right tibia</td>
<td>53</td>
</tr>
</tbody>
</table>
Figure Page
3.10A Occlusal view of Burial One's maxillary dentition................. 58
   B Occlusal view of Burial One's mandibular dentition................. 58
3.11A Lateral view of Burial One's maxillary dentition................. 61
   B Lateral view of Burial One's mandibular dentition................. 61
3.12A X-ray of Burial One's clavicles................................. 71
   B X-ray of Burial One's right femoral head.......................... 71
   C Articular surfaces of Burial One's ulnae, with some
      arthritic lipping evident........................................... 71
3.13 X-ray of Burial One's tibia showing transverse lines............. 79
3.14A Healed fracture on Burial One's left fifth metatarsal............ 82
   B Abnormal pitting and deposition of bone on Burial One's
      left third cuneiform and navicular............................... 82
4.1A Frontal view of Burial Two's cranium.................................. 86
   B Superior view of Burial Two's cranium.............................. 86
   C Left lateral view of Burial Two's cranium.......................... 86
4.2A Posterior view of Burial Two's cranium................................ 89
   B Basilar view of Burial Two's cranium............................... 89
   C Right lateral view of Burial Two's cranium........................ 89
4.3A Left lateral view of Burial Two's maxillae............................ 92
   B Right lateral view of Burial Two's maxillae........................ 92
4.4A Left lateral view of Burial Two's mandible........................... 95
   B Right lateral view of Burial Two's mandible....................... 95
4.5A Anterior view of Burial Two's left humerus.......................... 99
   B Posterior view of Burial Two's left humerus....................... 99
   C Medial view of Burial Two's right ulna and radius................ 99
4.6A Anterior view of Burial Two's left femur............................. 103
   B Posterior view of Burial Two's left femur........................ 103
   C Anterior view of Burial Two's right femur........................ 103
   D Posterior view of Burial Two's right femur........................ 103
   E Burial Two's femoral head epiphysis cemented by
      cave deposits to femoral neck..................................... 103
4.7A Anterior view of Burial Two's left tibia............................. 105
   B Posterior view of Burial Two's left tibia........................ 105
   C Anterior view of Burial Two's right tibia........................ 105
   D Posterior view of Burial Two's right tibia........................ 105
   E Distal end epiphyses for Burial Two's tibiae...................... 105
4.8A Occlusal view of Burial Two's maxillary dentition................. 110
   B Occlusal view of Burial Two's mandibular dentition................. 110
<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.9A</td>
<td>Left lateral view of Burial Two's maxillary dentition......112</td>
</tr>
<tr>
<td>B</td>
<td>Right lateral view of Burial Two's maxillary dentition......112</td>
</tr>
<tr>
<td>C</td>
<td>X-ray of Burial Two's maxillary dentition.......................112</td>
</tr>
<tr>
<td>4.10A</td>
<td>Sciatic notch of Burial Two's left ilium......................120</td>
</tr>
<tr>
<td>B</td>
<td>Sciatic notch of Burial Two's right ilium......................120</td>
</tr>
<tr>
<td>5.1</td>
<td>Paleolithic sites with human skeletal material in North America........................................142</td>
</tr>
<tr>
<td>6.1</td>
<td>Beringia and peripheral areas, including rivers of Siberia mentioned in text..........................153</td>
</tr>
<tr>
<td>7.1</td>
<td>Location map of Texas sites mentioned in text................176</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

This is a descriptive and comparative study of the Paleoindian double burial excavated from Horn Shelter, Number 2 (41BQ46) in central Texas. While a Paleoindian presence in North America is well-documented their actual skeletal remains are few and fragmentary. The recovery of Horn Shelter individuals, relatively well-preserved and from a well-stratified site, offer a unique opportunity to examine two representatives of these early Americans.

The primary purpose of this study is to provide an osteological description and analysis of the two individuals from Horn Shelter. The site of Horn Shelter, the history of excavations, and the record of radiocarbon dates are briefly discussed in Chapter II. Chapter III provides the description and analysis of the adult skeletal material. The age, sex, stature, and health of this individual are assessed based on suitable forensic techniques presently available. Chapter IV follows this same format in the analysis of the subadult skeleton.

The remainder of this study attempts to place these individuals into a historical and biological context. Chapter V presents a history and brief descriptions of other Paleoindian skeletal finds in North America. Nineteen archaeological sites are considered, but ultimately only 11 are found to have sufficient documentation to be accepted as dating to

This paper follows the style of the American Journal of Physical Anthropology.
the late Pleistocene/early Holocene. Of these 11 sites, only five have skeletal remains sufficiently intact to be of comparative value. Chapter VI then examines past and present theories on the Old World origins and characteristics of the Paleoindians in order to establish a biological framework within which to interpret Paleoindian skeletal material.

Finally, Chapter VII compares the Horn Shelter individuals to 1) more recent Texas aboriginal populations and 2) a temporal sample comprised of the other generally accepted Paleoindian skeletons in North America. In the regional comparison, the question asked is simply, are the Horn individuals significantly different from later Texas populations? Early writers, notably Hrdlička (1918, 1937), hypothesized that these first Americans would have more primitive features. To answer this, the Horn individuals are compared to prehistoric central Texas samples on cranial and post-cranial measurements as well as discrete traits. The temporal comparative study, limited by a small sample and lack of data, is primarily a compilation of the available data and comparative remarks. These comparative remarks focus upon the presence or absence of physical characteristics that various researchers, as discussed in Chapter VI, have hypothesized for the Paleoindian population in the New World.

THE PALEOINDIANS - A PROBLEM IN DEFINITION

It is beyond the scope of this thesis to review the present archaeological record of Paleoindian sites in North America. Nor is it the intent of this author to enter the debate on when man first arrived in the New World. The only debate this thesis will address is the
definition of Paleoindian.

There is no consensus on the definition of the term Paleoindian, nor is there agreement on what constitutes acceptable archaeological evidence for it in the archaeological record. The term Paleoindian has been used to denote the earliest migrants into North America (Roberts, 1940), a particular subsistence adaptation, specifically the hunting of now extinct megafauna (Griffin, 1978; Suhr et al., 1954; Shafer, 1977; Prewitt, 1981), or as a time period, corresponding roughly to the end of the Pleistocene and early Holocene epochs (Sellards, 1952; Haynes, 1971; Hester, 1976). Often the term is simply not defined and the meanings apparently used interchangeably. As a result of this ambiguity, what constitutes archaeological evidence for Paleoindians becomes muddled. Archaeologists have used projectile point types, and/or inferred means of subsistence, or simply chronological dates to define whether or not a site has a Paleoindian component.

Frank H.H. Roberts (1940), though using a title "Developments in the Problem of the North American Paleo-Indian", never actually defined the term Paleoindian. From the text of his article it appears as if Paleoindian simply refers to the first migrants into the New World. He did write that these peoples were unquestionably hunters, but noted that in addition to now extinct species, many of the animals that they exploited were the same game animals that exist today. Other authors (Sellards, 1952; Worthington, 1957; Suhr et al., 1954) however, have emphasized the association with extinct fauna. Sellards (1952) defined "early man or Paleoindian" as

all occurrences of man or relics of man of such antiquity as to be associated with species of animals
or plants that are now extinct; those that occur in geologic formations which appear to be of an age equivalent to those which elsewhere contain extinct species, as in some river terraces; and those that, lacking both stratigraphic equivalents and diagnostic fossils, nevertheless afford evidence of having formed under climatic conditions notably different from present (Sellards, 1952:5).

Though offering no chronological dates, this definition seems to focus primarily on a time, when man co-existed with extinct flora and fauna under climatic conditions different from that of present. In this definition, Sellards made no specific remarks on means of subsistence. C. Vance Haynes (1971, 1980) has also used "Paleoindian" to designate periods of time and divided the Paleoindian period into Early, Middle and Late segments. His Late Paleoindian period is defined as the years between 11,500 to 7000 BP; he referred to the peoples living then as the Clovis culture.

Wormington (1957) used the term "Paleoindian" to designate the oldest inhabitants in North America, which she then elaborated to "people who hunted animals which are now extinct, to the people who occupied the western United States prior to about 6,000 years ago, and to the makers of the fluted points found in the eastern United States" (Wormington, 1957:3). This definition apparently incorporates subsistence, a chronological date, and point types to define various Paleoindian occupations depending upon the region of the country.

Suhm et al. (1954) preferred to limit the term "Paleo-American"(at the time they wrote there were hypotheses that early man in North America were more Caucasoid than Mongol), to those who "lived as nomadic hunters of big game, and survived about as long as the last of the Pleistocene animal species which eventually became extinct, that is,
until approximately 5000 BC" (Suhm et al., 1954:16-17). Suhm (1960) appeared to define Paleoindian sites solely on the presence of Clovis, Folsom, or Plainview point types. Griffin (1978), in discussing a eastern United States chronology, did not define Paleoindian but seemed to use the word interchangeably with "fluted point hunters".

Willey and Phillips (1958) preferred not to use the term "Paleoindian", as it implied a population distinct from later groups, and instead referred to the earliest New World occupation as simply "Lithic", and defined it as a stage of adaptation by early man to the late Glacial/early post-Glacial conditions. They considered the descriptions of these people as primarily big game hunters to be assumptions and suggested that the early populations in the New World probably made the best use of whatever animal and vegetal resources were available within the limits of their technology. "The relative importance of hunting and gathering would be a function of the ecological and technological balance in a particular time and place" (Willey and Phillips, 1958:81).

In focusing specifically on Texas, it is also clear that archaeologists have reached no consensus on the use of the term Paleoindian. Shafer (1977) equated Paleoindian with big game hunting populations on the Plains. By definition then, Paleoindian occupations in Texas would be restricted primarily to the southern High Plains. Hester (1976) though appeared to use Paleoindian as a time frame, and suggested there were cultural adjustments to local environments by the "early Paleo-Indian" period which he dated at approximately 11,000 to 9,500 years BP. Prewitt (1981), in outlining a cultural chronology for
central Texas, returned to a definition based on subsistence and used "Paleoindian" to denote cultures which were orientated towards big game, and noted Clovis, Folsom, and Plainview points as "key index markers".

Clearly each of these definitions has both merit as well as difficulties when applied to the archaeological record. While acknowledging the importance of finding a workable, and generally accepted definition of Paleoindian, this too is beyond the scope of this thesis. The option to avoid the term was considered but its recognition value in the literature is too high to abandon it completely. The author hopes then only to provide and define a workable definition with reference to this particular study.

At present, a strictly cultural definition for Paleoindian is too limiting for the purposes of this investigation. Early archaeological sites with human skeletal remains are rare enough without requiring associated extinct fauna or diagnostic point types. As this study focuses on the biological evidence of early man, and the changes in human skeletal remains through time, a chronological definition of Paleoindian seems most applicable. Certainly it can not be denied that cultural evolution has affected human biological evolution, but it is equally certain that biological evolution proceeds at a considerably slower pace. Perhaps as the sample of early human skeletal remains increases, physical anthropologists can one day examine the microevolutionary differences between the nomadic big game hunters and the populations already adapting to a more sedentary lifestyle during the early Holocene, but the present sample size of early man in North America demands a broader scope.
For the purposes of this study then, "Paleoindian" will refer to human remains that date to, or in excess of, roughly 8,000 years BP. This early Holocene date was chosen for two reasons. First, the presence of a nomadic big game hunting population is well-documented for at least the Plains and the Southwest regions at this time, and secondly, numerous authors (Haynes, 1971; Suhm et al., 1954; Smith, 1976; Hester, 1976; and Owen, 1984) have used dates of 7,000 to 8,000 years BP to define the end of a Paleoindian or early man period.
CHAPTER II
THE HORN SHELTER, NUMBER 2 SITE (41BQ46)

SITE DESCRIPTION

Horn Shelter No. 2 is located on the west bank of the Brazos River in eastern Bosque County, central Texas, roughly 16 km downstream from the Lake Whitney Dam (Fig. 2.1). The rockshelter faces east, overlooking a bend in the river. At present the river's edge is approximately 18 m from the mouth of the shelter. Forrester (1985) estimated the shelter's bedrock floor is roughly 4.6 m above the river.

The shelter, which was created by erosion in Cretaceous limestone, is approximately 46 m in length with a maximum overhang of 7.6 m. Both Redder (1985) and Forrester (1985) described the shelter as being naturally divided into two areas, a north end and a south end; the south end being both wider and deeper. The strata in the north and south units showed great variation, "seeming to be almost two separate shelters" (Redder, 1985:39). The Paleoindian burials were recovered from the south end.

Horn Shelter originally contained as much as 8 m of sediments. Shortly after 1900, the south end was partially cleared to provide living space for an Anglo-American family. They and possibly some flooding by the Brazos River, removed some 2 m of fill from the south end (Redder, 1985). Forrester (1985) noted that when he began excavations in the north end of the shelter, the fill was within 30 cm or less of the shelter's ceiling.

Paleoenvironmental studies in central Texas suggest that since
Fig. 2.1. Location map of Horn Shelter on the Brazos River in central Texas.
approximately 14,000 years BP there has been a gradual reduction in forest cover and an increase in grasses (Bryant and Shafer, 1977; Bryant and Holloway, 1985). At the time of the Paleolithic occupation of Horn Shelter, the surrounding terrain was probably a mosaic of grassland and forest, with the grasses predominating. This interpretation is based on sequential changes in fossil pollen records taken from peat bogs in central Texas. Attempts to recover pollen from the Horn Shelter deposits themselves were not successful.

HISTORY OF EXCAVATIONS

In the spring of 1967, Frank Watt and Albert J. Redder, experienced avocational archaeologists, began excavations in the south end of Horn Shelter. Watt and Redder decided to excavate a five foot trench in the middle of the south end of the shelter, and imposed a grid system of five foot intervals along a base line running north-south, roughly paralleling the face of the shelter. They established a primary datum point at the south edge of the shelter and a secondary elevation point at the highest level of undisturbed fill. This latter point was marked by driving a steel pin into the rockshelter wall.

Watt and Redder excavated in one foot levels but followed the natural stratigraphy, the deposits generally sloping towards the east and north. At the bottom of each 12 inch level they drew floor plans and also drew wall profiles at each five foot north-south line and each five foot east-west line. Bedrock was reached at 207 inches (5.25 m) below datum.

Ultimately 27 major strata were identified and labelled 1-27, from
oldest to more recent (Fig. 2.2). These stratified deposits contain a record of human occupation from the Paleoindian period through historic times. Redder (1985) described these deposits in three general divisions. The first, laying on the rock floor of the shelter, was comprised of gravel, sand, and clay deposited by the Brazos River. From these deposits, Watt and Redder recovered extinct faunal remains, large turtle of the genus Geochelone or Gopherus, and a ground sloth, Nothrotherium. Additionally, they exposed a fire hearth containing flint and bone. A radiocarbon date of 10,150±120 years BP was obtained from the turtle bone (Table 2.1).

The second major division of strata described by Redder (1985) was a thick accumulation of gray cave deposits. These deposits, up to 1.52 m in thickness, consisted of gray roof spalls and limestone powder and contained much cultural material. Redder recognized eight substratum (5A-G) within this second major division of the shelter's deposits. A fragmentary Folsom point and an unidentified dart point were recovered from the lowest substrata (5A). Substratum 5C contained a hearth with numerous small animal bones. In substratum 5D another hearth was exposed; this substrata also contained worked bone, fragments of bone needles, and a large knife knife. Faunal remains from 5D included bison, deer, and numerous small animals.

The double burial, the primary focus of this thesis, was located in substratum 5E with the burial pit originating in 5G. Radiocarbon tests on charcoal recovered from substratum 5G yielded dates of 9,500±200 years BP and 9,980±370 years BP (Table 2.1). Radiocarbon tests on shell from this same substratum produced results of 10,030±130 years BP and
Fig. 2.2. East-west profile of Horn Shelter deposits. (from Redder, 1985).
10,310±150 years BP. In addition to the burial goods (described in detail in the following section), a projectile point named "Brazos Fishtail" by Watt (1978) was recovered from this stratum. This point resembles the San Patrice point type (Suhm and Jelks, 1962; Turner and Hester, 1985). San Patrice points are generally found in east and northeast Texas and date to the Paleoindian period, ca. 10,000 to 8,000 years BP, as defined by Turner and Hester (1985).

Table 2.1 Radiocarbon dates from Horn Shelter

<table>
<thead>
<tr>
<th>Date</th>
<th>Material</th>
<th>Lab</th>
<th>Stratum</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,150±120 yrs</td>
<td>bone</td>
<td>(Tx - 2189)</td>
<td>3</td>
</tr>
<tr>
<td>9,500±200 yrs</td>
<td>charcoal</td>
<td>(Tx - 1830)</td>
<td>5G</td>
</tr>
<tr>
<td>9,980±370 yrs</td>
<td>charcoal</td>
<td>(Tx - 1722)</td>
<td>5G</td>
</tr>
<tr>
<td>10,030±130 yrs</td>
<td>shell</td>
<td>(Tx - 1998)</td>
<td>5G</td>
</tr>
<tr>
<td>10,310±150 yrs</td>
<td>shell</td>
<td>(Tx - 1997)</td>
<td>5G</td>
</tr>
<tr>
<td>8,400±110 yrs</td>
<td>shell</td>
<td>(Tx - 1996)</td>
<td>8B</td>
</tr>
<tr>
<td>4,145±190 yrs</td>
<td>shell</td>
<td>(Tx - 1995)</td>
<td>10</td>
</tr>
<tr>
<td>3,855±205 yrs</td>
<td>charcoal</td>
<td>(Tx - 1720)</td>
<td>10</td>
</tr>
<tr>
<td>2,635±185 yrs</td>
<td>shell</td>
<td>(Tx - 2000)</td>
<td>10</td>
</tr>
<tr>
<td>2,405±170 yrs</td>
<td>charcoal</td>
<td>(Tx - 1999)</td>
<td>10</td>
</tr>
<tr>
<td>610±135 yrs</td>
<td>charcoal</td>
<td>(Tx - 1723)</td>
<td>19</td>
</tr>
</tbody>
</table>

Redder (1985) described the third general division of strata as having been deposited during periods of flooding. At the lowest level of this third division were a series of red alluvial sand deposits which contained three Plainview points. Radiocarbon tests on shell taken from the same stratigraphic level as the points produced a date of 8,400±110 years BP (Watt, 1978). As none of these overlaying red sands were mixed in the burial fill, the double burial could not represent a later intrusion into the lower strata (Redder, 1985).

Above these Plainview levels lay an Archaic midden. Over 40
projectile points, including Gary, Perdenales, Kent, and Yarborough types were recovered. The midden also contained bone pin and fish hook fragments and remains of deer, turtle, rabbit, and birds. The overlaying strata indicate continuing, if intermittent, occupation into historic times (Watt, 1978; Redder, 1985). The lowest 11 strata which contained Indian cultural material are detailed in Appendix A. Stratum 12 and above, associated with Anglo-American occupations are not discussed.

Watt (1978) provided a useful summation of the archaeological record at Horn Shelter. He identified five cultural horizons based on a stratified sequence of projectile points and 11 radiocarbon dates. The point types and associated ages are: Perdiz (650 years BP), Marcos (2,450 years BP), Perdenales (3,950 years BP), Plainview (8,950 years BP), and Brazos Fishtail (9,950 years BP). These 11 radiocarbon dates are presented in Table 2.1.

THE BURIAL

In 1970, a double burial was located 442 cm below the present surface of the rockshelter and near the bottom of the stratum characterized as gray cave fill (substratum 5G). Both individuals were flexed and lying on their left sides, with the child facing the back of the adult (Fig. 2.3). Though both skeletons suffered considerable post-mortem damage from ground pressure (and from a minimal amount of rodent gnawing), the remains were essentially complete. Post-mortem alteration of the bones includes cracks and warping on the skulls, breaks in the long bones, and crushing of the ribs, vertebrae, scapulae,
Fig. 2.3. The Paleolithic double burial from Horn Shelter. (from Redder, 1985).
and pelvis. This breakage, as well as missing fragments, precludes some osteological measurements and makes others approximate. Additionally, portions of the bones were covered with cave deposits of calcium carbonate, obliterating the edges of some of the breaks, and in some instances, cementing bones and associated artifacts together. The bones are a yellowish tan in color and some have mineralized to the point of producing a clinking sound when tapped with a fingernail. Stewart (Wendorf et al., 1955) noted the same condition with the Midland Paleoindian cranium.

The two skeletons had been covered by 19 limestone slabs from below the crania interred with numerous burial goods. These included red ochre, 80 small shell beads (*Meritina canines*), a large Oliva shell bead (*Oliva sayana*, identified by Redder (1985) by its former name *Oliva litterata*), four perforated non-human canine teeth, a bone needle, one flint biface, bird claws (probably from a hawk or eagle), an unidentified bone tool made from a cannon bone of a deer, a tool manufactured from a deer tyne, two antler billets and two thin sandstone slabs (Redder, 1985). The adult's face was covered by the remnants of a turtle carapace and the adult's skull rested on top of a stack of three inverted turtle carapaces. A fifth turtle shell lay beneath the adult's pelvis. Each of these shells had been intentionally cleaned of vertebral fragments (Redder, 1985).

**THE PALEOINDIAN PRESENCE IN CENTRAL TEXAS**

Archaeologists' definitions of central Texas have varied (Prewitt, 1981; Biesaart et al., 1985; Suhm, 1960). Suhm (1960) defined the
central Texas archaeological area as the land drained by the middle stretches of the Colorado and Brazos Rivers. The earliest occupation in this area dates to the late Pleistocene. Aside from the Horn Shelter site, evidence of this occupation consists of surface collections of Clovis, Folsom and Plainview points as well as a few stratified sites such as Wilson-Leonard (41WM25) in Williamson County (Young, 1983), Levi Rockshelter (41TV49) in Travis County, (Alexander, 1963) and the Adair-Steadman site in Fischer County (Tunnell, 1977). According to the Office of the State Archaeologist's recent report, 68% of the Paleoindian sites in central and north central Texas are on active or active to fossil floodplains (Biessart et al., 1985).

In what he defined as the early Paleoindian period, roughly 9,500 - 11,000 years BP, Hester (1976) discerned two major traditions in Texas, the Plains-related Tradition, in which he grouped all of the Clovis and Folsom sites (these are primarily located in north central Texas and the Panhandle, but have also been found in east and south Texas and along the Coast), and a Small Projectile Point Tradition in northeast Mexico and south Texas. Hester noted that there was little data in the way of faunal associations with Clovis and Folsom materials in central Texas. In the terminal Pleistocene, approximately 8,000 to 9,500 years BP, Hester suggested they were adaptations to fairly localized environments resulting in a wide variety of cultural remains.

Hester's assessment would appear to be reflected in the Horn Shelter's assemblages. At Horn Shelter, substratum 5A contained a basal fragment of a Folsom point and no faunal remains. Substratum 5D contained bison, deer, and numerous small animals such as rabbit,
turtle, fish, snakes, and birds. From substratum 5F Redder and Watt recovered a mid-section of a Scottsbluff point and a Brazos Fishtail point. Faunal remains in this substratum included deer, rabbits, fish, and turtle remains. The overlying substratum (5G), the level in which the burial pit originated, has radiocarbon dates that range between 9,500 and 10,310 years BP. Such faunal assemblages as discussed then, suggest adaptations to more localized resources prior to 9,500 years BP. Shafer (1977) also discussed the appearance of localized adaptations in central and east central Texas during this time but identified these peoples as "Early Lithic" as opposed to Paleoindian.
CHAPTER III

DESCRIPTION AND ANALYSIS OF BURIAL ONE

INTRODUCTION

This chapter provides a detailed description of the adult skeletal and dental remains and estimates of sex, age, stature, and general health, based on these remains. Each bone recovered is first described, noting 1) the general condition and extent of post-mortem damage and 2) discrete traits as well as features suggestive of either strong or weak muscle attachments. Cranial and post-cranial measurements are provided in Table 3.1. Measurements and descriptions follow those of Stewart (1952), Steele and Bramblett (n.d.), and McMinn and Hutchings (1977).

After the inventory and description of the bones, the dentition is analyzed. Much of this description focuses on the severe attrition, which has obliterated cusp patterns as well as evidence of other morphological traits. An apparent imbalance of occlusal surfaces is also examined.

Finally, this chapter addresses the questions of gender, age, stature, and the general level of health of this individual. These inferences are based on the macroscopic and, in some instances, X-ray analysis of the bones and teeth.

INVENTORY AND DESCRIPTION OF THE SKELETAL REMAINS

Frontal bone

This bone is primarily intact. Post-mortem damage consists of the loss of the two orbital plates and the development of three cracks which
| Table 3.1 Measurements and indices of Burial One |

**Cranial**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum length</td>
<td>187 mm</td>
</tr>
<tr>
<td>Maximum breadth</td>
<td>140 mm</td>
</tr>
<tr>
<td>Minimal frontal breadth</td>
<td>95 mm</td>
</tr>
<tr>
<td>Porion-bregma height</td>
<td>138 mm</td>
</tr>
<tr>
<td>Nasal breadth</td>
<td>24 mm</td>
</tr>
<tr>
<td>Cranial index</td>
<td>74.87</td>
</tr>
<tr>
<td>Bicondylar breadth of mandible</td>
<td>130 mm</td>
</tr>
<tr>
<td>Height of mandibular symphysis</td>
<td>34 mm</td>
</tr>
<tr>
<td>Bigonial breadth of mandible</td>
<td>101 mm</td>
</tr>
<tr>
<td>Height of right ascending ramus</td>
<td>61 mm</td>
</tr>
<tr>
<td>Minimum breadth of ascending ramus</td>
<td>32 mm</td>
</tr>
<tr>
<td>Length of mandibular body</td>
<td>79 mm</td>
</tr>
<tr>
<td>Gonial angle</td>
<td>124.5 degrees</td>
</tr>
</tbody>
</table>

**Post-cranial**

<table>
<thead>
<tr>
<th>Bone</th>
<th>L</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humerus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum diameter at mid-shaft</td>
<td>20.5 mm</td>
<td>22.5 mm</td>
</tr>
<tr>
<td>Minimum diameter at mid-shaft</td>
<td>15 mm</td>
<td>16.5 mm</td>
</tr>
<tr>
<td>Maximum diameter of head</td>
<td>45 mm</td>
<td>44 mm</td>
</tr>
<tr>
<td>Circumference of mid-shaft</td>
<td>60 mm</td>
<td>68 mm</td>
</tr>
<tr>
<td>Least circumference of shaft</td>
<td>60 mm</td>
<td>65 mm</td>
</tr>
<tr>
<td>Robusticity Index</td>
<td></td>
<td>20.65</td>
</tr>
<tr>
<td>Radius</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum length</td>
<td></td>
<td>250 mm</td>
</tr>
<tr>
<td>Maximum diameter of crest</td>
<td></td>
<td>16.5 mm</td>
</tr>
<tr>
<td>Minimum diameter of crest</td>
<td></td>
<td>11 mm</td>
</tr>
<tr>
<td>Radio-humeral index</td>
<td></td>
<td>79.43</td>
</tr>
<tr>
<td>Ulna</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum length</td>
<td></td>
<td>265 mm</td>
</tr>
<tr>
<td>Maximum diameter of crest</td>
<td></td>
<td>267 mm</td>
</tr>
<tr>
<td>Minimum diameter of crest at above point</td>
<td>16 mm</td>
<td>13 mm</td>
</tr>
<tr>
<td>Clavicle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circumference at (estimated) midshaft</td>
<td>31 mm</td>
<td>35 mm</td>
</tr>
<tr>
<td>Femur</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bicondylar length</td>
<td></td>
<td>433 mm</td>
</tr>
<tr>
<td>Maximum length</td>
<td></td>
<td>436 mm</td>
</tr>
<tr>
<td>Maximum diameter of head</td>
<td></td>
<td>46 mm</td>
</tr>
<tr>
<td>Subtrochanteric anterior-posterior diameter</td>
<td>22 mm</td>
<td>23 mm</td>
</tr>
<tr>
<td>Subtrochanteric medio-lateral diameter</td>
<td>32 mm</td>
<td>33 mm</td>
</tr>
<tr>
<td>Medio-lateral diameter at mid-shaft</td>
<td>26 mm</td>
<td>27 mm</td>
</tr>
<tr>
<td>Anterior-posterior diameter at mid-shaft</td>
<td>29 mm</td>
<td>29 mm</td>
</tr>
<tr>
<td>Circumference at mid-shaft</td>
<td>85 mm</td>
<td>86 mm</td>
</tr>
<tr>
<td>Platymeric Index</td>
<td>68.75</td>
<td>69.70</td>
</tr>
<tr>
<td>Robusticity Index</td>
<td></td>
<td>12.73</td>
</tr>
<tr>
<td>Tibia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anterior-posterior diam. at nutrient foramen</td>
<td>38 mm</td>
<td>34.5 mm</td>
</tr>
<tr>
<td>Medio-lateral diameter at nutrient foramen</td>
<td>20 mm</td>
<td>21 mm</td>
</tr>
<tr>
<td>Platycnemic Index</td>
<td>52.63</td>
<td>60.87</td>
</tr>
<tr>
<td>Talus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum length</td>
<td>52 mm</td>
<td>53.5 mm</td>
</tr>
</tbody>
</table>
alter the shape of the bone (Fig. 3.1A,C).

The frontal exhibits pronounced supraorbital ridges. They are particularly developed on the lateral edges having an estimated thickness of 10.0 mm near the frontal/zygomatic suture. On the posterior aspect of the left external angular process, the upper temporal ridge, which provides attachment to the temporal fascia, is sharply defined. The frontal eminences are not prominent. A supraorbital notch is present only on the left orbit, both right and left orbits have supraorbital foramina. There is no evidence of a metopic suture.

Parietals

Most of the left parietal is present (Fig.3.1B). Post-mortem damage consists of cracking and subsequent warping. It is difficult to estimate if any of the inferior margin of the left parietal has been lost. The bone may have separated right at the juncture of the temporal and parietal. All of the right parietal bone is present (Fig.3.1D). This bone too is cracked but not as severely as the left.

Both parietals display prominent parietal eminences. There is a slight elevation along the sagittal suture. The lines of the temporal muscles are not easily distinguished. On the internal surface of the parietals there are three clusters of small pits identified as Pacchonian depressions: one cluster is 38 mm posterior to the coronal suture on the left parietal, the two other clusters are 28 and 86 mm posterior to the coronal suture on the internal surface of the right parietal.
Fig. 3.1A. Frontal view of Burial One's cranium.
B. Left lateral view of Burial One's cranium.
C. Superior view of Burial One's cranium.
D. Right lateral view of Burial One's cranium.
Occipital

The occipital bone is fragmented, with only portions of the tabula still articulated with the rest of the cranium (Fig.3.2A). Much of the basilar portion of the occipital is missing (Fig.3.2B). There is, however, a fragment of the right border of the foramen magnum, with the anterior portion of the occipital condyle and the anterior condyloid foramen present. There is also a fragment of the left border of the foramen magnum. This fragment does not include the condyle but does exhibit the anterior condyloid foramen. Major fragments of tabula are also missing. The remaining tabula still attached to the cranium displays numerous post-mortem cracks.

The external occipital protuberance is of medium development. The superior nuchal line is marked by a slight ridge of bone, noticeably on the left side, less so on the right. There is a lambda ossicle to the right of lambda.

Temporals

The left temporal has been reconstructed from five major pieces. The bone had been pushed inward, along a major crack posterior to the mastoid process, and had been cemented by cave deposits in this position (see Fig.3.1B). It exists now as a separate piece, not in articulation with the rest of the cranium. The superior margin of the squamous portion is missing as well as the anterior portion of the zygomatic process and the styloid process.

The right temporal is primarily intact with some displacement along the anterior portion of the squamous suture (see Fig.3.1D). The squamous
Fig. 3.2A. Posterior view of Burial One's cranium.
B. Basilar view of Burial One's cranium.
portion of this bone exhibits three post-mortem cracks. The anterior portion of the zygomatic process is separated from the rest of the temporal and has been attached to the zygomatic bone in previous reconstruction efforts. The styloid process is missing.

The tubercles on the zygomatic processes which serve as the area of attachment for the external lateral ligament of the mandible, are large. The right supramastoid crest, extending from the superior border of the zygomatic posteriorly to above the external auditory meatus, is well defined by an elevated rounded ridge. The supramastoid crest on the left temporal is less developed. The mastoid processes are not prominent and taper almost to points. The auditory meati are oval in shape, the left is 9.0 by 7.0 mm, the right is 9.0 by 6.0 mm in diameter. There is no evidence of auditory exostosis.

Maxillae

The left maxillary is primarily intact, and is fused with the left zygomatic and inferior portion of the right maxillary, primarily the alveolar process and palate (Fig.3.3A,B). This bone is missing the nasal process, a portion of the orbital surface, maxillary tuberosity and posterior portion of the palatine process. Erosion of the bone has exposed the roots of the left central incisor, and portions of the roots of the premolars, and first and second molars.

The right maxillary is represented by most of the palatine and alveolar processes (Fig.3.3A,B). A separate piece consists of the anterior margin of the orbit and nasal process. A fragment of the posterior surface is glued to the right zygomatic. This fragment
Fig. 3.3A. Frontal view of Burial One's maxillae.
B. Superior view of Burial One's maxillae with odontome circled.
exhibits the posterior dental canals. The right maxillary is missing most of the facial and orbital surfaces. The posterior portion of the palate and alveolar process has fragmented and has been cemented by cave deposits in incorrect alignment. Erosion of the bone has exposed the roots of the right lateral incisor, canine and third premolar.

The two halves of the maxillae had been broken apart at the anterior nasal spine with the break paralleling the midpalatal suture on the right side. The maxillae display a nasal sill. The upper palate does not appear prognathic. The canine fossae on both right and left sides are very pronounced. The left maxillae displays an odontome in the palate process, adjacent to the nasal spine (see Fig.3.3B). The left infraorbital foramen is 3.0 mm in diameter. The right infraorbital foramen is missing.

Zygomatics

The left zygomatic is primarily intact and is fused to the left maxillary (see Fig.3.3A), with the very tip of the frontal process missing. There are two malar foramina. The right zygomatic is also primarily intact, with a fragment of the posterior surface of the right maxilla attached. There are three malar foramina on its external surface.

Across the mid-portion of the external surfaces of each bone there are well defined ridges which extend antero-posteriorly. These ridges indicate strong attachments for the zygomaticus major muscles.
Sphenoid

The sphenoid is represented by the middle portion of the body and fragments of both the left and right greater wings. This bone is missing the lesser wings, pterygoid and hamular processes.

Mandible

The mandible is essentially complete (Fig.3.4A,B), although exhibiting three post-mortem cracks. One splits the mandible at the mental symphysis, the second extends inferiorly from the left canine, and the third follows an oblique angle from the left third molar. A fragment from the medial side of the left condyle is missing as well as most of the surface of the right condyle. Some bone has been lost on the alveolar border, exposing portions of the roots of the first right molar, right premolars, canine, and incisors, and of the left incisors, canine and third premolar and first molar.

The body of the mandible is not robust, nor is the mental eminence particularly prominent. The chin is squared with medium protrusion. Internally, the genial tubercles are fused into two pairs. There are well defined mylo-hyoid grooves. The ridges for the insertion of the internal pterygoid muscles are also well defined.

Miscellaneous cranial bones

The ethmoid, nasals, lachrymals, vomer, palatines, and the inferior turbinated bones are missing or are too fragmented to have been identified.
Fig. 3.4A. Right lateral view of Burial One's mandible.
B. Left lateral view of Burial One's mandible.
Clavicles

The left and right clavicles are represented principally by their shafts. Enough of the medial end of the right clavicle is present though to see that the medial epiphysis had fused, leaving no remnant of an epiphyseal line.

The right clavicle is more robust than the left; the anterior border of the left clavicle near the lateral end being much more tapered and thinned than that of the right. The conoid tubercle on the left clavicle is also much less pronounced.

Vertebrae

The vertebral column is represented by innumerable fragments. The only major, and specifically identifiable pieces, consist of the odontoid process of the axis and the first and second thoracic vertebrae cemented together by cave deposits. The first vertebra displays an entire costal facet on the superior margin of the body and a demi facet on the inferior margin. The first vertebra has lost portions of the anterior surface of the body and most of the spinous and transverse processes. The second vertebra has a demi facet on the superior margin of the body and the suggestion of demi facets on the inferior margin. This vertebra too, has lost most of the transverse and spinous processes and a large portion off the anterior margin of the body. There is only slight lipping of bone on the edges of the vertebral bodies.

Ribs

The ribs are represented by 95 fragments; no one rib is complete,
most (66) cannot even be identified as to side. There are 14 fragments of left ribs, including a dorsal section of the first rib and one fragment of a vertebral end displaying two articular facets. The fact that this fragment has two articular facets only indicates that it could represent any one of the ribs from the third to the ninth.

There are 15 fragments of right ribs; one fragment comes from the medial section of the first rib, two vertebral ends display two articular facets, indicating a third to ninth rib, one vertebral end has only one articular facet indicating it represents either a tenth, eleventh, or twelfth rib, and one fragment has no tuberosity which suggests it's either an eleventh or twelfth rib.

Only two sternal ends were preserved. They each display sharp edges suggesting ossification of the cartilage (Ubelaker, 1978; İşcan et al., 1984).

**Innominates**

The innominates are represented by five identifiable fragments: a portion of the rim of one acetabulum; a fragment of the left ilium displaying the greater sciatic notch; a fragment of the right ilium with the anterior inferior iliac spine; and a fragment of the right ischium consisting of the anterior portion of the acetabulum, the lateral edge of the obturator foramen and the ischial tuberosity. The largest innominate fragment, a portion of the right ilium, exhibits the greater sciatic notch and the auricular surface for the sacrum (Fig.3.5A,B).
Fig. 3.5A. Sciatic notch of Burial One's right ilium.  
B. Auricular surface of Burial One's right ilium.
Sacrum

The sacrum is represented by several fragments. One consists of much of the promontory including the left articular facet for the last lumbar vertebra. A second fragment is much of the superior bone of the coccyx with cornua intact. There are also fragments of the medial sacral crest.

Scapulae

The left scapula is represented by most of the glenoid cavity, approximately 85.0 mm of the axillary border, and 50.0 mm of the spine and the acromian process. (The outer border of the acromian process however is missing.) The coracoid process is present as a separate piece. The fragment of the neck necessary to re-attach this piece properly to the rest of the scapula is missing. A fragment of bone has been identified as the base of the spine.

The right scapula is also represented by most of the glenoid cavity, approximately 100.0 mm of axillary border, a portion of the spine with the beginnings of the acromian process, and the coracoid process.

The left scapula has a pronounced roughened depression where the long head of the triceps muscle arises. The right scapula exhibits pronounced origins for the teres muscles along its axillary border. Both exhibit very minor bone deposition on the posterior edges of the glenoid cavities, it being more pronounced on the right scapulae.

Humeri

The left humerus is primarily intact (Fig.3.6A,B). The head of the
humerus had been detached but is cemented onto the shaft out of correct anatomical alignment by cave deposits. Much of the surgical neck area is missing as is much of the inferior portion of the lesser tuberosity. This humerus has a perforation, 8.0 mm in diameter, in the olecranon fossa.

The right humerus is essentially complete (Fig.3.6C,D). The greater tuberosity is missing as is compact bone in the region of the head and anatomical neck. On the distal end, the lateral epicondyle is missing as well as the lateral edge of the capitulum.

Both humeri have pronounced deltoid crests and well defined roughened ridges for the attachment of the pectoralis major muscles. The pectoralis major serves to adduct the arm. On the right humerus there is minor deposition of bone in the form of a ridge 1.0 by 10.0 mm running parallel to the shaft, on the anterior surface between the capitulum and the trochlea. The left humerus displays minor pitting, which had developed during the life of the individual, on this same surface between the capitulum and trochlea. This degeneration at the joint surfaces probably represents the beginnings of arthritic changes.

Radii

The left radius is primarily intact, although in pieces (Fig.3.7E). The right radius is complete (Fig.3.7A,B). Both of the radii have very pronounced interosseous crests, with the left being extremely pronounced. This suggests strong attachments for the flexor pollicis longus, which act to clenched the fingers. The bicipital tuberosity on the right radius is also pronounced. Its surface is roughened and
Fig. 3.6A. Anterior view of Burial One's left humerus.
B. Posterior view of Burial One's left humerus.
C. Anterior view of Burial One's right humerus.
D. Posterior view of Burial One's right humerus.
presents a depressed 11.0 by 1.0 mm groove. The surface of the left bicipital tuberosity is also roughened but it has a less defined groove.

Ulnae

The left ulna is fairly complete (Fig.3.7E); The right ulna is intact, missing only the styloid process (Fig.3.7C,D). The interosseous border on the left ulna is well defined, actually forming a slight cavity on the external border. The interosseous border on the right ulna is not as pronounced as that on the left. On the left ulna, there is some deposition of bone, forming a slight lip, at the middle, lower part part of the greater sigmoid (trochlear notch) cavity. The right ulna too, displays minor lipping of bone on the edges of the articular facets inside of the greater sigmoid notch. Such bone deposition is usually identified as arthritic lipping.

Carpals

The left scaphoid, lunate, trapezium and hamate are essentially complete; the other carpal are missing. The right carpals are represented by the scaphoid, pisiform, trapezium, trapezoid, capitate and hamate.

Metacarpals

The first left metacarpal is represented by only the head and distal end of the shaft. The right first metacarpal is essentially complete. The left second metacarpal is missing the head but the shaft and proximal end are primarily intact. The right second metacarpal is
Fig. 3.7A. Anterior/medial view of Burial One's right radius.
B. Posterior/lateral view of Burial One's right radius.
C. Medial view of Burial One's right ulna.
D. Lateral view of Burial One's right ulna.
E. Lateral view of Burial One's left radius and ulna.
essentially complete. The left third metacarpal is missing entirely; the right third metacarpal is missing the head and a section of the distal shaft. Both the left and right fourth metacarpals are fairly complete. The left fifth is represented by most of the shaft and proximal end. The head, which is missing minor sections, is present as a separate fragment. The right fifth metacarpal is missing the proximal end but retains the head and much of the distal end of the shaft.

**Hand phalanges**

The phalanges are represented by six intact proximal phalanges, five intact medial phalanges and one medial phalanx missing its proximal end, and five intact distal phalanges, including the first.

**Femora**

The left femur is represented by the shaft and a major portion of the head (Fig.3.8A,B). Aside from a break at midshaft, the shaft is fairly well preserved. The proximal end displays the most damage; the greater trochanter and neck are gone. The right femur is primarily intact though both the proximal and distal ends had been broken from the shaft (Fig.3.8C,D).

Both femora exhibit pronounced linea aspera and pectineal lines. The area beneath the lesser trochanter is very roughened suggesting strong attachments for the gluteus maximus, adductor magnus and adductor brevis. This area of attachment is also rough on the left femur but less so than the right. On the posterior surfaces of both the shafts, just superior to the medial condyle, the area where the gastrocnemius
Fig. 3.8A. Anterior view of Burial One's left femur.
B. Posterior view of Burial One's left femur.
C. Anterior view of Burial One's right femur.
D. Posterior view of Burial One's right femur.
attaches is elevated and rough. On both the right and left femoral heads, there are areas of slight erosion immediately superior to the fovea capitis. These areas of shallow pitting may be due to stress from the ligamentum teres. The left femur displays a third trochanter, oval in form. The corresponding surface on the right femur is missing.

Patellae

Both left and right patellas are present and primarily intact. Both patella display vastus fossae, small depressions on the superior/anterior and lateral surface.

Tibiae

The left tibia is primarily intact but missing most of the articular surface on the proximal end (Fig.3.9A,B). Present as separate pieces are fragments of the medial condyle and the posterior side of the proximal shaft immediately inferior to the articular surface of the medial condyle. The right tibia is represented by most of the shaft and the proximal end; most of the distal end is missing (Fig.3.9C,D).

A protuberance on the lower portion of the tubercle of the right tibia suggests a strong ligamentum patella. This protuberance on the left tibia is not as pronounced. The popliteal line on the right tibia presents a relatively wide (6.0 mm) and prominent ridge at its proximal end which extends for approximately 22.0 mm, then tapers and is not easily distinguished. On the left tibia, the popliteal line presents the reverse appearance. The line is not particularly prominent on the proximal end but forms a sharp ridge on the distal end. There is no
Fig. 3.9A. Anterior view of Burial One's left tibia.
B. Posterior view of Burial One's left tibia.
C. Anterior view of Burial One's right tibia.
D. Posterior view of Burial One's right tibia.
evidence of squatting facets.

Fibulae

The left fibula is represented only by the shaft. The right fibula is represented by roughly 50% of the proximal end and the shaft. The distal articular end is missing. Both fibulae display sharply defined interosseous ridges.

Tali

The left talus is primarily intact, missing bone on its lateral side including the facet for the lateral malleolus and the lateral section of the facet for the calcaneus. This talus has a double inferior anterior articular facet. The right talus is also primarily intact.

Naviculae

The left navicular is essentially complete; the right navicular is missing much of its medial side, including the tuberosity and portion of the facet for the first cuneiform.

Calcanei

The left calcaneus is represented by the anterior portion; the tuberosity of the calcaneus, containing the medial and lateral processes is missing. The anterior calcaneal facet is composed of two discrete facets. The right calcaneus is missing.
Cuboids

The left and right cuboid are primarily intact. The left cuboid appears to have a facet on its posterior medial edge for the navicular.

First (medial) cuneiforms

The left and right first cuneiforms are basically intact. The articular facets for the second cuneiform are not contiguous.

Second (intermediate) cuneiforms

The left second cuneiform is primarily complete, missing only cortical bone on the plantar edge. The articular facet for the first cuneiform does not appear contiguous, the "L-shape" is interrupted. The right second cuneiform is complete.

Third (lateral) cuneiforms

The left and right third cuneiforms are essentially complete. On the posterior margin of the dorsal surface of the left cuneiform there is a 3.0 by 3.0 by 3.0 mm hole which appears to have formed antemortem. This abnormal bone may have been caused by either mechanical stress or infection.

Metatarsals

The left first metatarsal is missing. The right first metatarsal is essentially complete. The left second metatarsal is represented by the shaft and tarsal extremity essentially intact, and the disarticulated head. The right second metatarsal is intact. Both the left and right
third and fourth metatarsals are primarily intact. The left fifth metatarsal is also intact; extra deposition of bone on the lateral and medial sides of the shaft indicates a healed fracture. The right fifth metatarsal is complete.

Foot phalanges

The phalanges of the foot are represented by five proximal (including first), two medial (probably a third and fourth), and two distal phalanges.

Dentition

All permanent teeth are present except for the ante-mortem losses of the right maxillary first incisor and distal halves of the mandibular first molars, and the post-mortem loss of the left maxillary second incisor (Fig.3.10A,B). The teeth all show heavy to severe attrition; only the left maxillary second and third molars and both mandibular third molars have any enamel remaining on their occlusal surfaces. The development of secondary dentine, however, has prevented the exposure of the pulp cavity in most cases. The heavy attrition has reduced the incisors to pegs. The canines appear oval and with the exception of the maxillary third premolars, the premolars also appear oval. Having worn down to near root level, these maxillary third premolars display a figure-8 shape. The molars, although generally reduced in size through wear, essentially retain their original quadrate and rhomboid shapes.

The attrition on the maxillary incisors, canines, and premolars is severe but basically even. The only exception to this is the right
Fig. 3.10A. Occlusal view of Burial One's maxillary dentition.
B. Occlusal view of Burial One's mandibular dentition.
maxillary fourth premolar which angles severely to the mesial side. The right maxillary second incisor, canine, and third premolar and the left canine, and third and fourth premolars extend only two to four mm beyond the alveolar bone (Fig. 3.11A). The mandibular incisors, canines, and premolars are also worn down to only two to five mm beyond the alveolar bone (Fig. 3.11B). Only the left mandibular fourth premolar displays an exposed pulp cavity. The occlusal surfaces of the left maxillary canine and left mandibular premolars are slightly concave. The occlusal surfaces of the mandibular incisors, canines, and third premolars, and the maxillary right canine, both left premolars and the right third premolar are convex. This "rounding" of the anterior mandibular teeth suggest their possible use as tools (Coon, 1966; Brace, 1975; Hinton, 1981).

The occlusal surfaces of the molars, both mandibular and maxillary, display more disparate shapes and degrees of attrition than the more uniform anterior teeth. The right maxillary first molar, though displaced post-mortem, presents an occlusal surface that slants strongly towards its buccal aspect. The right maxillary second molar appears to be represented only by root fragments. The right maxillary third molar shows relatively even wear but either heavy attrition or caries has exposed the pulp cavity on its lingual aspect.

The left maxillary first molar is intact and worn relatively evenly down to four mm beyond the alveolar bone. The left maxillary second molar is worn severely on its lingual side but does retain enamel on the mesial-buccal portion of its occlusal surface. The left maxillary third molar displays relatively even wear and retains a small section of
Fig. 3.11A. Lateral view of Burial One's maxillary dentition.
B. Lateral view of Burial One's mandibular dentition.
enamel on the distal lingual occlusal surface.

Both mandibular first molars are represented by only their medial halves. The severe attrition evident on these halves and the bone remodeling posterior to them suggests that these distal halves were lost ante-mortem, or were soon to be lost. These distal halves may be represented by two fragments of adult teeth recovered with the burial. The right second mandibular molar is worn severely and slants inferiorly towards its buccal aspect. The right third mandibular molar also presents an uneven occlusal surface, slanting distal-lingually. A relatively large portion of enamel (3 by 6 mm) remains on the mesial buccal section of the occlusal surface.

The left second mandibular molar is also worn severely, with an occlusal surface angling lingually. The pulp cavity is exposed on its distal-lingual aspect. The left third mandibular molar also slants severely towards the distal-lingual aspect. A chip is missing from the mesial side of this tooth. This appears to have occurred ante-mortem as the edges of the enamel are smoothed.

Due to the heavy attrition it is impossible to determine the presence or absence of various structural traits such as shovel-shaped incisors, Carabelli's cusp, or protostylids. The severe wear also prohibits assessment of molar cusp patterns.

In their present state, all of the teeth do not seem to occlude properly. Dahlberg (1963) though, noted that such imbalances of the occlusal surfaces are not unusual among American Indians. These imbalances reflect varying chewing patterns through an individual's lifespan. As severe attrition is common among hunter-gatherer groups
(Hinton, 1981), shifts to different chewing areas were probably necessitated as nerve endings were exposed in one area or the occluding partners lost. Such conditions would produce sequential changes in occlusal planes.

At the time of death, Burial One appears to have had only two, or possibly three, functional chewing surfaces. On the right side, the maxillary second incisor, canine, and premolars occlude with the mandibular canine, premolars, and the remnant first molar. On the left side, the maxillary first incisor occludes with both of the mandibular left incisors. A third possible chewing surface may have involved the left maxillary second molar and the mandibular second and third molars.

ESTIMATION OF SEX

Both metric and nonmetric observations indicate Burial One is male. The discrete skeletal features which suggest Burial One is male include heavy supraorbital ridges (see Fig.3.1A,C), blunt upper edges on the eye orbits, a square chin, and a well-developed musculature. The development of the nuchal crest is fairly strong, but muscle attachments are not so strongly defined as to positively indicate male (see Figs.3.1B; 3.2A). Post-mortem damage though, may have obscured a more pronounced development. The pelvic area which generally provides the most definitive sex estimations is fragmented and of little diagnostic value. Only the right greater sciatic notch is preserved and it is not particularly wide which would indicate female, nor particularly narrow (see Fig.3.5A) which would suggest male. The lack of a well-defined pre-auricular sulcus however, does support that Burial One
is male.

Measurements taken on the mandible, femora, and talus also point to a male estimation for Burial One. The gonial angle, formed by the junction of the body of the mandible and the ascending ramus, can be diagnostic of sex, with a gonial angle of less than 125 degrees generally considered a male characteristic (Krogman, 1962). Burial One's right gonial angle measures 124.5°. The midshaft circumference of the femur is also considered diagnostic of sex. The measurements of 86 mm for the right femur and 85 mm for the left, are in the male range as determined by Black (1978) for the sample from the Libben site in Ohio. Steele (1976) proposed that the maximum length of the talus can be used to estimate sex. The length of Burial One's right talus, 53.5 mm, and the length of the left talus, 52 mm, are both in the male range of a proto-Historic Arikara population examined by Steele.

At this point, a cautionary note must be introduced for each of these sex estimation methods are based on populations different than the population to which Burial One belonged. Black (1978) and Steele (1976) both warn that it is necessary to understand the degree of sexual dimorphism and the range of variation within the population that is being studied before estimating the sex of any one individual. As neither the range of variation or degree of sexual dimorphism within the Paleoindian population is known, it makes it difficult to state the sex of Burial One conclusively. However, as most of the skeletal observations do suggest male, Burial One is considered a male.

The archaeological context of Burial One does provide supporting evidence of this male estimation. The grave goods associated with
Burial One include two antler billets, presumably knapping tools, and another antler tool with a circular notch, suggested by Redder (1985) to be a shaft straightener.

ESTIMATION OF AGE

Burial One is a mature adult, apparently in his 30's to early 40's. This determination is based on several observations: the fusion of all epiphyses, eruption of the third molars and severe dental attrition, the degree of fusion of ectocranial sutures, and the beginnings of degenerative changes noted in both macroscopic and radiographic examination of this individual's bone.

The adult status is based initially upon complete fusion of all epiphyses and the eruption and attrition of the third molars. Such evidence indicates the formative years had ended and the individual had reached maturity. Generally, the medial epiphysis of the clavicle is the last to fuse, occurring between 25 and 30 years of age (Mckern and Stewart, 1957). From the remnant of the medial end of Burial One's right clavicle, it is clear that this epiphysis had fused completely, leaving no evidence of an epiphyseal line. Complete dentition and marked attrition also indicate Burial One was an adult. The third molars usually erupt around 18 years of age. Their presence and severe attrition in Burial One suggest this individual was, at the least, mature.

Once an individual has reached maturity, assigning a specific chronometric age on the basis of skeletal evidence has always been a difficult task. Recently Lovejoy et al. (1985a) presented a
multifactorial method that uses a principal components weighting of five separate age indicators. Results showed this method to be more accurate in estimating age than any single age indicator. This "summary age" method however requires the seriation of individuals by age within a skeletal population on the basis of each of those indicators. An intercorrelation matrix is then generated to assign weights to each of the age indicators. With only two individuals from the Horn Shelter population this method cannot be employed. In the aging of single individuals then, only the reported reliability of separate aging techniques can guide the investigator. The aging techniques presently available and of utility in this case are based upon the degree of cranial suture closure; age-dependent changes on the sternal extremities of the ribs and the auricular surface of the ilium; and the amount of cortical and trabecular bone loss in the proximal end of the femur and the clavicle.

Although the degree of cranial suture closure has been thought to be too unreliable in the estimation of age (McKern and Stewart, 1957), Meindl and Lovejoy (1985) have recently suggested that suture closure can provide "valuable" estimates of age at death when used in conjunction with other skeletal indicators. Their method is based on a scoring system (0-3) for the degree of closure at 10 specific sites on the cranium. They found the strongest correlation with chronological age at the sites of the pterion, sphenofrontal, midlambdoid, and lambdoid sutures. Meindl and Lovejoy did note, however, that these correlations were only moderate and required "that age estimates based upon them be accompanied by wide confidence intervals" (Meindl and
Lovejoy, 1985:60). Of the four points mentioned, only two, the midsphenoid and lambdoid are preserved on Burial One (see Fig.3.2A). There is significant closure at each of these points and at this degree of closure, Meindl and Lovejoy found mean ages of 46.8 with a standard deviation of 10.7 for the midsphenoid point, and a mean age of 45.2 with a standard deviation of 13.2 for the lambdoid point.

Meindl and Lovejoy (1985) did determine that a specific combination of five of the ten observation points on the cranium could predict age more accurately than any single observation. Of these five points however, only two were preserved on Burial One. Even with this system though, the range of ages reported for particular composite scores spanned 24 to 45 years. For example, with a composite score of 2, the mean age was 36.2 years, with a range of 25 to 49 years of age. With composite scores of 3, 4, or 5, the mean age was 41.1 years, with a range of 23 to 68 years of age. With such wide intervals, Meindl and Lovejoy were wise to caution that this aging method is not without risk. It is felt that the degree of suture closure on the cranium of Burial One can only generally corroborate a middle-aged adult status, placing this individual somewhere between his mid 30's to mid 50's.

A more promising aging technique is based upon age-dependent changes on the auricular surface of the ilium (Lovejoy et al., 1985b). Blind tests on samples with known ages suggest an error rate of only 3 to 7 years. Only one auricular surface, that of the right ilium, was preserved. The face of this surface is granulated with the beginnings of densification and slight microporosity apparent at the lower face (see Fig.3.5B). Based on Lovejoy et al., (1985b) such an appearance
suggests Burial One was in his mid to late 30's to early 40's at the time of death.

İşcan et al. (1984) have proposed an age determination method based on degenerative changes, the result of ossification of the cartilage, at the sternal extremities of ribs. They scored the ribs on three components, pit depth, pit shape and rim and wall configuration. The one complete rib extremity recovered from Burial One has a V-shaped pit, approximately 2.0 mm in depth, and has relatively thick and even walls. The composite score for these characteristics suggests a mean age of 22.5, with a 95% confidence interval between 17.2 and 27.8. The only other sternal rib end recovered is incomplete, having lost much of its rim. Pit depth is shallow, approximately 1.0 to 1.5 mm, suggesting a young age in the late teens or early 20's. The section of rim that does remain is thin and irregular suggesting an age in the late 20's through 30's, It is not possible to accurately assess pit shape. It should be noted that İşcan et al. (1984) did find pit depth to be a less accurate indicator of age than either of the other two components.

With this aging technique İşcan et al. (1984) cautioned that individual variation increased after the third decade and cited several other factors that might affect the remodeling of bone at the rib's extremity, including strenous physical activity and the position of the rib. They cited Semine and Damon (1975) as reporting that the first rib changes at a considerably faster rate than lower ribs. İşcan et al. (1984) based their method specifically on changes at the fourth rib. As it is impossible to identify which ribs are represented by the sternal ends recovered from Burial One, a source of error may have been
introduced. Additionally, Semine and Damon (1975) noted significant differences in the extent of costochondral ossification in different populations. This too could certainly introduce considerable error in the age estimation of Burial One as this aging technique was based on a sample of modern white males. At best then, evidence from the rib extremities can only provide tentative support for an adult in his 20's to 30's.

A final chronometric aging technique to be utilized in this study is based upon radiographic changes in clavicles and the proximal ends of femurs (Walker and Lovejoy, 1985). Specifically, Walker and Lovejoy (1985) examined the texture, density, and opacity of trabecular bone and the strength and opacity of the cortical bone. They demonstrated that the clavicle showed consistent changes with age and stated that age estimates based on this technique would be equivalent to "those of other major skeletal age indicators." (Walker and Lovejoy, 1985:74) The femur showed only an intermediate degree of regularity.

From an x-ray (Fig.3.12A) it can be seen that both of Burial One's clavicles are generally translucent, and showing some thinning of cortex bone at the lateral and sternal ends as well as an enlargement of the medullary cavity. It is difficult to assess the texture and density of trabeculae in the extremities as all have suffered some post-mortem damage. Overall Burial One's clavicles would appear to most closely resemble Walker and Lovejoy's phases 6 and 7, suggesting an age between 45 and 54. The reported average absolute error of age estimation on individuals between 31 and 40 was 7.5 years, on individuals between 41 and 50, 9.5 years, and on individuals between 51 and 60, the average
Fig. 3.12A. X-ray of Burial One's clavicles.
B. X-ray of Burial One's right femoral head.
C. Articular surfaces of Burial One's ulnae, with some arthritic lipping evident.
error was 2.3 years.

Only the proximal end of the right femur was sufficiently intact to be used in this radiographic examination (see Fig. 3.12B). The trabeculae of the head are somewhat coarse and the inferior portion of the head shows some loss of secondary trabeculae. Loss of trabeculae is also apparent in the medullary cavity, though Ward’s triangle retains some trabeculation. Combined, these characteristics suggest Walker and Lovejoy’s phases 4 and 5, which would indicate Burial One was between 35 and 44 years of age at the time of his death. The reported average rate of error for age estimation based on the femur was follows: between the ages of 31 and 40, the error rate was 8.1 years; between the ages of 41 and 50, the average error was 9.5, and between the ages of 51 and 60, the error rate averaged 4.3 years.

Other minor degenerative changes have also been noted on Burial One. There is minor bone deposition on the posterior edges of the glenoid cavities on the scapulae, at the articular margins on the proximal ends of the ulnae (see Fig. 3.12C), and a very slight amount of bone deposition on the anterior surface of the trochlear area on the left humerus. The right humerus exhibits a small area of pitting on this same surface. Such changes as these certainly mark the beginnings of biological degeneration, but there are as yet no methods to utilize such data in assessment of a chronological age.

The severe attrition apparent on all teeth of Burial One might suggest this individual had reached an advanced age in terms of chronological years. The rates of dental attrition however are known to vary between populations and severe attrition is a trait that is
characteristic of hunter-gatherer populations (Hinton, 1981). While
dental wear has been demonstrated to be a highly reliable age indicator
in skeletal populations, it requires a reasonably sized sample which
would allow seriation procedures to be utilized. In the Horn Shelter
sample, only two individuals were recovered. The Horn Shelter
subadult's dentition can however provide some indication of the
attrition rate in this population. From the examination of this child's
dentition it is clear that the Horn Shelter population had a relatively
fast rate of wear. The right mandibular first molar which had only been
in functional occlusion for approximately six years, had already lost
the enamel on the mesial/lingual cusp. The one remaining deciduous
tooth has little or no enamel left on its occlusal surface. This tooth
had probably been in functional occlusion for less than ten years. From
this evidence, the severe dental attrition noted on Burial One cannot be
used to argue for an advanced age.

There are other methods of aging that provide a more precise, or
specifically, a chronometric age. These include macroscopic examination
of the pubic symphysis (McKern and Stewart, 1957; Meindl et al., 1985),
the microscopic examination of histological structures in compact bone
(specifically, the number of osteons, osteon fragments, non-Haversian
canals and percentage of lamellar bone) (Kerley, 1965; Ahlqvist and
Damsten, 1969; Kerley and Ubelaker, 1978), and Gustafson's (1950) method
based on the microstructure of teeth. Each of these methods are based on
the premise that the observed changes in bone and teeth are age
dependent. None of these methods were employed however for reasons as
will be discussed.
Age estimates based on the macroscopic changes on the pubic symphyseal face can be accurate to within approximately 10 years. This method however could not be applied as post-mortem damage destroyed the necessary bones, the pubic symphyseal surfaces. The microscopic examination of compact bone structure or teeth, though accurate to within 6-10 years and 3.6 years respectively, were not employed because each of these methods requires the destruction of the material.

Age estimation based on the microstructure of bone is also considered to be of questionable value for two reasons. First, the rate of osteon formation apparently varies somewhat between populations (Dr. Douglas Ubelaker, personal communication, 1984). As Burial One is a single representative of a population with unknown parameters, this author deems it inappropriate to damage the long bones to obtain an age which would still be held in question. More fundamentally, the method itself has come into question. Lazenby (1984) not only criticized the difficulties in application (ie. questions on definitions as well as the field size), he also questioned the assumptions upon which this aging technique is based; namely, that 1) Haversian canal systems are distributed evenly throughout bone cortex, and 2) that the ratio of Haversian systems to the other microstructural elements, (whole and fragmentary osteons and non-Haversian canals), is constant and directly related to age. Lazenby cited recent evidence (Martin and Burr, 1982) which suggested that secondary osteons are a response to biomechanical stress within the cortex.

To summarize, the various aging techniques utilized in this analysis have offered diverse information on Burial One, suggesting ages from the
early 20's to the early 50's. Clearly however, some of the aging methods, e.g. cranial sutures, are more unreliable than the others and can only be used in conjunction with other skeletal age indicators. Additionally, the condition of some of the skeletal material used in these age assessments may have precluded more accurate estimates. Post-mortem damage on the clavicular ends destroyed considerable cortical and trabecular bone. In the light of such factors as these, the age suggested by the appearance of the auricular surface of the ilium, that of mid 30's to early 40's, is considered to be the best estimate of Burial One's age.

ESTIMATION OF STATURE

Stature estimation from skeletal remains are based on the fact that body height can be correlated with the lengths of the long bones. The proportions of the long bone's lengths to stature is known to vary between populations and separate formulae have been calculated for several major populations. As the specific population of Burial One is unknown, stature estimations are based on formulae for Mesoamerican males (Genovés, 1967a) and Mongoloid males (Trotter and Gleser, 1958), the two populations thought to most closely approximate the population of Burial One.

The lower limb bones, the femur, tibia, and fibula, show the best correlation with stature. Of the lower limbs recovered for Burial One though, only the right femur was sufficiently intact to measure its maximum length, of 43.6 cm. The Genovés (1967a) formula for Mesoamerican males, 2.26 (Femur) + 66.379 3.417, provided a stature
estimation of 162.415 3.417 cm, after subtracting 2.5 cm as suggested by Genovés to obtain a more accurate measure of living stature. The Trotter and Gleser (1958) formula for Mongoloid males, 2.15 (Femur) + 72.57 3.8 cm, provided a greater estimate of 166.31 3.8 cm. Based on these formulae, the Horn Shelter adult was probably between 162 and 166 cm in height. This estimate though can only be taken as an approximation of true stature since the Horn adult was not a member of the populations on which these stature estimations were based.

INFERENCES ON HEALTH

Introduction

Statements on the health of prehistoric peoples are necessarily incomplete. Most illnesses or nutritional deficiencies do not progress so far as to affect the skeleton. Paleopathologists must also contend with the fact that those pathological conditions that do affect bone do so in a similar manner.

All abnormal conditions of bone can be placed in one of the following general categories reflecting bone cell activity: (1) abnormal bone loss, (2) abnormal bone gain, (3) a combination of abnormal bone loss and abnormal bone gain, and (4) normal activity of bone but abnormal shape or contour. (Ortner and Putschar, 1981:36-37).

The exact cause of a particular pathological state then, cannot often be determined as numerous diseases and dietary deficiencies can result in the same type of condition.

Ubelaker (1978) cautioned that diagnosis of paleopathological conditions should be reserved to the few persons qualified to make them; he noted that these few did not include all pathologists and "certainly
not all physical anthropologists" (Ubelaker, 1978: 77). Despite the
aforementioned limitations of paleopathology, and perhaps those that
practice it, general inferences on an individual's health history can be
made through cautious, if understated analysis. The skeletal analysis
of Burial One suggests episodes of both past stress and trauma, but no
cause of death.

Skeletal evidence

Transverse, or Harris lines, are visible on x-rays of Burial One's
long bones, specifically, the femora and tibia (Fig.3.13). Radiopaque
transverse lines consist of horizontally arranged bone extending across
the marrow cavity of the long bones, most frequently on the distal end
of the tibiae (Garn et al., 1968). Research has demonstrated that these
lines represent periods of increased or renewed growth following a
period of interrupted growth during an individual's developmental years.
During such a interruption of growth, mineralization continues (at the
junction of the growth cartilage and the metaphysis), so that when
growth does resume a line of increased mineralization is left behind.

Both disease and nutritional deficiencies are known to cause tranverse lines (Garn et al., 1968; Hummert and Van Gerven, 1985) and
consequently no specific agent is determinable for the transverse lines
noted in Burial One. The transverse lines apparent suggest only some
degree of stress in Burial One's sub-adult years.

The platymeric femora and the plathymeric tibiae may also provide
information on Burial One's general health. Buxton (1938) suggested
long bone flattening was due to a deficiency of bone in relation to the
Fig. 3.13. X-ray of Burial One's tibia showing transverse lines.
area needed for muscle attachments. Angel (1966) related this same flattening to a general economy of bone, which he described as typical in hunting populations with "just adequate" diets. A just adequate diet would be consistent with the conditions favorable in producing transverse lines. Hrdlička (1938) however noted that long bone flattening was more pronounced in Indian populations than in either white or blacks, and hypothesized that this was "partly of racial, partly of functional significance" (Hrdlička, 1938:185). Platycnemia and platymeria have been noted to occur more frequently in earlier man and modern primitive groups (Brothwell, 1981).

There is evidence of past traumatic injury to Burial One. Heavy deposition of bone on both the lateral and medial sides of the left fifth metatarsal indicate a healed fracture (Fig.3.14A). This was confirmed by x-ray analysis. The fracture runs diagonally across the shaft and though the two halves of the shaft appear to be somewhat misaligned laterally and medially, the overall alignment in the dorsal/plantar aspect is good. The compactness of the bone forming the callus suggests the healing of the fracture was complete. This healing process though was probably complicated by infection as evidenced by a pronounced cloaca in the callus on the lateral side. This fracture may have contributed to the shortening of the left metatarsal. The left metatarsal measured 64.5 mm as compared to the right which measured 67.0 mm.

Additionally on the left foot, there is abnormal pitting and deposition of bone on the dorsal surfaces of the third cuneiform and the navicular where these two bones articulate. (Fig.3.14B). This abnormal
Fig. 3.14A. Healed fracture on Burial One's left fifth metatarsal.
B. Abnormal pitting and deposition of bone on Burial One's left third cuneiform and navicular.
bone growth may have been caused by either infection or mechanical stress. As bone reacts to abnormal conditions by only increased deposition and/or increased absorption, it is difficult to pinpoint causes. The condition of the cuneiform and navicular then may or may not be related to the fractured metatarsal on the same foot.

Dental evidence

The dentition of Burial One is relatively free of caries. Only one possible caries, on the right third maxillary molar, was noted. Ante-mortem losses of the right central maxillary incisor and the distal halves of the mandibular first molars were most likely due to severe attrition which led to the exposure of the pulp cavities. The remodeled bone in the alveolus surrounding the left second mandibular molar suggests the loss of this tooth was also forthcoming prior to Burial One's death. The severe attrition and lack of caries is consistent with dentition studies from hunter-gatherer populations (Hinton, 1981).

In the left maxillary sinus there is abnormal bone growth which appears as a porous plating. This abnormal growth may be connected to an apparent abscess on the root of the left first maxillary molar which has opened into the sinus cavity. Finally, a small area of alveolar bone on the lingual side of the right mandibular second molar is marked by the deposition of infectious periosteal bone (see Fig.3.4B). Due to the severe attrition which has removed much of the enamel borders of the teeth, it is not possible to examine Burial One for evidence of dental hypoplasia. This condition would have been a corroborating indication of childhood stress.
CHAPTER IV

DESCRIPTION AND ANALYSIS OF BURIAL TWO

INTRODUCTION

This chapter follows the general format established in Chapter III. Each bone is described, noting the extent of post-mortem damage and the appearance of discrete traits and areas of muscle attachments. Generally, the bones of the Burial Two, a subadult, were less well preserved than those of Burial One. None of the long bones were sufficiently intact to measure. The description of the bones is followed by an examination of this child's dentition, and estimations of sex, age, and health status.

INVENTORY AND DESCRIPTION OF THE SKELETAL REMAINS

Frontal

The frontal is badly fragmented making reconstruction difficult. The left side has been pushed both posteriorly and medially (Fig.4.1A,B,C). The superior margin of the left orbit lies inferior and posterior to that of the right. Most of the orbital plates are missing.

Each orbit displays supraorbital notches and foramina. The foramina above the left orbit is larger. Due to the age of this individual, it is difficult to assess the development of the browridges. Breakage also makes it difficult to assess development of the frontal eminences. There is no evidence of a metopic suture.
Fig. 4.1A. Frontal view of Burial Two's cranium.
B. Superior view of Burial Two's cranium.
C. Left lateral view of Burial Two's cranium.
Parietals

The left parietal is fragmented, missing fragments from both the anterior and posterior portions (see Fig. 4.1C). The entire bone has been pushed posteriorly, the left parietal eminence lying posterior to that of the right.

The right parietal is also fragmented but less so than the left. This bone has been pushed forward so that its anterior margin underlies the frontal bone for a few millimeters (Fig. 4.2C).

Despite the breakage, the parietal eminences are still visible on both parietals.

Occipital

The occipital is fragmented with much of the basilar portion anterior to the foramen magnum missing (Fig. 4.2A,B). Generally, the entire bone has been pushed anteriorly on its right side. The external occipital protuberance is roughened but post-mortem breakage and the young age of the individual makes it difficult to assess its degree of development.

Temporals

The left temporal is in a fragmented state. Sections of the squamous portion are missing as are the anterior segment of the zygomatic process and the styloid process (see Fig. 4.1C).

The right temporal is primarily intact, only the styloid process is missing (Fig. 4.2C). Gaps at the anterior superior border suggest it had not completely fused to the parietal. It is difficult to assess whether
Fig. 4.2A. Posterior view of Burial Two's cranium.
B. Basilar view of Burial Two's cranium.
C. Right lateral view of Burial Two's cranium.
or not the temporal had fused to the greater wing of the sphenoid for the articular edge of the sphenoid appears to have been glued to the temporal during the preliminary conservation efforts.

The supramastoid crests are not developed. The mastoid process on the right is visibly larger than that of the left; the right mastoid process extends 8.0 mm inferiorly from the digastric groove, the left extends only 5.0 mm. The auditory meati are oval in shape. The left is 6.0 mm by 5.0 mm and the right is 7.0 mm by 5.0 mm. There is no evidence of auditory exostoses in either ear.

Maxillae

The left maxillary is represented by only the alveolar process, the very base of the zygomatic process and the lateral margin of the palate process (Fig.4.3A).

The right maxillary is also represented by the alveolar process, base of the zygomatic process and the lateral portion of the palate process (Fig.4.3B). The alveolar bone on the external surface for the first and second incisors and canine is completely gone, The teeth are now held together by glue applied during the preliminary conservation efforts of Redder and Watt. The alveolar bone is fragmented above the premolars and the first molar.

The two halves of the maxillae had been split roughly at the midpalatal suture, though both of the central incisors are glued to the right maxillary. On the right maxillary there is no noticeable canine fossa; missing bone on the left maxillary makes assessment of such impossible. The right infraorbital foramen is 3.0 mm in diameter. The
Fig. 4.3A. Left lateral view of Burial Two's maxillae.
B. Right lateral view of Burial Two's maxillae.
left infraorbital foramen is missing.

Zygomatics

The left zygomatic is missing. The right zygomatic is fragmented, missing much of the orbital and maxillary processes.

Sphenoid

The sphenoid is represented by only the articular margin of the right greater wing.

Mandible

The mandible is essentially complete, though exhibiting post-mortem breaks and erosion (Fig. 4.4A,B). Missing are the tips of the left coronoid process and the lateral segment of the left condyle. The mandible displays two small genial tubercles. The internal surfaces of the mandible are smooth, exhibiting no ridges for attachment of the internal pterygoids. The mylohyoid groove on the right side is not well defined; this area on the left is too fragmented to make an assessment.

Miscellaneous cranial bones

The ethmoid, vomer, lacrimals, palatines, hyoid, and inferior turbinated bones are missing, or are too fragmented to be identified. The superior portion of the left nasal bone is attached to the frontal.

Clavicles

The left clavicle is primarily intact, missing only the margins of
Fig. 4.4A. Left lateral view of Burial Two's mandible.
B. Right lateral view of Burial Two's mandible.
the sternal end and the majority of the articular surface of the acromial end. The only articular surface remaining on the acromial end is on the anterior border. The right clavicle is represented by only a 40.0 mm section of the acromial end; the articular surface of this end though is missing.

The conoid tubercles are not developed on either of the clavicles.

Vertebrae and ribs

The vertebrae are represented primarily by small fragments of the bodies or transverse processes. The only identifiable pieces are a fragment of the atlas with the superior articular surfaces, the axis, including the odontoid process, and the third cervical vertebra which is cemented by cave deposits to the axis. The ribs are represented by numerous fragments.

Innominates

The innominate are represented by four major fragments. There is a fragment of the left ilium which displays the greater sciatic notch, most of the acetabulum, and a section of the auricular surface. A roughened area at the anterior inferior iliac spine indicates the epiphyses had not yet fused. A large fragment of the right ilium also exhibits the greater sciatic notch. A third fragment consists of a segment of the right ischium, including the lateral edge of the obturator foramen and the acetabular notch. The fourth identifiable fragment is a 29.0 mm segment of the left pubic symphysis.
Scapulae

Both the left and the right scapulae are represented only by the base of the spine to the acromion process.

Humeri

The left humerus is represented by two fragments (Fig. 4.5A, B). The more proximal section (75.0 mm in length) displays a portion of the bicipital groove. The second fragment is 121.0 mm in length and includes much of the distal end. The coronoid, radial, and olecranon fossae are essentially complete. Though most of the cortical bone on the distal articular surface is gone, there is a small section of the articular surface remaining. Its roughened appearance indicates the distal epiphysis had not yet fused. The right humerus is represented by 187.0 mm of the shaft, including the superior margin of the olecranon fossa.

Both humeri exhibit shallow bicipital grooves. The right humerus shows very minor development of the deltoid crest. In contrast to the smooth surrounding bone, the bone in the area of the deltoid crest is slightly roughened. There are three perforations in the left olecranon fossa (Fig. 4.5A, B). The smooth edges suggest these perforations formed ante-mortem.

Radii

The left radius is represented by a 81.0 mm fragment of the shaft. This section of the shaft is from the proximal end and contains the nutrient foramen about midpoint on the piece.
Fig. 4.5A. Anterior view of Burial Two's left humerus.
B. Posterior view of Burial Two's left humerus.
C. Medial view of Burial Two's right ulna and radius.
The right radius is represented by much of the proximal end and most of the shaft (144.0 mm total length). The fragment of articular surface remaining on the head suggests the proximal epiphysis had not yet fused. There are two repaired breaks in the shaft. This bone is cemented by cave deposits to the right ulna (see Fig. 4.5C).

The tuberosity on the right radius is not strongly developed, nor is the interosseous border on either the left or right radius.

Ulnae

The left ulna is represented by 125.0 mm of the shaft. The right ulna is represented by 125.0 mm of shaft (see Fig. 4.5C). Neither of the ulnae display any strongly marked features.

Carpals

The only identifiable carpals are the left scaphoid, the right scaphoid, the right lunate, and the right trapezium. These are all intact.

Hand phalanges

There are portions of seven proximal phalanges and one proximal phalanx that is intact. There are four medial phalanges; two are intact, the others are missing minor sections of bone of the extremeties. The distal phalanges are represented by five intact bones, including a first distal phalanx.
Femora

The left femur is represented by most of the shaft and the neck (Fig.4.6A,B). The total length of the fragment is 285.0 mm. The unfused epiphysis for the head is also present. The area of the intertrochanteric crest is missing as well as much of the bone on the proximal aspect of the neck. The distal end of the shaft is also badly fragmented.

The right femur is represented by 267.0 mm of the shaft (Fig.4.6C,D), and in a separate piece, 48.0 mm of the neck and epiphysis for the head (Fig.4.6E). This epiphysis is cemented by cave deposits to the neck. Most of the intertrochanteric crest area is gone. Of what remains, a remnant surface on the greater trochanter, indicates the epiphysis had not yet fused. Additionally, the femora are represented by an unsided fragment of a distal epiphysis.

In the area of the gluteal ridge, both the left and right femora display linear depressions. The linea aspera appear only as slight ridges.

Tibiae

The left tibia is represented by 232.0 mm of the shaft (Fig.4.7A,B) and the unfused distal epiphysis (Fig.4.7E). The distal end of the shaft had been fragmented. Two unidentified pieces of cancellous bone are cemented by cave deposits to the posterior surface of the shaft at approximately mid point.

The right tibia is represented by 248.0 mm of the shaft (Fig.4.7C,D) and the unfused distal epiphysis (Fig.4.7E). There appears to be rodent
Fig. 4.6A. Anterior view of Burial Two's left femur.
B. Posterior view of Burial Two's left femur.
C. Anterior view of Burial Two's right femur.
D. Posterior view of Burial Two's right femur.
E. Burial Two's femoral head epiphysis cemented by cave deposits to femoral neck.
Fig. 4.7A. Anterior view of Burial Two's left tibia.
B. Posterior view of Burial Two's left tibia.
C. Anterior view of Burial Two's right tibia.
D. Posterior view of Burial Two's right tibia.
E. Distal end epiphyses for Burial Two's tibiae.
gnawing on the anterior surface of the shaft, just below the tibial tuberosity.

The popliteal lines take the form of slightly roughened depressions on both tibiae.

**Fibulae**

The left fibula is represented by 238.0 mm of the shaft including the distal articular end. Its roughened appearance indicates that the distal epiphysis had not yet fused.

The right fibula is also represented by 238.0 mm of the shaft including the distal articular end. This surface too indicates that the distal epiphysis had not fused.

**Tali**

The left talus is represented by one fragment consisting of the head and neck. Only portions of the middle and anterior calcanean articular surfaces remain. Much of the cortical bone on the head is lost. The right talus is primarily intact, but is missing much of the interior surface of the head.

**Naviculae**

The left navicular is essentially intact but missing much of its dorsal margin, including the tuberosity and portions of the facet for the internal cuneiform. The right navicular is also primarily intact but is missing the medial/dorsal margins. Only a small section of the facet for the internal cuneiform remains.
Calcanei

The left calcaneus is missing. The right calcaneus is represented by only the anterior portion, including the anterior, middle, and most of the posterior facets for the talus.

First (medial) cuneiform

The left first cuneiform is primarily intact. The proximal epiphysis of the first metatarsal is cemented by cave deposits to the cuneiform's distal side. The right first cuneiform is missing. It may be represented by a fragment of bone attached by cave deposits to the first right metatarsal's distal epiphysis.

Second (intermediate) cuneiform

The left second cuneiform is primarily intact. The right second cuneiform is missing.

Third (lateral) cuneiform

Both left and right third cuneiforms are represented by major portions of the bone. The left is missing much of the plantar and medial surfaces. The right third cuneiform is missing much of its medial surface.

Metatarsals

The left first metatarsal is represented by most of the head and very distal end of the shaft. The epiphyseal line for the head is still
visible. The right first metatarsal is primarily intact, missing only fragments from the head. The proximal epiphysis of the metatarsal is attached by cave deposits to the proximal end of the shaft. The left second metatarsal is essentially complete. The head though had not yet fused. The second metatarsal is missing. The left third metatarsal is represented by the proximal extremity and most of the shaft. The right third metatarsal is essentially complete. The left fourth metatarsal is primarily intact, missing the distal end of the shaft. The right fourth metatarsal is complete. The distal articular surface indicates the head had not yet fused. Both the left and right fifth metatarsals are represented by most of their shafts and proximal ends.

Foot phalanges

The foot phalanges are represented by seven proximal phalanges, (including both first proximals), and four medial phalanges.

Epiphyses

Twenty epiphyses were also recovered but they cannot be identified to bone or side.

Dentition

With the exception of the left maxillary fourth premolar and all third molars, the permanent dentition are erupted and are in occlusion (Fig.4.8A,B; Fig.4.9A,B,C). (The left maxillary central incisor and the mandibular right central incisor were recovered but are disarticulated.) Only one remaining deciduous tooth, the left maxillary second molar
Fig. 4.8A. Occlusal view of Burial Two's maxillary dentition. B. Occlusal view of Burial Two's mandibular dentition.
Fig. 4.9A. Left lateral view of Burial Two's maxillary dentition.
B. Right lateral view of Burial Two's maxillary dentition.
C. X-ray of Burial Two's maxillary dentition.
remains, death having occurred just prior to its evulsion.

The only tooth that displays heavy attrition is the remaining deciduous molar. Its occlusal surface is concave, worn down to secondary dentine over much of this surface. Only the mesial buccal portion retains any enamel. The permanent incisors, canines, and premolars display only slight wear facets. The occlusal surfaces of the first molars, exhibiting considerably more wear however, have lost much of their cusp definition. On the mandibular molars, attrition had progressed to the extent of exposing isolated spots of dentine. The second molars, in functional occlusion for a shorter period of time, show much less wear. The maxillary second molars exhibit only slight wear facets across their mesial-lingual cusps. Attrition is more evident on the mandibular second molars; all cusps are diminished and rounded.

The central maxillary incisors exhibit only a trace of shoveling as defined by a limited lingual extension of their lateral borders (see Fig. 4.8A). None of the lower incisors are shoveled. The maxillary first molars display Carabelli's pits (as defined by Kraus, 1951) on the anterior portion of their lingual surfaces.

Due to the attrition on some of the molars, it is difficult to evaluate the patterns of cusps and grooves. Tentative assessments though (following Dahlberg, 1951) have been made. The maxillary first molars have four cusps, and though the grooves are partially obliterated, the size of the hypocones suggest a classification of 4. The left maxillary second molar does not have a hypocone and is considered a 3. The right second upper molar, possessing a small hypocone, is classified as a 3+.
The mandibular first molars each have five cusps, but due to attrition, the groove patterns are not clear. The left first mandibular appears to exhibit a Y-5 pattern and the right exhibits a +5. These same patterns though are clearly repeated in the mandibular second molars; the left second molar has a Y-5 pattern and the right second displays a +5 pattern.

ESTIMATION OF AGE

Introduction

Estimating the age of a subadult skeleton allows for far more precision than estimating the age of an adult. Though recognizing both inter- and intra-population variation, the development of dentition and the appearance and fusion of ephiphyses are relatively dependable indicators of a chronological age. Burial Two is estimated to be approximately 12 years of age at the time of death. This age estimation is based primarily on dental calcification, eruption, and evidence of occlusion, and the lack of ephiphyseal fusion on the post-cranial material.

Dental evidence

At the time of death, Burial Two had a complete set of permanent dentition, with the exceptions of the left maxillary fourth premolar and all of the third molars. Only one deciduous tooth, the left maxillary second molar, is still in place, the emerging left fourth premolar though, is clearly visible. This individual died just prior to the evulsion of the deciduous molar. All three of the other premolars had
erupted previously and display slight wear facets. Premolars generally erupt during the tenth and eleventh years (Dahlberg and Menegaz-Bock, 1958) and are fully occluded by approximately the twelfth year (12 years + 30 months) (Ubelaker, 1978).

All second permanent molars had erupted, and judging by the very slight wear facets on the second maxillary molars, the second molars were just beginning to occlude prior to Burial Two's death. Research has demonstrated that the second molars generally erupt between the eleventh and twelfth year of an individual's life (Dahlberg and Menegaz-Bock, 1958; Moorrees et al., 1963; Ubelaker, 1978), and are in full functional occlusion at approximately 15 years of age (15 years 30 months) (Ubelaker, 1978).

Anderson et al. (1976) suggested that in assessing chronological ages, estimates based on tooth mineralization stages are preferable to estimates based on tooth emergence, because mineralization (or calcification), is less affected by local environments. Several studies (Garn et al., 1959; Moorrees et al., 1963; and Anderson et al., 1976) have provided data on the stages of crown and root development in children of known ages. To assist in establishing the age of Burial Two then, x-rays were taken of both the maxillae and mandible to assess root length and root closure of the erupted teeth and the degree of calcification of the third molars.

The x-rays of Burial Two's dentition support the age estimation of about 12 years. The root lengths of all the permanent teeth appear complete, with the exceptions of the second and third molars. The root lengths of the second molars appear to be approximately 3/4 complete;
the third molars are represented by unerupted crowns, approximately 3/4 developed as illustrated by Moorrees et al. (1963) (see Fig. 4.9C). Moorrees et al. (1963) presented data from a modern U.S. population, indicating that by the twelfth year, mature root length was achieved on all permanent teeth with the exception of the third molars; by the twelfth year, the third molars had completed crowns, but no roots. Garn et al. (1959) who studied the variability in tooth formation in a U.S. white population, found that crown completion on the third molars occurred between the ages of 12 and 17.1 years.

There is evidence that does suggest that the median ages of permanent tooth emergence differs between populations. Dalhberg and Menegaz-Bock (1958) observed a relatively late eruption of the Pima Indian anterior teeth and a relatively early eruption of the Pima posterior teeth when compared with English children. Despite population differences however, it is felt that this estimate of 12 years is the most accurate estimate presently available.

Post-cranial evidence

Subadult post-cranial skeletal material can also provide an estimation of age. These estimates are based on the size and fusion of epiphyses, and the lengths of the long bones. The lack of any epiphyseal fusion, even just the initial stages of union, suggests this individual was less than 14 years of age.

Though growth rates do vary between populations and individuals, the lengths of long bones can also be used to estimate an individual skeleton's age. Ubelaker (1978) compiled published data on sub-adult
long bone lengths from Archaic period skeletons from Indian Knoll, Kentucky, Late Woodland skeletons from Illinois, proto-historic Arikara and modern Eskimos, and from this data constructed general growth curves.

Only four of Burial Two's long bones, the left femur, right humerus, right tibia, left fibula were complete enough to estimate their maximum length. Their estimated maximum lengths and ages based on these lengths for the Arikara, Indian Knoll, Eskimo, and Late Woodland populations are presented in Table 4.1.

<table>
<thead>
<tr>
<th>Bone</th>
<th>Est. Max. Length</th>
<th>Arikara</th>
<th>Indian Knoll</th>
<th>Eskimo</th>
<th>Late Woodland</th>
</tr>
</thead>
<tbody>
<tr>
<td>l. femur</td>
<td>280 mm</td>
<td>7-8</td>
<td>8-9</td>
<td>10-11</td>
<td>12</td>
</tr>
<tr>
<td>r. humerus</td>
<td>200 mm</td>
<td>7-8</td>
<td>8-9</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>r. tibia</td>
<td>250 mm</td>
<td>8-9</td>
<td>10</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>l. fibula</td>
<td>240 mm</td>
<td>7-8</td>
<td>9-10</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

These age estimates, based on data from four populations different from that of Horn Shelter, range from 7 to 12 years of age. As would be expected, there is consistency with estimates from within single populations; but only the age estimate based on the Late Woodland femur length is close to the age estimate for Burial Two based on dentition. As Burial Two's population is not represented, and further, as post-cranial maturation is affected far greater by environmental factors than is the development of dentition, the estimate of 12 years is thought to be the more accurate estimate of chronological age.
ESTIMATION OF SEX

Estimating the sex of subadult skeletal material has generally been considered unreliable as the morphological characteristics distinctive of gender are not fully expressed until after puberty. But though assigning sex to subadult skeletal material is not without risk, it is hypothesized that Burial Two was male.

Skeletal sex differences have been observed as early as the fetal stage (Boucher, 1957; Weaver, 1980). Weaver (1980) using a non-metric trait, the elevation of the ilium's auricular surface, achieved a 91% accuracy rate in sexing male fetal and six month age groups. He also calculated indices based on ilium width, height, and length, and the sciatic notch. While he found no significant differences with these, Weaver did claim his results followed sex differences diagnostic in adults. He concluded that his study suggested "the determination of sex of infant skeletal remains may eventually be based on criteria which are very similar to those widely used in sexing adult skeletal material" (Weaver, 1980:195).

Using this hypothesis that sexual differences are apparent and diagnostic in subadult material, Burial Two's pelvic and cranial features were examined. The sciatic notches are relatively narrow and the auricular surfaces do not appear elevated (Fig.4.10A,B). Additionally, the mastoid processes are relatively large (see Fig.4.2C), and there is some development of the browridges. All of these traits would suggest male.

One of the more successful methods at establishing the sex of subadults was devised by Hunt and Gleiser (1955). Their method is based
Fig. 4.10A. Sciatic notch of Burial Two's left ilium.
B. Sciatic notch of Burial Two's right ilium.
on the fact that sexual dimorphism is generally more apparent in post-cranial material than in dentition; the post-cranial skeletons of males generally mature more slowly than females. An estimate of sex can then be made by comparing an individual's dental development with post-cranial development. Hunt and Gleiser (1955), utilizing dental and skeletal x-rays of living children, achieved an accuracy rate of 73% with children of two years of age, 76% with five year olds, and were 81% accurate with children of eight years of age. By looking at this difference between skeletal age and dental age, Sundick (1977) was able to accurately assess the sex of 300 subadults from the age of approximately 12 onwards. "Males in all instances were less mature skeletally than the females of the same dental age" (Sundick, 1977:142). As the post-cranial evidence suggests a considerably younger age than the dentition, this argument also suggests Burial Two was male.

INFERENCES ON HEALTH

No cause of death could be determined for Burial Two. There is no evidence of past traumatic injury on Burial Two. In the right maxillary sinus there is some plating of bone which suggests a minor infection. The post-mortem damage to the long bones excludes any examination for transverse lines.

The dental health of Burial Two was good. There were neither caries, infections in the alveolar borders, nor evidence of dental hypoplasia. The marked dentition on the one remaining deciduous tooth does suggest a relatively harsh diet.
CHAPTER V

A HISTORY OF PALEOINDIAN SKELETAL DISCOVERIES IN NORTH AMERICA

INTRODUCTION

The Horn Shelter skeletal material, representing only two individuals, warrants an in depth analysis due to the scarcity of Paleoindian skeletal remains in North America. Though discoveries of alleged ancient or Paleoindian skeletal material date back to the early nineteenth century, the present sample of authenticated human skeletal remains that are at least 8,000 years old is both small and controversial. The early finds predated the advent of radiocarbon dating and researchers necessarily used geologic context, association, and in some instances "morphological dating" (Stewart, 1949) to assess the age of skeletal remains. Some of these discoveries, as will be discussed, remain in doubt today due to different interpretations of the skeletons' proveniences.

The acceptance of these early discoveries as Paleoindian skeletal material was also problematic in that there was no general acceptance of even a Paleoindian presence in the New World until the late 1930's. At the close of the nineteenth century and the beginning of the twentieth, the early man debate seemed irreconcilable. There were two major theories on the prehistory of the New World; those that believed there was no significant prehistory, and those that argued for an American Paleolithic. There was simply no agreement on the definition of antiquity; it had yet to be determined if the human record in the New World was different from that in the Old World. (For a full account of
this debate see Meltzer, 1983).

Between 1840 and 1940 there were numerous discoveries of reportedly ancient human skeletal remains, but Aleš Hrdlička, a man of immeasurable influence in American physical anthropology, summarily rejected their claims to antiquity. Hrdlička, to his credit, insisted upon sound geological context, but additionally he assumed that older skeletal material should look more primitive. He refuted many claims of ancient skeletal material based on the fact that these skeletal remains fell within the range of variation of historic Indian groups. In 1907 he published "Skeletal Remains Suggesting or Attributed to Early Man in North America". This monograph provided both detailed descriptions of 14 skeletons discovered in the latter half of the nineteenth century and the conclusion that none offered proof of early Americans. In a second monograph in 1912, Hrdlička dismissed the alleged Paleoindian material in South America. A third paper published in 1918, followed the same tone and attacked the reported antiquity of skeletal remains in Peru, California, and Florida.

The discovery of the Folsom site in 1926 played a critical role in the debate on the antiquity of man in the New World. The clear association of artifacts with extinct bison indicated a far greater antiquity for man in the New World than had been previously thought. By the 1930's more and more researchers accepted the presence of Paleoindian in North America, but Hrdlička remained unconvinced. At the International Symposium on Early Man held in Philadelphia in 1937, Hrdlička reviewed the skeletal remains recovered since 1918 that were suggested to be of Paleoindian age. He again concluded that on the
basis of skeletal evidence, there was nothing to justify the assumption of any great geological antiquity (Hrdlička, 1937:104).

Ironically, though the presence of Paleoindian in the New World is now accepted as fact, time has proven Hrdlička correct on his repudiation of most of the early finds he examined. What was lacking then as now were abundant, well-documented Paleoindian skeletal remains. The few remains that have been found have been critically reviewed by several authors. In addition to Hrdlička's periodic denial (1907, 1918, 1937), other writers have provided more accepting accounts (Roberts, 1945:412-419; Wormington, 1957:225-248; Stewart, 1973:155-170). Within the last 15 years there have been three general reviews of the present Paleoindian skeletal sample, each differing slightly in the list of Paleoindian material it accepted, or even considered.

Smith (1976) provided a thorough survey of early skeletal remains including both morphological descriptions as well as discussions of each site. He selected 15 sites as having skeletal remains possibly attributed to early man. His stated criteria for selection were "(1) reasonable evidence of geological antiquity, (2) radiocarbon or other chronometric date of at least 8,000 years BP- either directly from the specimen or from some feature associated with it and (3) some historic interest" (Smith, 1976:117).

Ultimately he accepted only seven sites as containing Paleoindian skeletal remains: Arlington Springs, California; Browns Valley, Minnesota; Gordon Creek, Colorado; La Brea, California; Marmes, Washington; Midland (Scharbauer), Texas; and Pelican Rapids, Minnesota.
Smith suggested the data supporting the antiquity of Natchez, Taber, Tepexpan, Laguna Beach, Los Angeles, Vero Beach, Melbourne, and the San Diego and Del Mar skeletons which are considered Paleoindian remains by some authors was not conclusive. In his estimation, too many questions exist on either their geologic context or reported dates.

Protsch (1978) published a catalog of what he referred to as fossil hominids in North America, including remains that date to at least 8,000 BP as well as more recent material. It is a useful tool in that it furnishes a synopsis of the reported information on the discovery, geology, associated fauna, absolute dates, and relevant publications. All of this data however, were presented with no discussion or apparent recognition of the controversies surrounding some of the finds and their dates. Sites which Protsch listed with absolute dates in excess of 8,000 years BP, were Arlington Springs, California; Browns Valley, Minnesota; Gordon Creek, Colorado; La Brea, California; Laguna Beach, California; Los Angeles, California; Midland (Scharbauer), Texas; Yuha, California; and Taber, Alberta. He also listed sites with skeletal remains without chronometric dates but found in geological formations dating to the Pleistocene. These included Clear Fork (J.C. Putnam), Texas; Natchez, Mississippi; Sauk Valley, Minnesota; Trenton, New Jersey; and Vero Beach, Florida.

Owen (1984) in arguing against a pre-Clovis occupation in the Americas, reviewed the dating of human skeletal evidence that had been used to advance the acceptance of what he termed an early Paleo-American period (pre-28,000), a middle Paleo-American period (28-12,000) and a establish dates, he offered no morphological descriptions of any of the
skeletal remains. Written more recently than either Smith or Protsch, he had the advantage of more recently obtained radiocarbon dates that suggested middle Holocene dates for the Taber skeleton from Alberta, Canada, and the Del Mar, Sunnyvale, and Yuha finds in California. He accepted only Arlington Springs, Browns Valley, Marmes, and Midland (Scharbauer) as authentic Paleoindian sites.

In 1985 Taylor et al. used radiocarbon analysis by the accelerator mass spectrometric technique to provide new dates on the skeletal remains that had been previously dated by amino acid racemization as old as 70,000 to 15,000 years BP. The new dates indicated middle Holocene ages for numerous California finds including Sunnyvale, Yuha, Los Angeles and Laguna Beach. Taylor et al. concluded that the currently oldest human skeletal remains dated by C-14 analysis on organic fraction were from the Wilsall site in Montana (10,600±300 years BP) and from the Mostin site in California (10,470±490 years BP). Neither of these sites had been published in major journals and were not reviewed by either Smith (1976) or Owen (1984).

To familiarize the reader with the early problems in assessing the age of skeletal finds and the general intellectual climate, it is necessary to provide brief descriptions of the major sites noted in these reviews, including both those now accepted as Paleoindian and those that remain in question. These sites to be discussed are Natchez, Mississippi; Trenton, New Jersey; La Brea, California; Vero Beach, Florida; Pelican Rapids, Minnesota; Browns Valley, Minnesota; Sauk Valley, Minnesota; J.C. Putnam (Clear Fork), Texas; Tepexpan, Mexico; Scharbauer (Midland), Texas; Arlington Springs, California; Gordon
Creek, Colorado; Marmes, Washington; Wilsall, Montana; Mostin, California; Fishbone Cave, Nevada; Old Crow River, Alaska; Wilson-Leonard, Texas; and FF:10:14 in Whitewater Draw, Arizona.

THE SITES

Natchez, Mississippi

Sometime between 1837 and 1844, a fragmentary innominate was found near Natchez, Mississippi by a Dr. Montroville Dickeson. It was reportedly located in a blue clay which also contained fossils of extinct sloth, mastodon, horse and bison (Wilson, 1895; Hrdlička, 1907; and Quimby, 1956). An early fluorine test on the human pelvis and an associated sloth (Mylodon) indicated that they were approximately the same age (Wilson, 1895). Noted scientists however, such as Hrdlička and Charles Lyell visited the area and did not believe the geological evidence could prove its antiquity (Hrdlička, 1907:16-19).

Stewart (1951) described that original fluorine test, which had not been widely disseminated, as an important and objective argument in favor of man's antiquity America. In 1954, Quimby attempted to relocate the Natchez site but concluded that erosion had removed the locus of the human material (Quimby, 1956). Today the only evidence to support a Pleistocene date is Wilson's original fluorine analysis.

Trenton, New Jersey

In 1899, a human femur was exposed in a railroad cut near Trenton, New Jersey. It was located in sands under a deposit of glacial gravel. The site was investigated by F. W. Putnam of the Peabody Museum of
Archaeology and Ethnology who dated the age of the deposits in which the femur was located to the Terminal Pleistocene. Hrdlička (1907) described the femur as displaying ordinary dimensions with some flattening at the proximal end, a characteristic he associated with American Indians. He noted no osteological evidence that would suggest antiquity, commenting that the antiquity of this material must rest on geological evidence alone. Stewart would later remark that Hrdlička's early reports displayed a "restraint and a reasonableness" which disappeared in his later writings (Stewart, 1949:9).

La Brea, California

In 1914, a complete cranium and fragments of post-cranial remains were recovered from the La Brea asphalt pits, near Los Angeles, Ca. Geologically it is considered an unstable area (Howard, 1960) with channels and vents capable of moving materials up and down. As such, the skeletal remains have no interpretable stratigraphic context. An absolute date however is available. Berger (1975) obtained a date of 9,000±80 years BP on the residual collagen. Smith (1976:129) stated this radiocarbon date "convincingly argues for an immediate post-Pleistocene date". Such acceptance though seems to contradict a later statement in his article in which he demanded some knowledge of geological context as necessary to demonstrate antiquity. For instance, though Laguna Beach remains have a collagen date of 17,150 years BP, Smith rejected it because it had no geological or archaeological context (Smith, 1976:133). Owen (1984) did not include the La Brea remains in his review, nor were they tested by Taylor et al. (1985).
Vero Beach, Florida

E. H. Sellards first reported human skeletal remains at Vero Beach in 1917 (Sellards et al., 1917). He identified three strata at the locality. The earliest stratum was a marine deposit which produced no vertebrate remains. The middle stratum was defined as a non-marine sand containing extinct fauna such as mammoth, horse, camel, mastodon, and the human skeletal remains. The top stratum, described as sand and muck, was separated from the middle stratum by an erosional disconformity. This uppermost level contained both pottery and artifacts typical of the Archaic period. Sellards claimed that the human bones in the middle stratum were not intrusive from the upper levels and were of Pleistocene age. He maintained that the crossbedding of deposits evident in the upper stratum that overlay the skeletal remains ruled out the possibility of intrusion.

Others however, notably Hrdlička (1918) and later Rouse (1950), believed the human material to be of more recent age. After studying both the site and the bones Hrdlička concluded they were the remains of "modern Indian type". The Vero material, a fragmentary cranium and some post-cranial remains, was described by Hrdlička as possessing "superior modern characteristics" (Hrdlička, 1918:55). Though he did note that the skull type was not typical of the type found in more recent Florida Indians, he did not find "primitive" traits on the Vero material and denied its antiquity, remarking that "anthropology has a right to expect that human remains of whatsoever nature assigned to great antiquity should show some adjustment in structural type to such antiquity" (Hrdlička, 1918:36).
Hrdlička maintained that the bones' association with Pleistocene age faunal remains was misleading and could be explained by the fact that the human remains represented a latter intrusion.

Stewart (1946) in re-examining the shape of the Vero skull remarked that this individual would have been a stranger in comparison to more recent Florida Indian crania. He concluded that there was no morphological reason for denying its antiquity. Rouse (1950) suggested that the burial dated to the time of the disconformity that separated the middle and top stratum and hence there would be no disturbance in the top stratum. Rouse also noted that the skeleton was not complete; the bones were broken and distributed in such a fashion as to indicate a later disturbance. He suggested Archaic Indians disturbed the burial when attempting to dig a well. Additionally, the artifacts found with the skeletal remains were considered by Rouse as typical Archaic forms.

Regrettably, no absolute dates are available for the Vero remains and the relative chemical tests are inconclusive. Owen (1984) aptly commented that the Vero beach bones are now of more interest in the study of American archaeology than they are as putative fossils.

Pelican Rapids, Minnesota

In 1931, near Pelican Rapids, Minnesota, a highway road crew exposed a nearly complete skeleton in glacial silts. In 1932 Albert Jenks of the University of Minnesota, excavated the area and found fragments of the skeleton in situ. Jenks believed that the human remains lay in undisturbed Late Pleistocene deposits, dating to approximately 20,000
years ago (Jenks, 1936:177). Others including Hrdlička (1937) and Ernst Antevs (as discussed in Wormington, 1957 and Smith, 1976), believed the skeleton to be a later intrusion into these deposits. There are no direct radiocarbon dates nor diagnostic artifacts to lend credence to one side of the argument or the other. Since the 1930's new dates of 11,000 years or less have been established for the glacial deposits (Wormington, 1957:235) and Smith (1976) believed an 11,000 years BP date to be reasonable. Owen (1984) appeared to have reached no conclusion. While he noted that many accept the 11,000 years BP date he also stated that others believe it to be an intrusive burial. The Pelican Rapids material has not been tested by accelerator mass spectrometry.

Browns Valley, Minnesota

The find at Browns Valley, Minnesota was first reported in 1934 (Jenks, 1934). The skeletal material, initially exposed by gravel quarrying operations, was excavated by Albert Jenks. Both cranial and post-cranial remains were recovered, as well as "Folsom-Yuma type" artifacts (Jenks, 1937). The bones were found in a gravel deposit which had been formed by Lake Agassiz. This deposit was geologically dated to 12,000 years BP. Based on the geological evidence and the associated artifacts, the Browns Valley skeleton has been dated to approximately 8,500 years BP. (Jenks, 1937). Both Smith and Owen accepted Browns Valley as Paleoindian. It was not tested by Taylor et al. (1985).

Sauk Valley, Minnesota

Another reportedly Paleoindian skeleton was found in Minnesota in
1938, near Sauk Valley, Minnesota. A fairly complete skeleton was exposed by workmen in a gravel pit. The human material was turned over to professionals but the exact provenience of the skeleton was lost, and nothing remained in situ. The claims to antiquity have been based on the presence of a limonitic sand within the cranium. Bryan et al. (1938) proposed that this skeleton had to have been interred during a different climatic period for the limonitic sand to have formed. That and the depth of the skeletal material suggested antiquity. Neither Smith (1976), Owen (1984), or Taylor et al. (1985) considered this material in their papers.

J.C. Putnam (Clear Fork), Texas

In 1943, a human skeleton was found in Texas, eroding out of the Brazos River bank 6.43 m below the present valley floor. Frank H.H. Roberts, from the Smithsonian Institution, examined the area and reported that undisturbed strata above the burial ruled out a more recent intrusion. Roberts (1945) judged the silts to be late Pleistocene in age. The human material, referred to in the literature as the J.C. Putnam or Clear Fork burial, consisted of an incomplete skull, and most of the long bones; the innomates, scapulae, and vertebrae were fragmented. No diagnostic artifacts were found with the burial.

T. Dale Stewart (1945) examined the skeletal remains and concluded that this skeleton presented no features that would distinguish it from other Indian remains from that region.

Being relatively long-headed and high-headed, the skull could have belonged, so far as our present knowledge goes to an early type of Indian. However, it is impossible to establish the antiquity of this
individual on the basis of bones alone (Stewart, 1945:38).

Neither Smith (1976), Owen (1984), or Taylor et al. (1985) commented on the Clear Fork burial. A chronometric date though may soon be available. The Center for the Study of Early Man is attempting to get accelerator mass spectrometric dates on a number of early New World human skeletons, including the Clear Fork remains (Sorg and Bonnichsen, 1984).

Tepexpan, Mexico

In 1943, in the Valley of Mexico near the town of Tepexpan, Helmut De Terra excavated an essentially complete human skeleton in an alluvial deposit which dated to the Late Pleistocene (De Terra et al., 1949). De Terra believed that the level which contained the human material could be correlated to levels which had earlier produced mammoth remains. Based on geological evidence he estimated the human skeleton was 11,000 to 12,000 years old.

Heizer and Cook (1959) ran fluorine tests on the mammoth and human bone and concluded that the Tepexpan skeleton was younger than the mammoth. They could not however, say how much younger. They noted that the human material might be anywhere from 500 years to several thousands of years younger than the mammoths. To add further doubts, Black (1949) and Krieger (1950) criticized the excavation methods, suggesting that the excavators did not recognize evidence which would indicate the skeleton was a later intrusion. Smith (1976), and Owen (1984) both find the data less than conclusive, nor was it tested by Taylor et al. (1985).
Scharbauer (Midland), Texas

In 1953, an amateur archaeologist, Keith Glassock, came across the Midland, Texas remains eroding out of a sand blowout. He notified Alex Krieger and Fred Wendorf who began excavations in 1954. Eventually fragments of a cranium, including portions of a maxillae with eight teeth in place, and a few fragments of post-cranial material were recovered. The exact age of the Midland material is still controversial. The gray sand stratum which contained the bones were radiocarbon dated to 7,100±1,000 years BP. Radiocarbon tests on burned caliche from the gray sands yielded a date of 20,000±2,000 years BP. Folsom points however were recovered from the red sand stratum overlying the bones. Shell recovered from the stratum beneath the human remains was dated at 13,000 years BP. Relative dating methods such as fluorine analysis indicated the human bone was contemporaneous with Pleistocene fauna. Wendorf and Krieger discussed dates from Midland as well as the Lubbock Lake, Blackwater Draw, and the Plainview sites, and concluded that the Midland remains could be as young as 7,100 or as old as 20,000 years (Wendorf and Krieger, 1959). Smith agreed that the Midland human skeletal remains were contemporaneous with Pleistocene fauna but assigned no date more specific than possible late Pleistocene (Smith, 1976). Owen (1984) cited estimated ages from 7,100 to 9,270 years but admitted the material may be slightly older.

Arlington Springs, California

The Arlington Springs site is on Santa Rosa Island, off the southern
California coast. It was first discovered in 1959 by Phil Orr (Orr, 1962, 1968). The human material, two fragmentary femora and a few other post-cranial fragments were discovered 11 meters below the surface. There was no evidence to suggest an intentional burial. Radiocarbon dates on the residual collagen in the bone itself as well as the stratum containing the bones indicated an age of approximately 10,000 years. Smith (1976) and Owen (1984) both accepted these dates. The Arlington Spring bones have not been tested by accelerator mass spectrometry (Taylor et al., 1985).

Gordon Creek, Colorado

The Gordon Creek, Colorado burial was excavated in 1963 by the Department of Anthropology, University of Colorado. This skeleton is fragmented but is essentially complete. All of the bones were stained with hematite. Radiocarbon tests on the residual collagen on the bone yielded a date of 9,700±250 years BP (Anderson, 1967; Bretnernitz et al., 1971). Though Smith (1976) stated that the associated artifacts apparently confirm a Paleoindian date, Anderson stated the artifacts are "apparently not diagnostic" (1967:31). Owen (1984) did not include Gordon Creek in his review, nor did Taylor et al. (1985) test these remains.

Marmes, Washington

The Marmes site in southeastern Washington was discovered in 1953 and excavations began in 1962 by Roald Fryxell and the Department of Anthropology, Washington State University. The skeletal material
consisted of numerous cranial fragments representing three individuals, two adults and one child, and a few fragments of post-cranial remains (Fryxell et al., 1968b). The bones have not been dated directly, but shell in the overlying stratum have radiocarbon dates of 10,000-11,000 years BP (Fryxell et al., 1968a). The geological context also suggests a an 11,000 to 13,000 years BP date. Though noting that radiocarbon dates on shell are less reliable than charcoal, Smith stated that the Marmes find was "one of the more securely dated finds of early man in North America" (Smith, 1976:122). Owen also commented on the reliability of shell but noted that unpublished C-14 dates in the 10,000 to 11,000 year range supported the original estimation (Owen, 1984:530). He did not say on what these later radiocarbon dates were determined. The Marmes material was not tested by Taylor et al. (1985).

Wilsall, Montana

The Wilsall (or Anzik) site in Montana, described accurately in print as "an exercise in frustration" (Taylor, 1969), contained two adult parietales and approximately 15% of a young child's skeleton, including parietales, the frontal bone, clavicles, vertebrae, and a few rib fragments (Dr. Mark Taylor, personal communication, 1985). Though Taylor et al. (1985) have dated the bone itself to 10,600±300 years BP, there is no provenience on the skeletal material. The site, apparently a bison jump kill, was dug by amateurs, who in addition to the human remains, recovered five Clovis points. The excavators believed the human bones came from approximately the same level as the points, but they excavated the site in such a way that several levels may have been
mixed. At the present time the human remains are at Northern Arizona University, but as of 1985 there has been no published description. Neither Smith (1976), Owen (1984), or Protsch (1978) commented on this site.

Mostin, California

The Mostin site in California was excavated by U.C.L.A. The human remains are extremely fragmentary and very poorly preserved (Kaufman, 1980). Kaufman reported that the burial was recovered "largely if not completely" from a dark cultural stratum which was radiocarbon dated with charcoal at 11,250±240 years BP (UCLA-2166). But while Taylor et al. (1985) reported a date of 10,470±490 years BP on the bone itself, questions on these dates have been raised. White and King (n.d.) concluded that these C-14 dates have been affected by "old carbon", endemic to the nearby Clear Lake. Clear Lake lies on an active fault line and geothermal fluids and gases are releasing fossil carbon into the waters. White and King noted that U.S. Geological Survey researchers have reported modern sediments yielding dates of 4,560±90 to 4,230±110 years BP and further, that the USGS had recommended subtracting 4,200 years from radiocarbon dates to allow for the effect of old carbon. To strengthen their case for a middle Holocene age, White and King (n.d.) also presented cross-dating and obsidian hydration evidence that suggested an age between 4,000 and 1,000 years ago. This find post-dates Smith (1976) and Protsch (1978). Owen (1984) did not include this site in his review.

None of the earlier reviews (Smith, 1976; Prostch, 1978; Owen, 1984;
Taylor et al., 1985) provided complete coverage of the Paleoindian skeletal sample. Aside from Horn Shelter, the focus of this thesis, there are other proposed Paleoindian sites with skeletal material, four of which have reported C-14 dates in excess of 8,000 years BP. These sites are Fishbone Cave, Nevada, Warm Mineral Springs, Florida, Old Crow River, Alaska, Wilson-Leonard site, Texas, and FF:10:14 in Whitewater Draw, Arizona.

Fishbone Cave, Nevada

From Fishbone Cave Phil Orr (1956, 1974) reported human remains dating to between 10,900 and 11,200 years BP. These dates were derived from the radiocarbon dating of packrat middens. The skeletal material now housed at the Nevada State Museum, has not yet been analyzed and published. The remains however are fragmentary and of little diagnostic value. Dr. D.R. Tuohy (personal communication, 1985) says the museum holdings consist of a mummified, carbonized foot and a clavicle. A scapulae that should be in the collection could not be immediately located.

Warm Mineral Springs, Florida

Warm Mineral Springs, a submerged site in Florida, was first excavated professionally in 1972. Clausen et al. (1975) found a human sacral vertebrae and a fragment of an ilium. Samples of wood from the same level of sediments as the human material yielded C-14 dates of 10,260±190 years BP. An earlier discovery of a human skull and other post cranial material was made by amateurs and has no documented
provenience.

Old Crow River, Alaska

In 1976, a right half of a child's mandible was recovered at the Old Crow River site in Alaska. Irving et al. (1977) claimed it the first human skeletal material found in Beringia with a Pleistocene date. The human bone itself was not dated, but other dated bone, as reported by Irving et al., fell into two age categories; bone that was between 11,000 and 12,000 years old, and bone that was older than 20,000 years. According to Irving et al., these two groups of bone were distinguishable by color, and, on this basis of color, the human material was assigned to the older group.

Wilson-Leonard, Texas

The Wilson-Leonard site near Leander, Texas, was excavated by the Texas Highway Department in 1982-1983. It received national television coverage in early 1983 but has not yet been fully analyzed or published. The remains consist of a nearly complete but badly fragmented individual. Radiocarbon tests indicate an age between 9,000 and 10,000 years old (Young, 1983).

FF:10:14, Whitewater Draw, Arizona

In 1983, a human skeleton was exposed during geological testing in Whitewater Draw in southeastern Arizona. Both the geological and archaeological contexts suggest this material dates to between 8,000 and 10,000 years BP (Waters, 1986). Most of the bone was removed in one
scoop of the backhoe, which suggested that the burial had been in a tightly flexed position. No grave offerings were found. The bones were fragmented and are now being reconstructed by Dr. Walter Birkby at the University of Arizona. Waters (1986) reported that a preliminary analysis indicates the individual was female, between 25 and 35 years old, and had the sinodont dental pattern.

SUMMARY

As seen in the preceding pages, even if one accepts all of the human remains discussed, the Paleoindian skeletal sample of North America is both small and usually too fragmentary to be of any comparative value. And unfortunately, not even all of the sites discussed in this paper are acceptable. This author agrees with both Hrdlička (1907) and Smith (1976) in demanding some knowledge of context. As has been warned, "archaeologists have a tendency to uncritically accept results from physiochemical dating techniques at the expense of other lines of evidence, including geologic, faunal and cultural contexts" (Dincauze, 1984:301-302).

Using context, and preferably, but not necessarily, a chronometric date, the following sites are considered Paleoindian by this author: Arlington Springs, Browns Valley, J.C. Putnam (Clear Fork), Fishbone Cave, Gordon Creek, Wilson-Leonard, Marmes, Scharbauer (Midland), Pelican Rapids, Warm Mineral Spring, and site FF:10:14 in Whitewater Draw (Fig. 5.1). Of these sites listed though, only five have human remains that are complete enough and have published measurements, to be of comparative value in this study. These are Browns Valley, J.C.
Fig. 5.1. Paleoindian sites with human skeletal material in North America.
Putnam, Gordon Creek, Scharbauer, and Pelican Rapids. These remains are described in more detail in Chapter VII.
CHAPTER VI

THEORIES ON THE ORIGINS OF THE FIRST AMERICANS

INTRODUCTION

A theoretical framework within which to place the osteological evidence of Paleoindians is, at best, lacking in definition, but this is not from the want of trying. Since the European discovery of the western hemisphere there has been continual speculation on the origins of the American Indians (Willey and Sabloff, 1980). Huddleston (1969) provided a fascinating account of theories offered during the years of 1492 to 1729. As early as 1607, Fray Gregorio Garcia summarized various opinions on this question. His list included arrivals both by sea and land, from such diverse points as Carthage, Atlantis and Israel. One theory held that the ancestors of the American Indians migrated overland from Asia, in the far north, where the New World most closely approaches the Old.

In the years that have elapsed, research within the field of physical anthropology has attempted to pinpoint the specific populations ancestral to the Paleoindians, the number of possible migrations, as well as to possibly identify physical traits that characterized these first Americans. Today, aside from the Asian origins of the American Indian, the only agreement seems to be that early New World populations were typically dolichocephalic (Dixon, 1923; Hrdlička, 1923; Hooten, 1933; Newman, 1962; Angel, 1966; Laughlin, 1967; Smith, 1976). Turner and Bird (1981), echoing a similar remark by Stewart (1973) said that the Paleoindian material culture is better known than their physical
characteristics. This is of course of no surprise considering the present sample of Paleoindian skeletal remains.

Although many observers have commented on the homogeneity of the American Indian, early studies did indicate a divergence of types (Stewart and Newman, 1951). The question remained whether this diversity was the result of differentiation within the New World or the reflection of different types in the original founding populations. The early approaches to this problem were typological in nature and hypothesized polyracial origins (Dixon, 1923; Rivet, 1925; Hooten, 1933; Birdsell, 1951; and Neumann, 1952). Cranial traits were thought to be conservative and non-adaptive, and consequently, any variation was considered to represent differences in original populations (Hooten, 1926).

Beginning in the early 1950's, the study of the New World aboriginal populations was changed significantly by developments in both archaeology and biology. First, the 1950's saw the advent of radiocarbon dating which provided the needed evidence of a longer chronology in the New World. This, in essence, offered a gift of time, during which evolutionary forces could operate. Secondly, the theory of population genetics with its more advanced concepts of intrapopulation variation and evolutionary dynamics brought the early racial typologies under strong criticism for their static views of human populations (Spuhler, 1954; Newman, 1953; Stewart, 1960; Newman, 1962; Long, 1966). Instead of establishing racial types, research has focused on establishing the frequencies of discrete traits among the early populations (Laughlin, 1967; Turner, 1971, 1979, 1983; Lampl and
(Blumberg, 1979; Turner and Bird, 1981; and Williams et al., 1985).

EARLY RACIAL TYPOLOGICAL APPROACHES

In one of the first major papers on American Indian origins, Dixon (1923) attempted to identify various morphological types among American Indians and assess their chronological relationships. He defined eight types based on three indices: the length/breadth of the cranium, the length/height of the cranium and the nasal index. These eight types were designated Caspian, Mediterranean, Proto-Negroid, Proto-Australoid, Alpine, Ural, Palaeo-Alpine and Mongoloid. Despite the names assigned, Dixon cautioned that these terms had very restricted meanings. They designated a particular combination of the three traits and nothing more. Thus, the Proto-Negroid type indicated that the skull was dolichocranic, hypsicranic, and platyrhine. The type carried no implication of additional features associated with Negro crania.

Dixon (1923) claimed that the skeletal variations seen among American Indians showed a definite sequence in both time and space. Specifically, he proposed that the geographical distribution of skeletal types could be used to determine a temporal sequence. This statement was based on the assumption that "in the distribution of species within any large area, such as that of a whole continent, those which are marginal are in general to be regarded as the earlier in comparison with species having a more central habitat" (Dixon 1923:398).

In his study Dixon found that the dolichocranic types of Caspian, Mediterranean, Proto-Negroid and Proto-Australoid were concentrated in marginal areas and concluded that these dolichocranic types represented
the oldest inhabitants of the New World. These types, while all dolichocranic, did however differ on the other two indices. The Caspian were characterized by skulls of average height, with narrow noses. The Proto-Negroid had skulls of average height but with broad noses. The Mediterranean were characterized by low skulls and narrow noses, and finally, the Proto-Australoid were defined by low skulls and broad noses.

Dixon reported that the Caspian and Mediterranean types were present along the north and northeast coasts and isolated spots along the Pacific coast. He also found Proto-Negroid and Proto-Australoid on the periphery of the continent, occurring along the Pacific coast and in regions east of the Great Lakes. Due to this geographical distribution, Dixon believed these types represented the oldest occupants in the New World. In short, Dixon disputed the homogeneity of the American Indian and suggested that the initial entry into North America was followed by other waves of migration, each of which brought different combinations of racial elements.

Aleš Hrdlička published an article on the origin of the American Indian in 1923, and his scenario also provided for several migrations. Hrdlicka however, viewed all early immigrants as belonging to the same basic race. This race though, was not strictly homogenous but was represented by three distinct subtypes. Hrdlička stated the earliest arrivals in the New World were dolichocranic, followed by a brachycranic group and lastly, after North America was well populated, the Eskimos and Athabaskans arrived.

In 1925, Rivet advanced a polyracial theory on the American Indian
origins, in which he hypothesized specific Old World parent populations. Seeing similarities in the crania of alleged early New World inhabitants from California and Lagoa Santa, Brazil, with Melanesians and Australian populations, he concluded that four separate racial elements were involved in the formation of the American Indian population. According to Rivet they arrived in the New World in the following order: first the Australians, then the Melanesians, followed by the Asiatics (which Rivet said to be the most important) and finally an Uralian element, represented by the Eskimo.

Earnest A. Hooten (1933), a student of Hrdlička's, was the first to use a stratified series of crania from Pecos Pueblo to argue that a racial typology could provide clues to the history of American Indian populations. Using the Pecos Pueblo sample, Hooten established morphological types and attempted to trace their biological affinities outside the New World. In this study Hooten laid out 129 of the best preserved male crania from all strata at Pecos and subjectively sorted them into groups which "looked alike". He established seven distinct groups by simple visual means and only then took measurements. He checked the validity of each of these groups by comparing the metrical features of each group against the random sample from the entire population.

In this fashion Hooten identified three dolichocranic types, all of which were more frequent in the lower strata of the Pecos Pueblo. (In his original report (1930) Hooten did note that "long heads" and "round heads" appeared in every strata.) Hooten named these three groups "Basket-Maker", "Pseudo-Negroid", and "Psuedo-Australoid". The
Basket-Makers were described as having small skulls that were dolichocranic, hypsicranic and acrocranic; the last two terms denoting a high skull in relation to length and breadth respectively. He remarked that the Basket-Maker showed striking similarities to Egyptian crania and suggested that one of the early strains which contributed to the American Indian population may have been "the fundamental Eur-African Mediterranean race" (Hooten, 1933:158).

The Pecos "Psuedo-Negroid" were described as having crania similar to the crania of black African groups which displayed some evidence of white admixture. Aside from dolichocrany, Hooten characterized these skulls as having low height in relation to both length and breadth, and possessing broad noses and pronounced alveolar prognathism. Hooten commented that if these similarities meant anything, they suggested there was some degree of Negro or Negroid admixture in the earlier strata of the American population (Hooten, 1933:159).

The third dolichocranic type, the "Proto-Australoid", consisted of skulls with heavy supraorbital ridges and low orbits. These skulls too, as were the Basket Makers, were hypsicranic, and acrocranic, with no facial prognathism. Despite the name, Hooten concluded this group only bore faint resemblances to the Australian aborigines but strongly resembled the Ainu of northern Japan. He suggested that this type represented an archaic form of modern white man. In summary, Hooten concluded that the early dolichocranic types in the New World may have been a blend of Mediterranean, Negroid, and an Archaic white element, which was ultimately mixed with Mongoloid traits from later migrants. Hooten agreed with Dixon's contention that a peripheral distribution
could have temporal significance. "If a continent has been peopled by successive waves of immigrants differing to some extent in racial and ethnic composition, we may well expect the most primitive and purest types to survive longest in areas of relative isolation" (Hooten, 1933:143). Hooten further concurred with Dixon's suggestion that the first arrivals in the New World were dolichocranic.

In 1935, Hrdlička reviewed the various polyracial hypotheses which had argued that blacks, Australians and Melanesians had played a role in American Indian origins and found them all to be wanting. He sharply criticized the reasoning involved in these theories and, apparently contradicting his own statement in 1923, condemned the notion of the permanence of skull types and their changeability only through racial mixtures. In general though, racial typological thinking in skeletal analysis persisted.

In 1951, Birdsell examined the peopling of America from a markedly different perspective. Instead of examining the skeletal material found in the New World and extrapolating back in time, he attempted to define the "major racial elements" present in Asia at the appropriate times for early migrations across Beringia. He reconstructed the distribution of Asia's populations based upon the distribution and sequence of racial elements he had determined for Australia. Using this approach, Birdsell decided that only two racial elements were available at the right time and place to have entered the New World. His dihybrid origin of the American Indian involved "Amurians" and Mongoloids. The "Amurians" as defined by Birdsell, were an eastern branch of the Caucasoïd race. The name for this group was taken from the Amur River Basin in Siberia (Fig.)
6.1) which Birdsell hypothesized was the area which may have been occupied by populations ancestral to the Ainu and Murrayians. The Murrayians were described as moderately short and stocky with rough-hewn Caucasian features and possessing long, low skulls with large brows. Birdsell considered the Ainu to be closely related to the Murrayians and both to be Caucasian. He suggested this particular Caucasian element in the New World explained the non-Mongoloid features apparent in American Indians.

Birdsell believed the Mongoloids to be of relatively recent origin, having evolved in response to a cold, dry environment, probably in the "general area now drained by the Kolyma and Lena Rivers" (Fig. 6.1) in northeast Asia (Birdsell, 1951:16). He suggested some of these people could have crossed Beringia, but hypothesized that if man entered North America as early as the third interglacial (no chronometric date provided), the type would have been unmixed Amurian. He further hypothesized that the Mongolid component in the immigrants to the New World increased with the passage of time and that populations crossing Beringia in post-glacial times were dihybrids.

Interestingly, in terms of the later developments in population studies, Birdsell, in this same paper, commented that the specific origins of the American Indians would remain a source of contention because anthropologists could not agree on the evolutionary processes responsible for the differentiation seen in the various Indian populations. In essence he accused the typological approach as used by early authors as scientifically "bankrupt" and suggested that anthropologists study "the processes of race formation" (Birdsell,
Fig. 6.1. Beringia and peripheral areas, including rivers of Siberia mentioned in text.
Specifically, Birdsell recommended a clinal approach and offered a list of possible traits to examine. This list included blood types; dental traits such as molar cusp patterns, shovel-shaped incisors, Carabelli's cusp; as well as cranial traits such as Os Japon, metopic sutures and palatine tori. In more recent years, the frequency of discrete traits such as those listed by Birdsell, have been used to establish biological distances between populations (Laughlin and Jørgenson, 1956; Brothwell, 1958; and Berry and Berry, 1967). Georg Neumann (1952), in perhaps the last major polyracial argument presented, ambitiously attempted to provide "a framework for the reconstruction of the American Indian racial history" (Neumann, 1952:13). He introduced his paper by claiming that the New World was not peopled as the result of a single wave migration but rather a continuing series of migrations possibly beginning as early as the immediate post-glacial times and lasting through the beginnings of what he called the Christian era.

In this paper, "Archaeology and Race in the American Indian", Neumann recognized eight basic morphological types as defined by a certain combination of traits. These types consisted of homogenous units, each a stabilized related community, from a number of archaeological horizons, from marginal or refuge areas or from continuous continental areas of distribution as yet undisturbed by the shattering effect of the arrival of a new group (Neumann, 1952:15).

Neumann described a four step methodology. First he gathered observations and measurements from crania with some archaeological context and which displayed relative homogeneity. He then examined
their variability and selected certain traits as diagnostic. At this point he eliminated groups that were not represented by an adequate size sample (which he did not define by a specific number) and finally he determined correlations between the physical anthropological data and cultural data.

Neumann claimed to have examined over 10,000 skulls but ultimately based his morphological types on 471 male crania. He defined eight types which he felt were sufficient to explain the diversity of the American Indian: Otamid (represented by a Texas coastal series, N=18), Iswanid (represented by a Kentucky shell mound, N=33), Ashiwid (represented by Arizona Basketmakers, N=15), Welconid (represented by a Middle Mississippian group, N=45), Lenapid (represented by central Algonkins, N=24), Inuid (represented by the present Eskimo, N=245), Deneid (represented by Canadian Northwest groups, N=32), and the Lakotid (represented by northern Plains populations, N=63). Though Neumann stated that he had eliminated groups that were represented by too small a sample, two of his types, the Otamid and Ashiwid were based on samples of less than 20 individuals.

Neumann, as did Dixon (1923) and Hooten (1933), also noted that the groups in peripheral or refuge areas of North America tended to be older. He identified the oldest group in the New World to be of the Otamid type. This particular variety was defined by a braincase that was dolichocranic and moderately high, with pronounced supraorbital ridges, prominent glabella, some sagittal elevation, small to medium parietal eminences and a low, bun-shaped occiput. Archaeologically, Neumann said this type was represented by a widely dispersed group
including the Karankawa on the Texas coast, the Coastal Focus people on
the Atlantic coast and the early Woodland Black Sand Focus people in
Illinois. To corroborate this hypothesized early time frame for the
Otamid type, Neumann noted that several examples of Paleoindian skeletal
material (as accepted in the 1950's, Browns Valley, Clark's Fork, the
Wyoming crania and the Nebraska Loess remains) fit into the Otamid
variety. Today however, only Browns Valley is still considered to be of
Paleoindian age.

AN EVOLUTIONARY FRAMEWORK

During the early 1950's, there were the beginnings of significant
changes in skeletal analysis. As Birdsell (1951) foresaw, there was an
increasing sophistication with respect to understanding population
variation and evolutionary processes. It was now proposed that the
differences between "races" could be assessed most simply as changes in
gene frequencies between populations.

On the basis of the theory of population genetics, biological relationships between populations can be
better determined by establishing the frequency of
genetic traits in the population than by finding the
frequency of varities or types (defined by a cluster
of attributes held in common), in the individuals who
constitute populations (Sphuler, 1954:606).

Newman (1953, 1962), Stewart (1960), and Long (1966), criticized the
early theories on Amerind origins for their static view of human
populations and apparent ignorance of evolutionary processes.

The data base with which physical anthropologists worked also began
to enlarge. Boyd (1950) questioned the use of skeletal material in
assessing populational affinities. He maintained that the skeleton was
too subject to environmental influences and that skeletal features were polygenic in origin. Boyd advocated the use of traits with a known mode of inheritance. Numerous researchers (Spuhler, 1954; Laughlin and Jørgensen, 1956; Laughlin, 1967; Turner, 1971, 1979, 1983; Szathmary, 1979; Turner and Bird, 1981; Williams et al., 1985) would turn to blood group data and discrete traits, that were thought to be controlled by simple modes of inheritance, to estimate population affinities.

Marshall T. Newman (1953) questioned the early polyracial hypotheses on the grounds that many of the traits considered diagnostic of race are not static as Hooten (1926) suggested, but are adaptive and subject to environmental influences. In his critique Newman tested the applicability of Bergmann's and Allen's rules to American Indian body forms. Briefly, Bergmann's rule is the proposition that within a wide-ranging species, populations in colder climates are larger in size; Allen's rule is the proposition that in colder environments populations will have shorter extremeties. Both of these statements are based on the fact that reduced body surface in relation to body mass serves to retain heat.

Newman plotted the distributions of human body size, stature, sitting height, head size (length plus breadth), upper face size (upper facial height plus bizygomatic breadth), trunk-leg proportions, upper facial index and the nasal index. He found that in general the distribution patterns followed Bergmann's and Allen's rules. He noted a few exceptions but suggested most of these represented adaptive solutions to different problems. For example, though facial and nasal proportions were not directly attributable to either Bergmann's or
Allen's rule, he suggested the demonstrated clines indicated adaptations to temperature and humidity (Newman, 1953:319).

Though he would later change this view, Newman initially reported that head form and relative head height were not readily interpretable as adaptive and admitted that the distribution of both long and low heads seemed best explained by migrations of different peoples. He did not however elaborate on this thought and concluded by remarking that the numerous races of previous classifiers are, at least in part, "ecological races" formed in the New World (Newman, 1953:325), and not remnants of earlier distinct populations.

Stewart (1960) agreed with Newman's hypothesis that elements of the American Indian phenotype were primarily adaptive responses. Stewart stated that the American Indians were characterized by a basic homogeneity both in phenotype and genotype and suggested the variations observed among Indians were the result of evolutionary forces: mutation, natural selection, genetic drift and admixture. Of these evolutionary forces, Stewart considered the role of the latter, to have been the least effective.

the only mixture that took place here for many thousands of years was that between groups of much the same genetic make-up. It does not seem likely, therefore, that mixture played a significant role in the development of the American population (Stewart, 1960:264).

Stewart's opinion has remained unchanged through the years. Stewart (1973) wrote that he had seen no evidence to indicate that the earliest American Indians differed importantly from more recent populations. He did not believe the variation among American Indian populations was evidence of past differences in original founding populations.
Unlike Stewart, Georg Neumann (1960) altered his earlier 1952 position. He abandoned the idea of numerous migrations of different populations, suggesting at this time, that only two migrations, that of the Paleoamerinds and the Cenoamerinds, had occurred. Stating that there was little bioanthropological evidence for any large scale migrations, he concluded that many of the morphological types defined in his 1952 paper had differentiated from an original Paleoindian stock. The Cenoamerinds were represented by more recent migrations including the Athabaskans.

The increasing recognition of evolutionary forces is seen in M. T. Newman's later (1962) work on temporal changes in head and body form in the American Indian. It had been generally acknowledged that early crania were dolichocranic and that later crania were brachyocranic. To rule out population replacement as a factor creating this change, Newman studied archaeological samples from areas that demonstrated physical and cultural continuities. He found no evidence for any point of origin for brachycephaly and its consequent spread through gene flow to other populations.

As a result of his research, Newman suggested that the shift to brachyocrania represented in situ evolutionary changes, not gene admixture. He cited evidence for this from regions throughout the United States. At the Perry site in Alabama he provided cranial evidence from two distinct levels, a pre-ceramic and early ceramic strata. Through an estimated 1,000 years, Newman found an increase in the mean male cranial indices from 72.39 to 73.74, and in the mean female indices from 73.39 to 75.32. He also noted that at the Archaic
site of Indian Knoll, cranial indices ranged from 67.4 to 86.0. This suggested to Newman that some biological process was already operating to increase variability. (Laughlin et al. (1979) demonstrated head shape plasticity by documenting a clinal distribution in the cephalic indices of the Aleuts and Eskimos. These indices ranged from 84.19 in the Western Aleutians to 76.84 in Greenland. No causal explanation was offered.)

As evidenced by Newman's work, evolutionary theory and a corresponding appreciation of variation within populations was now firmly entrenched in skeletal analysis. Additionally, in the 1960's, advanced multivariate analytical techniques and increasing use of computers, began to influence studies in skeletal biology. Long (1966) applied multiple discriminant analysis to published cranial data from eastern North American archaeological sites, which, according to Neumann (1952), could be represented by the types of Iswanid, Walcolid, Otamid, and Lenapid. Long's analysis employed the following 14 variables: cranial length, cranial breadth, cranial index, basion-bregma, length-height, upper facial height, upper facial index, nasal height, nasal breadth, nasal index, bizygomatic width, breadth-height index, zygo-frontal index, and transverse fronto-parietal index. On the basis of his analysis, Long concluded that in the sample he had examined, there was no statistical evidence for the Otamid variety. Overlapping and misclassifications between the groups suggested to Long that the Iswanid type had been the "basic American racial group since the earliest occupation of this continent" (Long, 1966:461). Overall, Long's data indicated that Neumann's "types" were
more easily explained by microevolutionary processes rather than remnant reflections of past separate migrations.

In 1967b Genovés criticized the lack of progress in understanding the biological affinities of American Indian populations. He condemned the lack of integrated studies and stated that what was needed was a thorough review of authenticated Paleoindian skeletons and present populations. He suggested that comparison of the material would necessarily have to be made on well-established criteria, both metrical and morphological, and further suggested, as did Birdsell (1951), that a survey of discrete traits and serological data was potentially valuable. Genovés concluded by remarking that some of the variation in modern American Indian populations was certainly due to evolutionary forces but also stated that evolutionary forces alone were not sufficient to explain all of the observed heterogeneity.

POPULATION GENETICS

In 1967, Laughlin hypothesized that on the basis of genetic data, specifically blood types, the external similarities between the American Indians and Asians could be translated into biological affinities attributable to a common ancestry. He rejected the idea of non-Mongoloid traits, noting that the variation observed in American Indian populations could all be contained within the general division of Mongoloids. He added that it was important to recognize that the Asiatic Mongoloids and American Indians had been evolving separately for at least 15,000 years.

Laughlin proposed that the ancestral Aleuts, Eskimos and possibly
the Chukchis (a population on the Chukotka peninsula in northeast Siberia), were more or less permanent residents on the coast and that the population ancestral to the American Indian were the people living in the interior. To Laughlin, Beringia presented two basic types of migration routes into the New World, a coastal and an interior route. Both of these involved a distinct ecological adaptation—a big game hunting adaptation in the interior and a marine exploitation along the coast. Laughlin described the condition in the interior as severe and hypothesized that probably only a few of its inhabitants made their way into North America. These few, according to Laughlin, were the ancestors to the American Indian. The settlers along the coast, exploiting a much more congenial environment, are suggested by Laughlin to be ancestors to the Aleuts and Eskimos.

Laughlin hypothesized that the distribution of the ABO blood types and the Diego factor within the Western hemisphere were reflections of earlier population differences. He noted a high frequency of O in South America, high frequencies of both A and O in North America, and the presence of all three, A, B, and O among the Aleuts and Eskimo. As additional evidence, Laughlin noted that the Diego factor was present in the blood of American Indians and many Asiatic Mongoloids, but that it was absent in Eskimos. To Laughlin, this distribution of Diego and the ABO blood types could be explained by a Mongolid population living on the coast (ancestors to the Eskimo and Aleut) which was bypassed by the ancestors of the American Indian migrating through the interior. Almost 20 years later, Harper and Laughlin (1982) reviewed the accumulating data on the peopling of the New World (much of it archaeological) and
found it to support Laughlin's original 1967 position. They concluded that an early, interior riverine population, (the ancestors of the American Indian), crossed over Beringia approximately 12,000 to 13,000 years ago and followed the Yukon River east.

Laughlin's theory is not without opposition. Alexseev (1979) from the Institute of Ethnography in Moscow, examined the geographic distribution of 20 cranial measurements and indices within Siberia, and concluded just the opposite from Laughlin. Alexseev found clear variations between Siberian populations and defined four general complexes; Uralian, Central Asiatic, Baikal and Arctic. In contrast to Laughlin who emphasized the differences between the Eskimo/Aleut and North American Indians, Alexseev stated that the Arctic complex, represented by the Eskimo, Aleut, and Chukchi, more closely resembled North American Indians "than any other Siberian morphological complex" (Alexseev, 1979:85). The Arctic complex was characterized by Alexseev as having more vertically profiled faces, the most pronounced nasal bones and narrowest nasal aperatures in Siberia. He also noted that "Pre-Aleut" and earlier Eskimo were dolichocranic.

Alexseev believed that the Siberian cranial data supported the idea that Asiatic Mongoloids were the product of two general ancestral stocks— a Pacific Coast and Internal Asiatic. The Arctic complex was thought by Alexseev to be the northern representatives of the Pacific Coast stock while the interior Siberian Mongoloids were considered Internal Asiatics. Alexseev suggested that if the similarities between the Arctic Mongoloids and the American Indian were indeed a reflection of a genetic relationship, then the population ancestral to the North
American Indian inhabited the coastal area of Northern Asia and further that Paleosiberians migrated from Asia to America by following the Asiatic coast northward. From this line of thinking, Alexseev concluded that the internal populations of Siberia "probably had little or nothing to do with the peopling of the New World" (Alexseev, 1979:77).

Data from Siberian populations is of course critical in the understanding of American Indian origins; unfortunately, much of what has been published is in Russian, Alexseev's work being one of the few exceptions. Until other works are translated it is difficult to either criticize or expand on Alexseev's research.

DISCRETE TRAIT ANALYSIS

While Alexseev based his theories on craniometric data, most of the recent studies on American Indian origins have focused on the distribution of discrete traits. (Discrete trait analysis as a method in comparative studies is discussed more fully in Chapter VII.) Turner (1971) examined the worldwide frequency of three-rooted mandibular first molars, which he suggested was an effectively non-adaptive trait and being maintained in Hardy-Weinberg equilibrium. If this is indeed the case, varying frequencies of three-rooted mandibular first molars would reflect differences in founding populations.

Turner found the highest frequency for this trait in Aleuts-Eskimos, ranging between 30-50%. Among Asiatics and American Indians three-rooted mandibular molars appeared at frequencies of 3-8%. Turner who found the trait infrequent among Europeans and Africans, suggested
that the relative homogeneity of "3RM1" frequency within American Indian groups indicated a single Asian origin for the American Indian. The only possible exception he saw to this homogeneity were the Navajo and Zuni sample, which had frequencies of 23% and 40% respectively. Turner also noted that the Navajos were relatively recent arrivals to the American Southwest and were descendents of the northern Athabaskans (Na-Dene), but he could not supply definitive data on the "3RM1" trait for current northern Athabaskans. The Zuni data was, in essence, dismissed by Turner as either a small sample (N=5), an example of genetic drift, or as representative of Navajo admixture.

To explain this variation seen in the frequencies of three-rooted mandibular first molars in the New World, Turner (1971) offered a a three migration hypothesis with "Pre-Indians", "Pre-Na-Dene", and "Pre-Aleut-Eskimo" as the ancestral populations. In his scenario, the "Pre-Indians", the big-game hunters of the Clovis and related cultures, crossed Alaska and spread southward. Subsequent to their migration into the New World, the ancestral Na-Dene occupied central Alaska, and then they too expanded southward. The final migration consisted of the ancestors of the Aleuts and Eskimos.

Turner (1979), expanding his study of dental variants, examined 20 crown and root characteristics in over 900 crania from both Siberia, Russia, and the New World. From this work, Turner defined two Asian dental patterns, sinodonty and sundadonty. He proposed that the American Indian and north Asians shared the general sinodont dental pattern, which he defined as including one root on the upper anterior premolars, three roots on the mandibular first molars, shoveled
did differ though, between the Aleut-Eskimo and Na-Dene, and the rest of the American Indians.

From these dental characteristics, Turner hypothesized that a Paleoindian population, which had their origins in the Lena and/or Yenisei River basins in northeast Siberia (see Fig.6.1), was the ancestral group of most of today's Native Americans. He also suggested that the Aleut-Eskimo origins were in the Amur River basin and the Sea of Okhotsk region (see Fig. 6.1). Estimating the general rate of sinodont microevolution at 1% / 1,000 years, Turner further suggested that the sinodont pattern was no older than 40,000 years.

In 1981 Turner and Bird examined the dentition of a Chilean Paleoindian sample, recent American Indians, north Asians (comprised of Shang Dynasty An-Yang, recent Mongols, Japanese, and a few northeast Siberians), and Europeans, and again concluded that very little dental evolution had occurred in the New World. In this study ten dental traits (incisor shoveling, incisor double shoveling, tuberculum dentale, six cusped lower first molar, Carabelli's trait, Y-groove pattern on the lower second molar, four cusped lower second molar, single-rooted upper third premolar, three-rooted mandibular first molar and single-rooted mandibular second molar) were utilized. Their sample of Chilean Paleoindians was very small, ranging only from 2-7. Nevertheless, this sample provided an interesting point of comparison. Turner and Bird suggested there were indications that incisor shoveling (N=2/2) and double shoveling (N=2/2) were probably common in Paleoindian dentition, as were tuberculum dentale (N=2/2), single-rooted upper third premolar (N=4/4), Carabelli's trait, (N=2/2), six cusps on the first mandibular
(N=4/4), Carabelli's trait, (N=2/2), six cusps on the first mandibular molar (N=1/2), and three-rooted mandibular first molars (N=1/3).

Overall, Turner and Bird found the Chilean Paleoindian sample, more recent American Indian, and the north Asian samples to be remarkably similar, and because of this lack of genetic diversity, they proposed that the original Paleoindian population was small, homogeneous and entered the New World late in the Pleistocene. They further proposed that "there was probably no other significant immigration until the arrival of today's Arctic Mongoloids, the Aleuts and Eskimos" (Turner and Bird, 1981:1054). Additionally, Turner and Bird (1981) noted that the Paleoindian and more recent American Indian teeth are very different from those of Europeans but that the teeth of modern Asians are even more dissimilar to the Europeans. Though acknowledging their small sample, Turner and Bird suggested this may be viewed as "a clue to a more precise region in Eurasia where Paleoindians orginated" (Turner and Bird, 1981:1054), indicating as did Birdsell (1951), that the Mongoloid traits evident today were relatively late developments, and Amerindians had pre-Mongoloid origins. In this paper Turner and Bird did not specify a particular area in Asia for Paleoindian origins.

Most recently, Turner (1983) again presented his three migration scenario based upon dental evidence. While noting that the Na-Dene, Aleut-Eskimo, and the rest of American Indians are all sinodonts, he commented that the dentition of the American Indians, the ancestors of the Paleoindians, "do shift slightly in some features toward the European condition" (Turner, 1983:156). Because of the small amount of dental evolution that had occurred in the New World, Turner believes
that the Na-Dene, Aleut-Eskimo, and Paleoindians began diverging in Siberia through isolation.

Turner (1983) reiterated his hypothesis that the Paleoindians migrated from the Lena River basin in northeast Siberia into Beringia, and suggested that they had done so by 15,000 years ago. He also suggested that the ancestral Na-Dene, who had inhabited the riverine and boreal forests in northeast Siberia, crossed into Alaska between 14,000 and 12,000 years ago. Lastly, the ancestral Aleut-Eskimo entered Alaska approximately 8,500 years ago by way of the now-submerged southern coast of Beringia. He did note the possibility that these peoples may have been on the coast before the Na-Dene crossed into Alaska.

As population genetics has become a more exact discipline, attention has also been focused on the distribution of alleles at loci controlling traits such as serum proteins, red cell antigens, and enzyme systems. Lampl and Blumberg (1979) suggested tracing American Indian origins by locating genes of polymorphic loci found exclusively in American Indians and in Asian populations. They discussed a number of different genes potentially useful in this approach to American Indian origins, focusing particularly on serum albumins. These albumin polymorphisms were suggested as possibly the most useful markers in identifying American Indian affinities. Albumins Naskapi and Mexico have been found in North American and Central American populations and in no others. In South America, unique albumins, typed Makiritara and Yanomano-2 have been identified. If these albumins could be located in Asiatic populations, Lampl and Blumberg stated this would offer a strong argument for their biological affinities to American Indians. They did caution however,
that this technique would not be valid if it was discovered that gene frequencies had changed very differently in the two continents through drift, admixture or natural selection.

Kirk (1979), as did Laughlin (1967), reported that the distribution of the Diego reaction appears to be a specific Mongoloid marker carried into the New World, varying in frequency among American Indian populations from 0% to 40%. Szathmary (1979) produced dendograms and mini-string trees based on the frequencies of ABO, Rh, MNSs, Diego, Duffy, Kell, Kidd and P loci. Each technique identified separate Eskimo and Na-Dene clusters. To Szathmary, this separation of Indian populations into clusters by blood groups suggested successive waves of immigration.

While of no direct application with skeletal data, blood group analysis as well as other non skeletal data, can be used to test hypotheses based on skeletal traits as well as to frame new specific research questions. Williams et al. (1985) examined current distributions of GM allotypes (antigen markers on immunoglobulin) with respect to Turner's original three migration hypothesis. The findings, based on blood typings from over 5,000 American Indians were consistent with three migrations. They reported distinct GM distributions for the Pimans, Puebloans and Pau (considered descendents of Paleoindians), the Apache and Navajo (related to the Na-Dene), and for the Eskimo-Aleuts. Additionally, they reported that an analysis of the GM allotypes in 34 Central and South American Indian tribes was consistent with a single migration of Paleoindians into these southern areas. What GM data that are available for East Asia suggests that the Paleoindians originated in
the northeast region.

Most recently however, Wallace et al. (1985) proposed possibly contrary evidence to the three migration theory, based on the examination of distinctive mitochondrial DNA in Southwest Amerindian groups. They found that the mtDNAs contained Asian restriction fragment length polymorphisms but at different frequencies than recorded for Asians. They also reported that different Amerind tribes had distinctive mtDNAs. As mtDNA is inherited through the maternal line, Wallace et al. hypothesized that American tribes were founded by a small number of maternal lineages, and that all Americans are descended from Asians who crossed into North America within the past 15,000 years. Wallace et al. concluded that they were at odds against the three migration hypothesis, but they also tied the three migration hypothesis to a different time frame (Paleoindians arriving between 40,000 and 20,000 years ago) than that proposed by Turner. Consequently, it is not clear if the disagreement is based on the time involved or not. They did suggest that mtDNA variation should be investigated in the hypothesized descendents of the Na Dene, and Aleut-Eskimo and Paleoindian populations.

APPLICATIONS

This chapter has reviewed the present history of theories on the peopling of the New World. Can these theories though, be translated into hypotheses with regard to particular characteristics that are recoverable in the archaeological record? Though recognizing
intrapopulation variation, human populations can generally be characterized by various physical attributes. What then have these theories suggested, and are there agreements between them?

In terms of metric data little can be gleaned from these theories other than the apparent agreement that early immigrants to the New World were characterized by dolichocrany, or long crania in relation to breadth (Dixon, 1923; Hrdlička, 1923; Hooten, 1933; Birdsell, 1951; Neumann, 1952; Angel, 1966; and Alexseev, 1979). In terms of other cranial indices, (length to height and breadth to height), and facial characteristics, there is little consistency. Aside from all being dolichocranic, Dixon's (1923) hypothesized early populations, the Caspian, Mediterranean, Proto-Negroid and Proto-Australoid were described as having average height skulls with narrow noses, low skulls with narrow noses, average height skulls with broad noses, and low skulls with broad noses respectively. Hooten's (1933) three dolichocranic types, which were reported in greater frequencies in the lower strata at Pecos Pueblo, also apparently shared little in common other than dolichocrany. Hooten's Pseudo-Negroid had low skulls and broad noses as did Dixon's Proto-Negroid; the Basket-Makers and Pseudo-Australoid possessed high skulls in relation to both breadth and length.

Many of these theories have also suggested certain non-metric morphological traits as characteristic of Paleoindian populations. Hooten (1933), Birdsell (1951), and Neumann (1952) each hypothesized that the earliest immigrants probably had heavy supraorbital ridges; Neumann also believed the earliest arrivals, as characterized by his
Otamid type, would have had a prominent glabella, some sagittal elevation, and a "bun-shaped" occiput.

Turner (1971, 1979, 1983) and Turner and Bird (1981), focusing on dental traits, have suggested that Paleoindian populations could be characterized by relatively high frequencies of three-rooted mandibular first molars, incisor shoveling, incisor double shoveling, single-rooted upper third premolars, six cusped lower first molars, Carabelli's trait, and tuberculum dentale. Theoretically, discrete dental traits such as these, thought to be little affected by environmental forces, and generally recoverable in the archaeological record, may ultimately prove to be of greatest value in pinpointing the Old World origins, and at least establishing the dental characteristics of early man in the New World. Questions however do remain, and are discussed in the concluding chapter.

The key word in this discussion of course, has been "population". As discussed in Chapter V, documented human skeletal remains of Paleoindian age are rare in the Western hemisphere, and though Paleoindians as a group may be characterized by certain frequencies of particular traits, as hypothesized by Turner and Bird (1981), these may or may not be reflected in isolated skeletal finds. Until there is a larger Paleoindian skeletal sample, as well as a larger sample from the supposed parental populations in Asia, we do not yet have sufficient data to definitively answer either the question of Paleoindian population characteristics or their specific origins in Asia.
CHAPTER VII

COMPARATIVE STUDIES

INTRODUCTION

Physical anthropologists have long been interested in defining human populations and the relationships between them. Of particular note are the biological distance studies such as those authored by Jantz (1973) and Droessler (1981) which not only define populations but place populations into an evolutionary framework. Advances in multivariate statistics, as studies like these and others demonstrate, make the problem of defining more distinct parameters for prehistoric populations approachable. The North American Paleoindians however present a difficult subject in this regard as the Paleoindian sample is comprised of few and fragmentary remains, which are spread over a wide geographic area, and separated temporally by hundreds if not thousands of years. In short, the presently documented Paleoindian skeletal sample consists of individuals, from unknown populations with undefined parameters. Attempts to assess the population affinities of the Horn Shelter skeletons are then, by the limited nature of the sample, speculative propositions. In an attempt to gain the most informative perspective possible on these individuals from Horn Shelter, they will be compared to both regional populations and a temporal sample comprised of the other accepted Paleoindian skeletons as established in Chapter V. The ultimate objective of such comparisons is to determine if these representatives of Paleoindians can be distinguished from more recent Amerind populations.
REGIONAL COMPARISON

The first question to be addressed is simply, does the population represented by the two recovered skeletons at Horn Shelter differ significantly from later populations in the same geographic area? To answer this question the Horn material is compared to more recent central Texas populations on 1) cranial measurements, 2) post-cranial measurements, and 3) discrete traits. Large samples from single sites with strict temporal control would be ideal in such a comparative analysis, but the nature of the present collection of central Texas skeletal populations requires a compilation of several sites and time periods. There was not a single central Texas skeletal population sufficiently intact to be of comparative value in this study. Consequently, this study utilizes the skeletons recovered from four separate central Texas sites: Loeve-Fox (41WM230) from Williamson County; Willison Farm (41BL3) from Bell County; Aycock Shelter (41BL28) also from Bell County and what is known as the "Mass Burial at Waco" from McClenann County (Fig. 7.1). As the Horn Shelter adult is a male, and human populations generally show significant metric differences between the two sexes, only the male individuals from these four populations were used in the comparative metric analysis.

The largest central Texas skeletal population, intact enough to have comparative value, comes from Loeve-Fox (41WM230), a site occupied intermittently from approximately 3,400 to 200 years BP (Prewitt, 1981). Skeletal material representing a total of 27 individuals (Butler, n.d.) as recovered from levels dating to roughly 900 years BP (Prewitt, 1974).
Fig. 7.1. Location map of Texas sites mentioned in text.
- Paleoindian Sites
  1 Scharbauer
  2 J.C. Putnam
  3 Horn
  4 Wilson-Leonard

- Post-Paleoindian Sites
  5 Waco
  6 Aycock
  7 Williams Farm
  8 Loeve-Fox
  9 McClure
  10 H. Wilson

Cities

0 100 mi. 150 km.
The data, both metric and non-metric, used in this study is taken from Butler's (n.d.) osteological analysis. The skeletal material, now at North Texas State in Denton, is to be shipped to TARL (Texas Archeological Research Laboratory) in Austin.

The R. T. Willison Farm (41BL3), located on Owl Creek in Bell County, was excavated by A.T. Jackson and students from the University of Texas in 1933. The burials excavated were associated with Bulverde, Marshall, Perdenales, Marcos, and Ensor points. Combined, these point types span the period between roughly 5,000 to 1,100 years BP. Dr. Harry Shafer (personal communication, 1986) suggests though that this time span could be reduced to ca 1500-400 years BP because this type of site (a rockshelter) was not used for burials until relatively late. The skeletal material now housed at TARL, was examined by this author; thirteen crania were sufficiently intact to be measured and scored for discrete traits.

Aycock (41BL28), also known as Kell Branch Shelter No. 1, is a rockshelter on the Kell Branch of the Leon River. This site was excavated by members of the Central Texas Archeological Society in late 1935 and early 1936. They recovered 31 skeletons in all; Aynesworth (1936) noted that the individual burials were at irregular depths and suggested that they represented a sample accumulated over a long period of time. Projectile points associated with the skeletons range from Ensor (2,150 - 1350 years BP) to Perdiz (750 - 350 years BP). Aynesworth (1936) provided only a limited number of cranial measurements: maximum length, maximum breadth, basion-bregma, nasal height, and nasal breadth. The crania, thought to be housed at the
Streucker Museum, Baylor University, could not be located to re-measure.

The fourth central Texas sample utilized in this study is the "Mass Burial At Waco" in McLennan County. This burial site, located on the west side of the Brazos River terrace, was excavated by Baylor University students and members of the Central Texas Archeological Society in the early 1930s. Meroney (1937) suggested that the site did not represent an accumulation through time, but rather a single event. Three Alba points (1150 - 650 years BP) and a Caddoan ear spool indicate a relatively late date, ca 1,000-900 years BP. Twelve individuals were recovered.

Cranial comparison

Table 7.1 compares the seven available cranial measurements from the Horn Shelter adult to the means, standard deviations, and ranges of the same measurements from the combined male crania from the aforementioned central Texas sites. Table 7.2 provides the same information for each of the separate central Texas sites. As both tables show, the Horn Shelter adult falls within one standard deviation of most of the combined central Texas means, with two exceptions, that of maximum breadth and minimum frontal. The minimal frontal measurement on the Horn adult falls outside of one standard deviation but does fall within the minimum and maximum values; the Horn adult's maximum cranial breadth does not fall within the range of this combined central Texas sample. It should be noted that post-mortem damage on the Horn Shelter adult made possible only an estimate of maximum cranial breadth.
Table 7.1 Mean cranial measurements of central Texas males and the Horn Shelter adult (Measurements from the Horn Shelter adult which fall outside of one standard deviation are marked by asterisks.)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>St.Dev.</th>
<th>Range</th>
<th>Horn Shelter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. length</td>
<td>30</td>
<td>183.20</td>
<td>7.14</td>
<td>170.0 - 195.0</td>
<td>187</td>
</tr>
<tr>
<td>Max. breadth</td>
<td>29</td>
<td>130.78</td>
<td>4.49</td>
<td>120.0 - 137.0</td>
<td>140 **</td>
</tr>
<tr>
<td>Min. frontal</td>
<td>15</td>
<td>89.40</td>
<td>4.36</td>
<td>77.0 - 96.0</td>
<td>95 **</td>
</tr>
<tr>
<td>Nasal breadth</td>
<td>18</td>
<td>25.06</td>
<td>1.63</td>
<td>22.5 - 29.0</td>
<td>24</td>
</tr>
<tr>
<td>Ramus height</td>
<td>10</td>
<td>63.00</td>
<td>5.42</td>
<td>56.0 - 71.0</td>
<td>61</td>
</tr>
<tr>
<td>Ramus breadth</td>
<td>13</td>
<td>33.85</td>
<td>2.17</td>
<td>31.0 - 37.5</td>
<td>32</td>
</tr>
<tr>
<td>Bigonial breadth</td>
<td>11</td>
<td>100.36</td>
<td>6.19</td>
<td>92.0 - 113.0</td>
<td>101</td>
</tr>
</tbody>
</table>

Table 7.2 Male cranial measurements from separate central Texas sites (The measurements from the Horn Shelter adult which fall outside of one standard deviation are marked by asterisks.)

<table>
<thead>
<tr>
<th>Loeve-Fox</th>
<th>N</th>
<th>Mean</th>
<th>Std.Dev.</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. length</td>
<td>11</td>
<td>188.00</td>
<td>5.33</td>
<td>176.50 - 195.00</td>
</tr>
<tr>
<td>Max. breadth</td>
<td>11</td>
<td>129.32</td>
<td>3.46</td>
<td>123.00 - 135.00 *</td>
</tr>
<tr>
<td>Min. frontal</td>
<td>10</td>
<td>91.00</td>
<td>2.71</td>
<td>87.00 - 96.00 *</td>
</tr>
<tr>
<td>Nasal breadth</td>
<td>6</td>
<td>25.67</td>
<td>2.09</td>
<td>22.50 - 29.00</td>
</tr>
<tr>
<td>Ramus height</td>
<td>8</td>
<td>62.75</td>
<td>5.50</td>
<td>56.00 - 71.00</td>
</tr>
<tr>
<td>Ramus breadth</td>
<td>9</td>
<td>33.50</td>
<td>2.05</td>
<td>31.00 - 36.50</td>
</tr>
<tr>
<td>Bigonial breadth</td>
<td>7</td>
<td>100.29</td>
<td>4.19</td>
<td>96.00 - 106.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Willison</th>
<th>N</th>
<th>Mean</th>
<th>Std.Dev.</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. length</td>
<td>5</td>
<td>179.80</td>
<td>8.52</td>
<td>171.00 - 192.00</td>
</tr>
<tr>
<td>Max. breadth</td>
<td>4</td>
<td>133.50</td>
<td>2.52</td>
<td>131.00 - 137.00 *</td>
</tr>
<tr>
<td>Min. frontal</td>
<td>5</td>
<td>86.20</td>
<td>5.54</td>
<td>77.00 - 91.00 *</td>
</tr>
<tr>
<td>Nasal breadth</td>
<td>3</td>
<td>25.33</td>
<td>1.53</td>
<td>24.00 - 27.00</td>
</tr>
<tr>
<td>Ramus height</td>
<td>2</td>
<td>64.00</td>
<td>7.07</td>
<td>59.00 - 69.00</td>
</tr>
<tr>
<td>Ramus breadth</td>
<td>4</td>
<td>34.63</td>
<td>2.56</td>
<td>32.00 - 37.50</td>
</tr>
<tr>
<td>Bigonial breadth</td>
<td>4</td>
<td>100.50</td>
<td>9.61</td>
<td>92.00 - 113.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Waco</th>
<th>N</th>
<th>Mean</th>
<th>Std.Dev.</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. length</td>
<td>5</td>
<td>181.00</td>
<td>4.74</td>
<td>174.00 - 187.00</td>
</tr>
<tr>
<td>Max. breadth</td>
<td>5</td>
<td>133.00</td>
<td>1.22</td>
<td>132.00 - 135.00 *</td>
</tr>
<tr>
<td>Nasal breadth</td>
<td>5</td>
<td>24.40</td>
<td>1.34</td>
<td>23.00 - 26.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Aycock</th>
<th>N</th>
<th>Mean</th>
<th>Std.Dev.</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. length</td>
<td>9</td>
<td>180.44</td>
<td>7.14</td>
<td>170.00 - 190.00</td>
</tr>
<tr>
<td>Max. breadth</td>
<td>9</td>
<td>131.11</td>
<td>6.49</td>
<td>120.00 - 136.00 *</td>
</tr>
<tr>
<td>Nasal breadth</td>
<td>4</td>
<td>24.75</td>
<td>1.50</td>
<td>23.00 - 26.00</td>
</tr>
</tbody>
</table>

Examining this cranial data for each of the four separate sites, the maximum breadth of the Horn adult's cranium, as already seen in Table
7.1 falls outside of one standard deviation of the mean for each of the sites and outside of the ranges for this particular trait. The minimum frontal on the Horn adult falls outside one standard deviation of the mean for the Loeve-Fox male crania but does fall within the range; it does not fall within the range of minimal frontal data for the Willison Farm sample. (Data on minimal frontal was not available for either the Aycock or Mass Burial site.)

Are these differences however statistically significant? A t-test tests whether or not the differences in means between two samples could have occurred on the basis of random sampling. In this instance, where the sample size of one of the populations is a single individual, a point t-test is utilized. The calculation of a point t-test is given by the formula:

\[
\frac{Y_1 - Y_2}{S_2 \sqrt{\frac{N_2 + 1}{N_2}}} \]

with \(Y_1\) being the value for the single specimen, \(Y_2\) the sample mean, \(S_2\) the sample standard deviation and \(N_2\) the sample size. The degrees of freedom is the value of \(N_2 - 1\) (Sokal and Rohlf, 1969:224). Using a significance level of .01 (the probability of making a Type I error or rejecting a set of assumptions when it is true), none of the Horn Shelter adult's cranial measurements are significantly different from the more recent central Texas aboriginal samples examined in this study.

To assess if the Paleoindian sample as a whole displayed any significant differences from the later Texas Indians, t-tests were run on 11 cranial measurements. The Paleoindian sample was comprised of the
Horn Shelter adult and the five other accepted Paleoindian skeletons as established in Chapter V; Pelican Rapids, Minnesota; Browns Valley, Minnesota; J.C. Putnam, Texas, Midland, Texas, and Gordon Creek, Colorado. With a significance level of .01, the only significant difference between these two samples is the maximum cranial breadth (Table 7.3). Certainly, however, a wider cranial breadth can not serve to distinguish Paleoindian crania from all more recent aboriginal crania. To cite just one example, Bass (1964) reported a mean cranial breadth of a Central Plains sample at 143.00 mm.

Table 7.3 T-tests on the Paleoindian and central Texas cranial measurements

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample</th>
<th>N</th>
<th>Mean</th>
<th>Std.Dev.</th>
<th>Std.Error</th>
<th>T</th>
<th>Prob.&gt; T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. length</td>
<td>Paleo 5</td>
<td>183.00</td>
<td>7.62</td>
<td>3.41</td>
<td>.75</td>
<td>.455</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Central 65</td>
<td>180.44</td>
<td>7.33</td>
<td>.91</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. breadth</td>
<td>Paleo 5</td>
<td>136.80</td>
<td>6.26</td>
<td>2.80</td>
<td>2.78</td>
<td>.007</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Central 62</td>
<td>130.13</td>
<td>5.07</td>
<td>.64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Min. frontal</td>
<td>Paleo 5</td>
<td>93.40</td>
<td>2.70</td>
<td>1.21</td>
<td>2.44</td>
<td>.021</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Central 26</td>
<td>88.62</td>
<td>4.12</td>
<td>.82</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basion-bregma</td>
<td>Paleo 3</td>
<td>137.00</td>
<td>8.66</td>
<td>5.00</td>
<td>2.41</td>
<td>.020</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Central 49</td>
<td>122.49</td>
<td>10.17</td>
<td>1.45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasal height</td>
<td>Paleo 3</td>
<td>48.23</td>
<td>2.14</td>
<td>1.23</td>
<td>1.78</td>
<td>.084</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Central 30</td>
<td>37.93</td>
<td>9.85</td>
<td>1.80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasal breadth</td>
<td>Paleo 3</td>
<td>23.90</td>
<td>2.46</td>
<td>1.23</td>
<td>-0.03</td>
<td>.976</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Central 33</td>
<td>23.93</td>
<td>2.50</td>
<td>.44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orbit height</td>
<td>Paleo 3</td>
<td>32.90</td>
<td>3.48</td>
<td>2.01</td>
<td>-1.18</td>
<td>.860</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Central 12</td>
<td>33.00</td>
<td>2.00</td>
<td>.58</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orbit breadth</td>
<td>Paleo 3</td>
<td>37.67</td>
<td>.58</td>
<td>1.34</td>
<td>-1.44</td>
<td>.173</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Central 12</td>
<td>39.67</td>
<td>4.64</td>
<td>1.34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ramus height</td>
<td>Paleo 4</td>
<td>58.75</td>
<td>9.74</td>
<td>4.87</td>
<td>.08</td>
<td>.936</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Central 22</td>
<td>58.45</td>
<td>6.14</td>
<td>1.31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ramus breadth</td>
<td>Paleo 4</td>
<td>34.43</td>
<td>2.06</td>
<td>1.03</td>
<td>1.32</td>
<td>.198</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Central 25</td>
<td>32.72</td>
<td>2.44</td>
<td>.49</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bigonial width</td>
<td>Paleo 5</td>
<td>104.40</td>
<td>10.60</td>
<td>4.74</td>
<td>2.08</td>
<td>.048</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Central 21</td>
<td>96.47</td>
<td>6.90</td>
<td>1.51</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Post-cranial comparison

This post-cranial comparison utilizes data compiled by Doran (1975) in an unpublished master's thesis from the University of Texas at Austin. Doran (1975) examined the variation in the maximum lengths of long bones between Texas Indian populations. His sample consisted of skeletal material from what he defined as four distinct archaeological areas: the Caddo (or east Texas) agriculturalists; hunter-gatherers in central Texas; hunter-gatherers in coastal Texas who also exploited marine resources; and the hunter-gatherers in the Trans-Pecos region. There was no attempt at temporal control beyond separating the historic from the prehistoric. Overall, Doran commented that there was a relative homogeneity between these areal subsamples, but also that there were consistent though small differences. The available post-cranial measurements from the Horn Shelter adult is compared with the measurements compiled by Doran in Table 7.4. The maximum lengths could only be measured on four of the Horn Shelter adult's long bones: the right humerus, right ulna, right radius, and the right femur.

Table 7.4 Maximum lengths of long bones in centimeters: Texas areal samples and the Horn Shelter adult (after Doran, 1975)

<table>
<thead>
<tr>
<th>Humeri</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central</td>
<td>16</td>
<td>32.5</td>
<td>1.6</td>
<td>29.7 - 36.3</td>
</tr>
<tr>
<td>Caddo</td>
<td>12</td>
<td>32.8</td>
<td>1.5</td>
<td>30.4 - 34.6</td>
</tr>
<tr>
<td>Coastal</td>
<td>10</td>
<td>32.7</td>
<td>1.9</td>
<td>29.5 - 36.5</td>
</tr>
<tr>
<td>Trans-Pecos</td>
<td>3</td>
<td>29.5</td>
<td>2.7</td>
<td>26.8 - 32.3</td>
</tr>
<tr>
<td>Horn Shelter</td>
<td>1</td>
<td>31.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ulnae</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central</td>
<td>7</td>
<td>27.0</td>
<td>1.2</td>
<td>24.8 - 28.5</td>
</tr>
</tbody>
</table>
Table 7.4 cont'd.

<table>
<thead>
<tr>
<th>Region</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caddo</td>
<td>6</td>
<td>28.1</td>
<td>1.2</td>
<td>25.8 - 29.3</td>
</tr>
<tr>
<td>Coastal</td>
<td>8</td>
<td>27.6</td>
<td>1.4</td>
<td>25.2 - 29.4</td>
</tr>
<tr>
<td>Trans-Pecos</td>
<td>2</td>
<td>25.1</td>
<td>-</td>
<td>23.8 - 26.4</td>
</tr>
<tr>
<td>Horn Shelter</td>
<td>1</td>
<td>26.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Region</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radii</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central</td>
<td>10</td>
<td>25.2</td>
<td>.9</td>
<td>23.3 - 26.5</td>
</tr>
<tr>
<td>Caddo</td>
<td>5</td>
<td>26.3</td>
<td>.7</td>
<td>25.6 - 27.2</td>
</tr>
<tr>
<td>Coastal</td>
<td>8</td>
<td>25.6</td>
<td>1.3</td>
<td>23.2 - 27.1</td>
</tr>
<tr>
<td>Trans-Pecos</td>
<td>3</td>
<td>24.1</td>
<td>1.7</td>
<td>22.1 - 25.4</td>
</tr>
<tr>
<td>Horn Shelter</td>
<td>1</td>
<td>25.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Region</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Femora</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central</td>
<td>16</td>
<td>45.4</td>
<td>1.9</td>
<td>42.0 - 48.5</td>
</tr>
<tr>
<td>Caddo</td>
<td>14</td>
<td>45.4</td>
<td>1.6</td>
<td>41.6 - 44.7</td>
</tr>
<tr>
<td>Coastal</td>
<td>8</td>
<td>46.6</td>
<td>1.2</td>
<td>45.1 - 49.0</td>
</tr>
<tr>
<td>Trans-Pecos</td>
<td>4</td>
<td>43.6</td>
<td>1.8</td>
<td>41.1 - 45.0</td>
</tr>
<tr>
<td>Horn Shelter</td>
<td>1</td>
<td>43.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The lengths of the Horn Shelter adult's ulna, radius, and femur fall outside one standard deviation of the means for the Caddo sample, and the Horn's femoral length also falls outside one standard deviation of the Coastal sample. On all other measurements the Horn Shelter values do fall within one standard deviation of the means for each bone for each group. Point t-tests showed no significant differences between the maximum lengths of the Horn Shelter adult's long bones with the mean maximum lengths of any of the areal Texas groups.

Table 7.5 shows that with the exception of the maximum length of the femur, the values for the Horn Shelter adult are consistently closer to the central Texas populations, followed by the Trans-Pecos and coastal groups, and is least like the Caddo. Recognizing the problem of the small samples, Loeve-Fox data was added to the central data compiled by
Doran (1975). These new totals are presented in parentheses to the right of the central Texas figures in Table 7.5. With 11 added humeri to the sample, the Horn Shelter was slightly more distant from the central mean but still closer to the central group than to any of the others. The lower arm bones also followed this pattern. With nine additional ulnae and radii, the Horn Shelter individual was further from the central means of both, but still were closer to the central mean than to any of the other populations. The additional femora (12) resulted in the Horn femur being closer to the central Texas mean value.

Table 7.5 Differences in centimeters between Horn Shelter maximum lengths and the means from areal subsamples in Texas

<table>
<thead>
<tr>
<th></th>
<th>Central</th>
<th>Caddo</th>
<th>Coastal</th>
<th>Trans-Pecos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humerus</td>
<td>.9 (.91)</td>
<td>1.2</td>
<td>1.1</td>
<td>-2.1</td>
</tr>
<tr>
<td>Femur</td>
<td>1.8 (1.7)</td>
<td>1.8</td>
<td>3.0</td>
<td>(no difference)</td>
</tr>
<tr>
<td>Radius</td>
<td>.2 (.58)</td>
<td>1.3</td>
<td>.6</td>
<td>.9</td>
</tr>
<tr>
<td>Ulna</td>
<td>.3 (.61)</td>
<td>1.4</td>
<td>.9</td>
<td>-1.6</td>
</tr>
</tbody>
</table>

Even ignoring the question of small sample sizes for the other areal groups, it is difficult to interpret these results. Doran (1975) rightly noted that as the maximum length of long bones is influenced by both genetic and environmental factors, it is difficult to assess what any variation in long bone lengths actually means. While it is interesting that the Horn values most closely approximate the central Texas sample, such limited evidence can not be used to suggest that regional differentiation of populations was already established by 9,000 years ago. The variation in maximum lengths may simply reflect different
nutritional levels; with the exception of the femur, the Caddoan agriculturalists, have longer bone lengths than any of the other three areal groups who were all hunter-gatherers. Interestingly, all four of the maximum length measurements of the Horn adult fall on the low side of the central Texas ranges. Whether or not these lower values for the Horn individual reflect a lower nutritional status than more recent central Texas populations is of course, impossible to determine. In summary, what can be said is that the Horn Shelter post-cranial material is not significantly different from any of the more recent Indians populations as reported by Doran (1975).

Discrete trait analysis

Numerous authors have recommended using non-metric morphological traits in establishing the biological affinities of human populations (Spuhler, 1954; Laughlin and Jørgensen, 1956; Berry and Berry, 1967; Anderson, 1968; Ossenberg, 1969; Finnegan, 1978; Finnegan and McGuire, 1979). Spuhler (1954) hypothesized that such discontinuous, or discrete, traits were the traits most likely to be controlled by simple modes of inheritance and less affected by environmental forces. Consequently, he suggested that discrete trait analysis could accurately reflect population genotypes and the biological distance between populations.

To test this hypothesis, Laughlin and Jørgensen (1956) recorded both metric data and the frequency of seven discrete traits in four separate series of Eskimo crania from the Northwest, Southwest, Southeast, and Northeast regions of Greenland. These Greenland populations presented a unique opportunity to test the genetic basis of non-metrical traits for
the histories and the paths of migration of these populations were known. All of the Eskimos had entered the island at one point (Cape York) and, as the interior was blocked with ice, subsequently moved in two opposite directions along the coast of the island. As a result, the Eskimo populations of Greenland were spread in a ring distribution with no exchange of genes possible across the interior.

From this known history, Laughlin and Jørgensen hypothesized that the greatest biological distance should be between the two terminal isolates of these two lines of migration, specifically, the Southeast and the Northeast populations. They calculated coefficients of divergence from both metric and non-metric data and, with each set of data, found evidence of relatively great biological distance between the Southeast and Northeast population isolates. From this initial test, Laughlin and Jørgensen concluded that discrete trait analysis was useful in determining biological distance, even though actual gene frequencies could not be computed.

Since Laughlin and Jørgensen's original work, the use of discrete trait analysis has met with some criticism (Rightmire, 1972; Corruccini, 1974; Armelagos et al., 1982; Richtsmeier and McGrath, 1986), and has also, in some instances, produced questionable results. Berry and Berry (1967) using a discrete cranial traits found the expected similarities between a stratigraphic sequence of Egyptian skulls, but using the same traits, they also found American Indians to be quite similar to an Ashanti population in Nigeria. From such results as these, El-Najjar and McWilliams (1978) concluded that non-metric trait analysis has more validity when applied to populations already suspected to be related,
but less reliable in comparing widely separated groups. They also noted that no studies had yet established definite modes of inheritance for any of the discrete traits used in comparative analyses.

Since the 1970s research has expanded on the utilization of discrete traits. Finnegar and Rubison (1984) and Finnegar and McGuire (1979) explored the possibility of devising a statistic where an individual cranium or skeleton could be accurately assigned to specific populations on the basis of discrete trait analysis. This could be of great value in archaeological work but, as Finnegar and McGuire (1979) noted, such assessments are predicated on the availability of discrete trait data on the necessary parent populations. Ossenberg also noted that "ranges of trait frequencies in both time and space must be established, as these are the osteological yardsticks by means of which populations affinities can be assessed" (Ossenberg, 1969:23). This does of course, severely limit the present potential of discrete trait analysis as it can be applied to Paleoindian biological affinities. Such discrete trait data is not generally available for either the parental populations in Siberia or the Paleoindian skeletal population in North America, if indeed a Paleoindian population can be defined.

Despite these limitations though, discrete trait analysis can still be of value in obtaining some sense of how similar or dissimilar the Horn Shelter skeletal material is to more recent aboriginal populations in central Texas. In this particular comparative analysis, the central Texas sample is comprised of skulls examined by the author from the sites of Willison Farm, McClure Mound, and the Hugh Wilson Farm; the discrete traits noted by Butler (n.d.) on the Loeve-Fox material are
presented separately. (Discrete trait data were not available for the Aycock or Waco sites, so the author added data of the four skulls excavated from McClure Mound (41WM8), in Williamson County and two skulls recovered from the Hugh Wilson site (41CD37) in Colorado County (see Fig. 7.1).

Table 7.6 provides a list of 21 discrete traits commonly used in such non-metric analyses (Berry and Berry, 1967; El-Najjar and McWilliams, 1978; Ubelaker, 1981) and their frequencies in both the composite central Texas sample described above and the Loeve-Fox sample. The total (N) for each particular observation varies as post-mortem damage made some observations impossible on some of the skulls, and not all of the traits listed were scored by Butler in her analysis of the Loeve-Fox material.

There appears to be a general uniformity within central Texas populations. Overall, traits that do not appear in the combined central Texas sample do not appear in the Loeve-Fox sample nor in the two individuals from Horn Shelter. The only possible exception to this apparent homogeneity is the frequency of mylohyoid bridges which appear in 14% of the Loeve-Fox individuals, but which do not appear in either the composite central Texas sample nor in the Horn individuals.

Conversely, the traits that do appear in relatively high frequencies in the composite central Texas and Loeve-Fox samples (lambdoid ossicles, supraorbital foramina, frontal notch or multiple foramina, and extrasutural mastoid foramina) also appear in the Horn Shelter individuals. The exceptions to this are the presence of parietal foramina which appear at frequencies of 72% and 46% in the central Texas
Table 7.6 Discrete trait frequencies in central Texas and Horn Shelter samples

<table>
<thead>
<tr>
<th>Observation per skeleton</th>
<th>Composite central Texas sample</th>
<th>Loeve-Fox sample</th>
<th>Horn Shelter sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>highest nuchal line present</td>
<td>1</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>coronal ossicles</td>
<td>1</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>ossicle at bregma</td>
<td>1</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>ossicle at lambda</td>
<td>1</td>
<td>18</td>
<td>2</td>
</tr>
<tr>
<td>lambdoid ossicles</td>
<td>2</td>
<td>18</td>
<td>4</td>
</tr>
<tr>
<td>parietal foramina</td>
<td>1</td>
<td>18</td>
<td>13</td>
</tr>
<tr>
<td>parietal notch bone</td>
<td>2</td>
<td>31</td>
<td>1</td>
</tr>
<tr>
<td>asterionic bone</td>
<td>2</td>
<td>34</td>
<td>0</td>
</tr>
<tr>
<td>auditory torus</td>
<td>2</td>
<td>34</td>
<td>0</td>
</tr>
<tr>
<td>accessory infraorbital foramina</td>
<td>2</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>epiteric bone</td>
<td>2</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>supra-orbital foramen complete</td>
<td>2</td>
<td>36</td>
<td>18</td>
</tr>
<tr>
<td>frontal notch or foramen present</td>
<td>2</td>
<td>36</td>
<td>24</td>
</tr>
<tr>
<td>metopic suture</td>
<td>1</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>mylohyoid bridge</td>
<td>2</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>palatine torus</td>
<td>1</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>foramen of Huschke</td>
<td>2</td>
<td>27</td>
<td>7</td>
</tr>
<tr>
<td>condylar facet double</td>
<td>2</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>mastoid foramen absent</td>
<td>2</td>
<td>22</td>
<td>2</td>
</tr>
<tr>
<td>mastoid foramen exsutural</td>
<td>2</td>
<td>29</td>
<td>7</td>
</tr>
<tr>
<td>post-condylar canal patent</td>
<td>2</td>
<td>15</td>
<td>5</td>
</tr>
</tbody>
</table>

189
sample and Loeve-Fox sample respectively, but do not appear in either of 
the Horn Shelter crania; and the presence of foramen of Huschke which 
appear at frequencies of 26% and 37% in the composite central Texas 
sample and Loeve-Fox sample respectively and do not appear in the Horn 
individuals. This absence though may only reflect the small sample size 
from the Horn Shelter population.

This data, while indicating a similarity between the Horn Shelter 
and later central Texas populations, can not be used to suggest a direct 
continuity. The discrete traits noted in this study have been reported 
in similar frequencies in other Indian populations in North and South 
America (Bass, 1964; Berry and Berry, 1967; Cybulski, 1975).
TEMPORAL COMPARISON

A comparison of the Horn Shelter remains to other documented, and relatively complete Paleoindian skeletons is limited in its scope by several factors. First, the sample as established in Chapter V, consists of only six adults and one child: Pelican Rapids, Minnesota; Browns Valley, Minnesota; J.C. Putnam, Texas; Midland, Texas; Gordon Creek, Colorado; and the child and adult from Horn Shelter, Texas. A sample of such small size has no statistical validity. Additionally, this sample is of mixed sex. This presents problems as skeletal features, particularly metric, generally show significant differences between the sexes within populations. Most comparative analyses separate the two, but this would further diminish the total adult Paleoindian sample to groups of just three males and three females. Finally, this study must rely solely on the measurements and descriptions available in the literature. These descriptions vary tremendously in the amount of data offered. The J.C. Putnam or Clear Fork remains were described in four short pages (Stewart, 1945); the Pelican Rapids skeletal analysis was no less than 142 pages (Jenks, 1936). The Midland remains, though reported in full by Stewart (Wendorf et al., 1955) consist only of a partial cranium and a few post-cranial fragments. Some authors noted discrete traits, others offered only metric data. There is little consistency in either the skeletal remains themselves, or in the published data to facilitate comparative analysis.

Due to these limitations, the analysis of this temporal sample is primarily descriptive, offering the reader a compilation of the published measurements (Tables 7.7, 7.8), as well as comparative
Table 7.7 Paleolithic cranial measurements

<table>
<thead>
<tr>
<th></th>
<th>Pelican R.</th>
<th>Browns V.</th>
<th>Midland</th>
<th>J. Putnam</th>
<th>Gordon C.</th>
<th>Horn S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum length</td>
<td>179</td>
<td>193</td>
<td>183</td>
<td>173</td>
<td>187</td>
<td></td>
</tr>
<tr>
<td>Maximum breadth</td>
<td>138</td>
<td>142</td>
<td>(126)</td>
<td>138</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td>Basion-bregma</td>
<td>(127)</td>
<td>(142)</td>
<td></td>
<td>142</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auricular height</td>
<td>116</td>
<td>124</td>
<td></td>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Porion-bregma</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>111</td>
<td>118</td>
</tr>
<tr>
<td>Left parietal</td>
<td>5</td>
<td>3</td>
<td>6-7</td>
<td></td>
<td>138</td>
<td></td>
</tr>
<tr>
<td>Minimum frontal</td>
<td>93</td>
<td>92</td>
<td>90</td>
<td>97</td>
<td></td>
<td>95</td>
</tr>
<tr>
<td>Bizygomatic diameter</td>
<td>(125)</td>
<td>(140)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasal height</td>
<td>47</td>
<td>50.7</td>
<td></td>
<td></td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>Nasal breadth</td>
<td>21</td>
<td>23.6</td>
<td></td>
<td></td>
<td>27</td>
<td>24</td>
</tr>
<tr>
<td>Interorbital breadth</td>
<td>(19.5)</td>
<td>(23)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basion-nasion</td>
<td>(94)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orbital height</td>
<td>34</td>
<td>35.7</td>
<td></td>
<td></td>
<td>29 r</td>
<td></td>
</tr>
<tr>
<td>Orbital breadth</td>
<td>38</td>
<td>38</td>
<td></td>
<td></td>
<td>37 r</td>
<td></td>
</tr>
<tr>
<td>Bicondylar breadth</td>
<td>115</td>
<td>(135)</td>
<td></td>
<td>118</td>
<td>(130)</td>
<td></td>
</tr>
<tr>
<td>Bigonial breadth</td>
<td>94</td>
<td>118</td>
<td>113</td>
<td>96</td>
<td>101</td>
<td></td>
</tr>
<tr>
<td>Height of ascending l. ramus</td>
<td>45</td>
<td>68</td>
<td>61</td>
<td>61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum width of l. ramus</td>
<td>34</td>
<td>34.7</td>
<td>37</td>
<td>32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symphyseal height</td>
<td>30</td>
<td>32</td>
<td></td>
<td></td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Gonial angle</td>
<td>128</td>
<td>104</td>
<td></td>
<td></td>
<td>124.5</td>
<td></td>
</tr>
<tr>
<td>Indices:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cranial</td>
<td>77.09</td>
<td>73.5</td>
<td>68.8</td>
<td></td>
<td>79.8</td>
<td>74.87</td>
</tr>
<tr>
<td>Length-height</td>
<td>(70.94)</td>
<td>(73.6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breadth-height</td>
<td>(92.02)</td>
<td>(100.0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasal</td>
<td>44.68</td>
<td>46.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orbital</td>
<td>(89.47)</td>
<td>(92.8)</td>
<td></td>
<td></td>
<td>78.3 r</td>
<td></td>
</tr>
</tbody>
</table>
Table 7.8  Paleolithic post-cranial measurements

<table>
<thead>
<tr>
<th></th>
<th>Pelican R.</th>
<th>Browns V.</th>
<th>Midland</th>
<th>Clear F.</th>
<th>Gordon C.</th>
<th>Horn</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L R</td>
<td>L R</td>
<td>L R</td>
<td>L R</td>
<td>L R</td>
<td>L R</td>
</tr>
<tr>
<td>Humerus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. length</td>
<td>(289) (293)</td>
<td>* *</td>
<td>* *</td>
<td>313</td>
<td>311</td>
<td>* 280</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>316</td>
</tr>
<tr>
<td>Max. dia. midshaft</td>
<td>16 18</td>
<td>20.5 22</td>
<td>* *</td>
<td>21 23</td>
<td>* 20</td>
<td>20.5 22.5</td>
</tr>
<tr>
<td>Min. dia. midshaft</td>
<td>10.8 12.2</td>
<td>14.5 16</td>
<td>* *</td>
<td>17 17</td>
<td>* 18</td>
<td>15 16.5</td>
</tr>
<tr>
<td>Max. dia. head</td>
<td>37.3</td>
<td>* *</td>
<td>* *</td>
<td>* *</td>
<td>* 41</td>
<td>45</td>
</tr>
<tr>
<td>Circum. midshaft</td>
<td>44 50</td>
<td>* *</td>
<td>* *</td>
<td>* *</td>
<td>* 60</td>
<td>68</td>
</tr>
<tr>
<td>Radius</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. length</td>
<td>(230)</td>
<td>* *</td>
<td>* *</td>
<td>252</td>
<td>* *</td>
<td>250</td>
</tr>
<tr>
<td>Ulna</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. length</td>
<td>(247) (250)</td>
<td>* *</td>
<td>* *</td>
<td>277</td>
<td>* 230</td>
<td>265</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(267)</td>
</tr>
<tr>
<td>Physio. length</td>
<td>218 221</td>
<td>* *</td>
<td>* *</td>
<td>* *</td>
<td>* 238</td>
<td>240</td>
</tr>
<tr>
<td>Femur</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bicond. length</td>
<td>(425)</td>
<td>* *</td>
<td>* *</td>
<td>454</td>
<td>456</td>
<td>* 433</td>
</tr>
<tr>
<td>Max. length</td>
<td>* *</td>
<td>* *</td>
<td>* *</td>
<td>459</td>
<td>* *</td>
<td>436</td>
</tr>
<tr>
<td>Max. dia. head</td>
<td>* *</td>
<td>44</td>
<td>* *</td>
<td>* *</td>
<td>* *</td>
<td>46</td>
</tr>
<tr>
<td>Circum. midshaft</td>
<td>65 65</td>
<td>* *</td>
<td>* *</td>
<td>* *</td>
<td>* *</td>
<td>95</td>
</tr>
<tr>
<td>Subtroch. ant/posterior</td>
<td>20.5 21</td>
<td>24</td>
<td>* *</td>
<td>25 24</td>
<td>* *</td>
<td>22</td>
</tr>
<tr>
<td>Subtroch. med/lateral</td>
<td>25 25</td>
<td>32</td>
<td>* *</td>
<td>34 34</td>
<td>* *</td>
<td>32</td>
</tr>
<tr>
<td>Midshaft ant/posterior</td>
<td>22.3 22.8</td>
<td>* *</td>
<td>* *</td>
<td>29 30</td>
<td>* *</td>
<td>29</td>
</tr>
<tr>
<td>Midshaft med/lateral</td>
<td>18.2 18.2</td>
<td>* *</td>
<td>* *</td>
<td>28 27</td>
<td>* *</td>
<td>26</td>
</tr>
<tr>
<td>Tibia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. length</td>
<td>(345)</td>
<td>* *</td>
<td>* *</td>
<td>(380)</td>
<td>385</td>
<td>* *</td>
</tr>
<tr>
<td>Nutrient fora.ant/post.</td>
<td>28.2</td>
<td>* *</td>
<td>* *</td>
<td>* *</td>
<td>* 38</td>
<td>34.5</td>
</tr>
<tr>
<td>Nutrient fora.med.lat.</td>
<td>22.2</td>
<td>* *</td>
<td>* *</td>
<td>* *</td>
<td>* *</td>
<td>20</td>
</tr>
<tr>
<td>Midshaft ant/posterior</td>
<td>24</td>
<td>* *</td>
<td>* *</td>
<td>34 35</td>
<td>* *</td>
<td>*</td>
</tr>
<tr>
<td>Midshaft med/lateral</td>
<td>18.3</td>
<td>* *</td>
<td>* *</td>
<td>21 20</td>
<td>* *</td>
<td>*</td>
</tr>
<tr>
<td>Fibula</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. length</td>
<td>(342)</td>
<td>* *</td>
<td>* *</td>
<td>377</td>
<td>314</td>
<td>* *</td>
</tr>
</tbody>
</table>
remarks. Each of the individuals will be discussed, noting the completeness of the remains and the age, sex, and stature estimations. This is followed by descriptions of the cranial and post-cranial remains when available.

Pelican Rapids, Minnesota

The Pelican Rapids, Minnesota skeleton is essentially complete. Jenks (1936) estimated this individual was female, and approximately 15 years of age. Using Genovés (1967a) formula for Mesoamerican females, her estimated stature was 155.8 cm. In Pleistocene Man in Minnesota, Jenks provided a very detailed analysis, including both measurements and comparative remarks. His interpretations of "primitive" however, date this report considerably, and may bring some of his comparative remarks into question.

On the Pelican Rapids skeleton, Jenks noted that there was little development of the supraorbital ridges but that the glabella did protrude. Both the frontal and parietal bosses are marked. He noted two parietal foramina, a parietal notch bone on the left side, two lambda ossicles, and two tiny epipteric bones. He described the mastoids as submedium in prominence. Jenks, who made a point of emphasizing what he termed "primitive", described the occipital as "slightly, though distinctly, bun-shaped, typical of Neanderthals" (Jenks, 1937:67). From norma occipitales, the cranium's appearance is house-shaped, with elevation along the sagittal suture. The cranial index is 77.09, or mesocranic.

The facial features of the Pelican Rapids individual were also
described by Jenks as primitive. He reported that the facial height fell within the means of more recent Algonkin and Sioux populations, but that the Pelican Rapids skull was notable in having very pronounced alveolar prognathism and in lacking a defined nasal sill. The suborbital fossae are very shallow, which Jenks considered a distinctive Mongoloid characteristic.

Jenks described the upper central incisors as shovel-shaped, and the one remaining lateral incisor as semi-shoveled. He noted the Y-5 molar cusp pattern on all of the mandibular molars with the exceptions of the right second molar and the left third molar, each of which has six cusps. The mandibular third molars are larger than the seconds. From the x-rays published in the manuscript, the Pelican Rapids individual does appear to have single-rooted maxillary third premolars. The mandibular first molars though do not have three roots, as might be suggested by Turner and Bird's (1981) data on Paleoindian dentition. Overall, the teeth exhibited only light wear. No caries were noted.

The long bones in general, were described by Jenks as notable for their smoothness. This is most likely a reflection of the individual's young age and lack of a developed musculature. On the humeri, the deltoid crests are submedium in prominence. The pectoral ridge though well-defined, was also described as submedium. Neither humerus has a perforated olecranon fossa. Both are platybrachic, or flattened. The features of the radii and ulnae, such as the bicipital tuberosity and interosseous borders were also described by Jenks as submedium in development.

As with the upper extremities, the bones of the lower extremeties
also lacked well-defined features for muscle attachments. Jenks described the femora as smooth and slender, with only faintly defined gluteal ridges. There are no third trochanters on either femur. The platymeric index of the right femur, 84, and that of the left, 82, shows only a small amount of flattening from front to back. In discussing the tibiae, Jenks remarked that their most notable feature was their lack of platycnemia, or flattening. Jenks reported them as eurycnemic.

Browns Valley, Minnesota

The Browns Valley, Minnesota remains, found just 80 miles southwest of the Pelican Rapids site, were primarily complete, and these too, were reported by Jenks (1937). He estimated this individual was male, and somewhere between 25 and 40 years of age. Though not as detailed as the Pelican Rapids analysis, Jenks provided a fairly complete description of both the cranial and postcranial remains. Again however, Jenks' interpretation of various features clearly reflect the typological thinking prevalent at that time.

Jenks (1937) stated that the Browns Valley individual exhibited prominent brow ridges with a very pronounced glabella. In particular, he noted the "fullness of the external angular processes and the marked post-orbital constriction" (Jenks, 1937:23). Neither the frontal or parietal bosses are prominent. The mastoids were described as average in size, but Jenks remarked that the supra-mastoid crests and sulcus were very pronounced. He described the occipital protuberance as above average. From norma occipitales, the skull is "house-shaped", with a slight sagittal elevation. The cranial index of the Browns Valley man
is 73.5, or dolichocranic.

Jenks (1937) declared that the short, broad face was one of the most conspicuous characteristics of the Browns Valley individual. In contrast to the Pelican Rapids cranium, he reported that the suborbital fossae in Browns Valley man were pronounced and that the zygomatics lacked "forward thrusting". The nasal sill, again in contrast to the Pelican Rapids individual, was described by Jenks as sharply defined. Jenks suggested that another of the most notable features on the Browns Valley man was the great width of the mandible (bigonial width, 118.0 mm). He further suggested that this great width was probably the reason for the relatively low position of the maximum breadth of the cranium. In this individual, the maximum breadth of the cranium was found on the supramastoid crests.

Dental attrition made it impossible to assess either molar cusp patterns or incisor shoveling. Dentine was exposed in all but the third molars, but the pulp cavities had not become involved. There was no evidence of caries. Two teeth, the right maxillary central incisor and the right maxillary third molar were lost ante-mortem.

Though Jenks did not describe the post-cranial remains in great detail, he did report that the humeri, femora, and tibiae all displayed a marked flattening. He also noted that the femora had pronounced gluteal ridges. He did not mention features such as third trochanters or perforated olecranon fossae. No stature estimation is available.

Jenks (1937) concluded that the Browns Valley man was of the same general physical type as the North American Indian but suggested that this particular skeleton belonged to an early dolichocranic, leptorrhine
type, as opposed to the more recent Indians in the Upper Great Lakes region which were mesocranic and mesorrhinic. Jenks also commented that the Browns Valley man was less primitive than the older glacial population of Minnesota as represented by the Pelican Rapids material.

J.C. Putnam (Clear Fork), Texas

The J.C. Putnam, Texas remains from north-central Texas, consist of an incomplete skull, most of the long bones, and fragments of the innominate, scapulae and vertebrae. T. Dale Stewart (1945) estimated this individual was male and approximately 40 years of age.

In his analysis, Stewart provided both cranial and post-cranial measurements but few comparative remarks. The reconstructed skull suggested dolichocrany, with an estimated cranial index of 73.0. Overall, Stewart described the skull as relatively long-headed and high-headed. He did report a small ear exostosis. Though Stewart did not comment on browridges, Roberts (1945) reported that Henry Shapiro, chairman of Anthropology Department at the American Museum of Natural History in New York, noted "heavy browridges". Stewart described the teeth as extremely worn, but noted nothing else on the dentition.

Aside from the post-cranial measurements, Stewart noted that neither of the humeri had perforated olecranon fossae and that the right femur had a medium sized third trochanter. Both femora were platymeric with indices of 70.6 for the right femur and 73.5 for the left. Both tibia were also flattened. The right tibia had an platycnemic index of 57.1 (rated as hyperplatycnemic) and the left tibia with a index of 61.8 was platycnemic. Stature was estimated at 166 cm.; Stewart did not state
which formula he used to obtain this estimate.

Scarbauer (Midland), Texas

The Midland remains, also analyzed by Stewart (in Wendorf et al., 1955), consist only of an incomplete cranium, two metacarpals, and portions of the maxillae with eight teeth still in articulation. Stewart stated the individual was a female, around 30 years of age.

Stewart described the browridges as small and the mastoids of intermediate size. He noted the occiput was "low-slung" and that it displayed little development for muscle attachments. Stewart suggested that the most notable feature of the Midland skull was its dolichocrany, with an estimated cranial index of 68.8. A drawing of the crania from norma occipitales suggests slight sagittal elevation. Stewart discussed the comparable traits between the Midland calvarium and Neumann's (1952) Otamid type (dolichocranic, low-curving frontal, long flat slope to the parietals), but he refused to draw any relationships based on such little data. He noted that numerous sites in Texas had produced dolichocranic skulls.

The eight teeth recovered with the Midland remains all showed moderate to extreme wear. Stewart recorded the presence of an "abnormally placed tooth" in the left side of the nasal cavity.

Gordon Creek, Colorado

The final individual in this Paleoindian sample is the Gordon Creek, Colorado skeleton. Though most of the skeleton was recoverable, the bones were badly fragmented; only a humerus, ulna and fibula were
relatively intact. Though Anderson (1966, 1967) estimated the individual to be an adult male, between 26 and 30 years of age, a later analysis indicated that the individual was female, between 25 and 30 years of age (Breternitz et al., 1971).

Breternitz et al. described the supraorbital ridges, nuchal crest, and mastoids as slight. The temporal lines however were well-defined. The authors also noted a slight degree of sagittal elevation. The cranial index on this individual is 79.77, or mesocranic. There was no evidence of a metopic suture, nor were there any wormian or Inca bones. Breternitz et al. did report slight dental prognathism.

The dentition displayed heavy attrition. Dentine was exposed in all teeth with exception of the second and third molars. Attrition was to the degree to make assessment of incisor shoveling and most molar cusp patterns impossible. The only readable cusp patterns were of the left mandibular third molar which displayed a 4+ pattern, and the right maxillary third, which displayed a 3+.

Neither Anderson (1966, 1967) nor Breternitz (1971) commented on whether nor not the long bones displayed any flattening. Using Genoves (1967a) Mesoamerican ratios for estimating stature, the Gordon Creek individual is estimated to have been approximately 149.5 cm. tall. This estimation is based on the combined stature estimates derived from the humerus, ulna, and fibula.

Only two pathological conditions were noted on the Gordon Creek skeleton, both of which involved the vertebrae. There was no fusion of the centra of the upper sacral vertebra, and the lumbar, thoracic and lower cervical vertebrae showed some arthritic lipping.
DISCUSSION

Skeletal remains

As evident from this review of the present Paleoindian skeletal sample, there is little to be concluded aside from the need of a larger sample, ideally from both North America as well as the putative parental populations in Siberia. But though recognizing the limitations of such a small sample size, the need to create a preliminary data base (and simply our fascination with the earliest Americans), demands that comparative statements be made. The basis of these comparisons are taken primarily from the hypotheses extracted from the theories presented in Chapter VI.

Numerous authors (Dixon, 1923; Hooten, 1933; Neumann, 1952) have suggested that Paleoindians were typically dolichocephalic. Two (both female) out of the six Paleoindian cranial indices available though are mesocranic. Additionally, the two reconstructed skulls from the Marmes rockshelter are also suggested to be mesocranic, with one perhaps even being brachycranic (Fryxell et al., 1968b).

Neumann (1952) described his earliest type, the Otamid, as possessing dolichocranic crania, which also displayed pronounced brow ridges, some sagittal elevation, and a "bun-shaped occiput". Certainly assessment of the first and the latter characteristics are subjective, but they are offered here as at least some point of comparison. All of the male Paleoindian crania are described as having heavy supraorbital ridges; the three females, the Midland, Gordon Creek and Pelican Rapids
individuals however, do not. Some degree of sagittal elevation is noted for five out of the six Paleoindian adult skulls. Stewart (1945) did not comment on this particular characteristic with the J.C. Putnam cranium. The third characteristic hypothesized by Neumann, that of a bun-shaped occipital, is difficult to evaluate. Jenks (1936, 1937) noted a "slightly though distinctly bun shaped" occipital on the Pelican Rapids crania, and an above average occipital protuberance for the Browns Valley individual. Breternitz et al. (1971) described the occipital protuberance on the Gordon Creek individual as slight. The occipital on the Horn Shelter adult is of medium development. No evaluation was possible on the J.C. Putnam and Midland, Texas remains.

Discrete cranial traits have proved valuable in estimating population affinities (Laughlin and Jørgensen, 1956; Berry and Berry, 1967; Finnegan and Marcsik, 1979). Unfortunately, such data on most of the Paleoindian skeletons is not reported; what is available in the literature is noted here. The Pelican Rapids individual is described as having numerous sutural bones. Jenks (1937) recorded epiteric bones, lambda ossicles and parietal notches. The Horn Shelter adult does have a lambda ossicle but post-mortem damage makes examination for either epiteric bones or parietal notches impossible. The subadult from Horn Shelter does not have lambda ossicles, nor epiteric bones or parietal notches on the right side. Post-mortem damage on the left side makes it impossible to score. Breternitz et al. (1971) reported only that the Gordon Creek individual did not have an Os Inca or wormian bones.

The information on discrete cranial traits for the three remaining Paleoindian individuals is also incomplete. From the photographs and
drawings in Stewart's (Wendorf, et al., 1955) description of the Midland cranium, this individual does not appear to have had any lambda ossicles, nor epiteric bone or parietal notch on the right side. It cannot be determined if the Midland cranium had any epiteric bone or parietal notch on the left side. No discrete cranial data of this type were reported on for either the J.C. Putnam or Browns Valley, Minnesota remains.

Discrete dental traits also represent a promising measure of biological affinities, but again their use in the study of Paleoindian remains is plagued by the lack of data. Turner and Bird (1981) hypothesized that Paleoindians would have relatively high frequencies of incisor shoveling, incisor double shoveling, single-rooted maxillary third premolars, three-rooted mandibular first molars, six cusps on mandibular molars, tuberculum dentale, and Carabelli's trait. The teeth of the Midland, Browns Valley, J.C. Putnam, and Gordon Creek individuals are too worn to provide any data on crown characteristics, nor have x-rays been provided to assess root numbers. Only the dentition from the Pelican Rapids individual and the two individuals from Horn Shelter can be compared to Turner and Bird's (1981) hypotheses on the probable dental traits of Paleoindians; and even this limited sample must be reduced when examining the crown characteristics. The severe attrition on the Horn Shelter adult's teeth limits its comparative value to the discussion of root numbers.

The central maxillary incisors in both the Pelican Rapids individual and the Horn Shelter subadult display shoveling, though the Horn Shelter subadult only displays a trace of shoveling. The upper lateral incisors
of the Pelican Rapids individual are semi-shoveled, the upper laterals on the Horn subadult are not. Neither the Horn subadult or the Pelican Rapids individual display a tuberculum dentale. Both of the Horn Shelter subadult's maxillary first molars have Carabelli's pits; it is not clear however if Turner and Bird recorded only Carabelli's trait as expressed by a cusp or if they also included its expression as a pit as defined by Kraus (1951). Jenks (1937) did not report on Carabelli's trait in his discussion of the Pelican Rapids dentition. Jenks (1937) reported six cusps on the right lower second and the left third molars of the Pelican Rapids remains; no molar from the Horn Shelter subadult has six cusps.

Both the Pelican Rapids individual and the Horn Shelter adult have single-rooted upper third premolars, the Horn Shelter subadult does not. This frequency of two out of three individuals would compare somewhat favorably with Turner and Bird's (1981) data from Chilean Paleoindians (100% 4/4). None of the Pelican Rapids or Horn Shelter individuals however have three-rooted mandibular first molars. Though not a trait usually considered in discrete trait analysis, it is of interest to note that two of the Paleoindian sample, Midland and the Horn Shelter adult, both have odontomes.

Published data on the post-cranial discrete traits of these Paleoindian skeletons is also very limited. Two out of the six adults (both male and from Texas, J.C. Putnam and Horn Shelter) have third trochanters on the femora. Of the four skeletal analyses which mentioned perforations of the olecranon fossae, two (both of the Horn Shelter individuals) had perforated fossae; J.C. Putnam and Pelican
Rapids did not. Long bone flattening, in the form of platymeric femora and platycnemic tibiae does appear to be a characteristic common in this Paleoindian sample, with more extreme flattening present in the three adult males. Though Jenks (1937) did not provide numbers, he did note that the femora and tibiae from the Browns Valley skeleton displayed marked flattening. The J.C.Putnam femora with indices of 73.5 (right) and 70.6 (left) are both considered platymeric; the right tibia with an index of 57.1 is hyperplatycnemic, or extremely flattened, the left tibia with an index of 61.8 is platycnemic. The femora of the Horn Shelter adult are also platymeric with indices of 69.69 for the right and 68.75 for the left; the right tibia is platycnemic with an index of 60.87 and the left is considered hyperplatycnemic with an index of 52.63.

Only one of the females in the Paleoindian sample has information on long bone flattening. The Pelican Rapids remains has platymeric indices of 82 and 84. While still falling within the range of platymeria, \( x < 84.9 \) these femora are considerably less flattened the those of the males in this sample. No data is available for the Midland or Gordon Creek material.

The final comparative physical remarks are on stature. In this Paleoindian sample, two males and two females have long bones complete enough to provide stature estimations. Based on Genovés (1967a) formula for Mesoamerican males, Horn Shelter and J.C.Putnam are estimated to have been 162 and 166 cm respectively. Using Trotter and Gleser (1958) ratios for Mongoloid males they are estimated to have been 166.3 and 170.6 cm respectively. The females, Pelican Rapids and Gordon Creek,
(based on Genoves (1967a) formula for Mesoamerican females) are estimated to have been 155.8 and 149.5 respectively. No other female ratios are available.

To conclude with this physical comparison, it must be noted that certain of the characteristics associated with Paleoindian skeletal material, specifically dolichocrany and flattened long bones, are of little diagnostic value. This is particularly so when dealing with Texas aboriginal material. Numerous sites in Texas have yielded dolichocranic skulls and flattened long bones. Stewart (1935) examined 20 crania from southwest Texas and characterized them as hyperdolichocranic. Forrester (1951) reported that 9 out of 10 crania from Shackelford County in north central Texas were dolichocranic. At Coontail Spin, a late Archaic site in south Texas, Benfer and McKern (1968) described the two skulls as extremely long-headed; Thomas (1933) also reported dolichocrany in the 6 skulls recovered from Fate Bell Shelter. Of the seventeen skulls from Loeve-Fox that were measurable, all were dolichocranic (Butler, n.d.).

Hrdlička (1938) noted that flattened long bones were more pronounced in Indians that whites or blacks and reported an average plagymeric index of 66 for the North American Indian. Hrdlička found a north central Texas sample to be of great interest in this regard as the mean plagymeric index of seven left femora was 57.84 and 58.63 for seven right femora. These were the lowest values he had ever recorded. He suggested that long bones flattened to such a degree were a response to habitual demands such as running, not genetics.
Burial practices

Three of these Paleoindian sites discussed, Browns Valley, Horn Shelter, and Gordon Creek, represent intentional burials. As such, it is of interest to compare the burial practices to see if there are any commonalities between them. This examination focuses on the presence or absence of covering stones, any evidence of body decoration, and associated tools.

Two of the burials had covering stones. The Horn Shelter double burial was covered by 19 limestone slabs, the Browns Valley individual was covered by a single flat stone. All three of the burials though, contained red ochre. Jenks (1937) described the Browns Valley burial pit as being lined with red ochre. Anderson (1967) wrote that the entire area around the Gordon Creek skeleton was stained with hematite. Redder (1985) reported a piece of red ochre was associated with the Horn Shelter burial.

No jewelry of any type was recovered with the Browns Valley individual. Both the Gordon Creek and Horn Shelter adult however had perforated non-human teeth associated with them. Anderson (1967) noted four elk teeth with the Gordon Creek burial; one was perforated at the root, the roots had broken off the other three. The Horn Shelter burial also contained four perforated teeth. Identification is uncertain; they are described only as canine (Redder, 1985). The burial at Horn Shelter also contained 80 small gulf shell beads (Neritina canines). No beads were found with the Gordon Creek burial.

Each of the three Paleoindian burials were associated with numerous tools. The Browns Valley individual was accompanied by six flint tools,
including two leaf-shaped, lenticular points described as "Folsom-Yuma" types (Jenks, 1937) and two asymmetrical bifaces identified as probable knives and two sandstone abrasion tools. Anderson (1967) recorded utilized flakes, an "end scraper", a polished stone, a hammerstone, and three blades with the Gordon Creek individual. None of the blades showed any wear, suggesting they were prepared especially for the burial. Finally, the Horn Shelter burial contained a flint biface, a bone needle, sandstone slabs, bird claws, and two antler billets. Perhaps most interestingly, the adult's head lay on top of a stack of three inverted turtle carapaces, with his face and pelvis area covered by a fourth and fifth shell. Redder (1985) noted that each of these carapaces had been intentionally cleaned of vertebral fragments.
CHAPTER VIII

SUMMARY AND DISCUSSION

SUMMARY

This study has described and analyzed the Paleoindian skeletal remains from Horn Shelter, Number 2 (41BQ46), a rockshelter in central Texas. The skeletal material consisted of only two individuals, an adult and a child. They were buried together and accompanied by numerous burial goods, including red ochre, perforated canine teeth of an unidentified mammal, marine shell beads, and turtle carapaces that had been intentionally cleaned of vertebral fragments. Chapter II briefly discussed the site of Horn Shelter, the history of excavations, and the associated radiocarbon dates that document the skeletal material as dating to the early Holocene.

Detailed descriptions and analyses of the recovered skeletal remains of the adult (Burial One) and the subadult (Burial Two) were presented in Chapters III and IV respectively. An analysis of the remains indicate Burial One was an adult male, in his mid 30's to early 40's at the time of death. Sharply defined areas for muscle attachments indicate a well-developed musculature. His stature was estimated to have been between 162 and 166 cm.

The osteological analysis revealed no cause of death but there was limited skeletal evidence from which to infer some of this individual's health history. The analysis indicated past episodes of both stress and trauma. Transverse radiopaque lines visible on x-rays of the tibiae indicated periods of interrupted growth during this individual's
developmental years. The very beginnings of arthritic changes were inferred from the slight degeneration of several of the joint surfaces, most notably at the elbows.

The only evidence of trauma was on the left foot. The left fifth metatarsal displays a healed fracture. Additionally, there is abnormal pitting and bone deposition on the dorsal surfaces of the third cuneiform and the navicular. It could not be determined if this abnormal bone was the result of mechanical stress or infection, or if this condition was related to the fractured metatarsal.

Burial One's dentition is relatively free of caries; attrition on all teeth, however, was severe. This severe attrition was the probable cause for the ante-mortem loss of three teeth. There is also an abscess on the root of the left maxillary first molar which had opened into the sinus cavity. This infection may have been the cause of some abnormal bone growth in the left sinus cavity.

The analysis of Burial Two suggested this individual was approximately 12 years of age and probably male. The age estimation was based primarily upon dental calcification and eruption. Though assigning sex to subadult skeletal material is not without risk, it is hypothesized that this individual was male. This estimation was based upon cranial and pelvic morphology as well as the discrepancy between dental and post-cranial development. No cause of death could be determined from the skeletal analysis. In the right maxillary sinus there is some plating of bone which suggests a minor infection. Dental health was good; there are no caries nor evidence of any infections.

In addition to simply analyzing the early human skeletal material
from Horn Shelter, this study attempted to provide a context in which to view this early man find. A total of 19 sites with alleged early human skeletal remains were discussed; ultimately however, only 11 of these sites were found to have sufficient documentation to be accepted as of late Pleistocene or early Holocene age. And of these 11, only six, including the Horn material, contained skeletal remains sufficiently intact to be of comparative value.

To better interpret these scant skeletal remains, past and present theories on the population characteristics and origins of these first Americans were discussed in Chapter VI. The early theories, which primarily represented applications of racial typologies, had little to offer. To date, discrete trait analysis, particularly that proposed by Turner (1971, 1979, 1983) who focused on dental traits, has offered the most specific answer to the question of Paleoindian origins. He suggested that all American Indians, with the exception of the Aleut-Eskimo and Na-Dene, are the descendents of a small group of Paleoindians whose origins were in the Lena River drainage of northeast Siberia.

In a rough fashion, Turner's hypothesis would agree with Laughlin (1967) and Harper and Laughlin (1982) who hypothesized that the Paleoindians of the New World were the descendents of populations who occupied the interior of Siberia as opposed to the coast. They based their hypothesis on both archaeological evidence and blood group data. The present distribution of GM allotypes in Native American populations has also been offered as support of Turner's three migration hypothesis (Williams et al., 1985). Alexseev (1979) however, working with cranial
measurements and indices, concluded the opposite and suggested that the ancestral populations to the Paleoindians had inhabited the coastal area of northern Asia and had entered Beringia by following the Asiatic coast northward.

The theories presented offered few consistent hypotheses on the osteological characteristics of the Paleoindian population. To examine the question of whether the Paleoindians could be distinguished as a group from later American Indians, the Horn Shelter remains were compared to both a sample from central Texas and the early man sample as established in Chapter V. On the basis of cranial, post-cranial, and discrete trait analyses, no significant differences were found between the Horn skeletal material and the more recent Amerinds of central Texas.

Additionally, the Paleoindian sample as a whole was compared to selected central Texas samples. With the exception of the maximum breadth of the cranium, there were no significant differences between these two groups. The tests on these particular samples suggested that Paleo crania were significantly wider. An examination of cranial breadths from other recent aboriginal groups however, which were wider, showed that this difference was not a significant difference between the Paleoindians and later American Indian groups as a whole.

An examination of the early man skeletal remains revealed primarily the need for a larger sample of adequately documented and relatively intact skeletons. What little that can be said of this small Paleoindian sample is that the male crania are dolichocranic, (though not as extreme as that seen in later Texas Indians), have heavy
browridges, (though not out of the range of more recent Indians), and have some degree of elevation along the sagittal suture. Two out of three of the females have mesocranic crania, all exhibit some degree of sagittal elevation, and none have pronounced browridges. Discrete cranial data has not been uniformly reported on this sample. The Pelican Rapids individual was described as having numerous sutural bones; the Gordon Creek skeleton was described only as not having an Os Inca or wormian bones. Post-mortem damage made complete examination impossible on either the Horn material or the Midland cranium, but only the Horn Shelter adult exhibits an ossicle. Discrete data were not recorded on the J.C. Putnam cranium.

Dental trait analysis, while a promising approach in determining population affinities, was in this study, also hampered by lack of available data. But of the traits hypothesized by Turner and Bird (1981) as characteristic of Paleoindian dentition, the following can be reported: two out of three individuals, for which information is available, have single-rooted maxillary third premolars, none of these three however have three-rooted first mandibular molars. Due to attrition and/or ante-mortem loss, incisor shoveling and double-shoveling, and the presence of a tuberculum dentale could only be assessed on two individuals. Both the Pelican Rapids and Horn subadult individuals have shoveled incisors, (though one only slightly expressed) and neither exhibited double-shoveling nor tuberculum dentales. Carabelli's pits were identified only on the Horn Shelter subadult. No first mandibular molar in this sample was reported to have six cusps. (The Pelican Rapids individual, however, did have six cusps on the right
second molar and the left third molar.)

DISCUSSION

Armelagos et al. (1982) have criticized the recent biological distance, or population affinity, studies as "historical-descriptive", or in essence, as merely modern extensions of the earlier typological approaches. And indeed, as they pointed out, physical anthropologists, though recognizing intrapopulation variation and the plasticity of skeletal features, are still trying to define features as characteristic or typical of different populations. But, while in agreement with Armelagos et al.'s observation, the author suggests it has been necessary to establish the characteristics of various populations in order to have a data base to address the more difficult questions. It is these more difficult questions that physical anthropologists must now face in order to evaluate the theories presented on Paleoindian origins.

At present, it is difficult to evaluate these theories. Of course, there is the continuing problem of the lack of Paleoindian skeletal remains, both in North America and Siberia, and this may well continue. If Alexseev's (1979) theory on a coastal migration route is correct, many sites are now submerged. More fundamentally however, there is no firm basis on which to assess the arguments. Different types of evidence, in the form of dental traits, blood group data, cranial measurements and even mitochondrial DNA, have all been employed; but there is no certainty on the significance of any demonstrated similarities, because the causes of such similarities, or variations, are not completely understood.
Alexseev (1979) who suggested the ancestral population of the Paleoindians occupied the Asian Pacific coast, based his hypothesis on the cranial measurements and indices from relatively recent (>1700 AD) Siberian crania. Clearly however, cranial shape plasticity has been demonstrated in many populations (Newman, 1962; Laughlin et al., 1979; Jantz, 1973; Carlson and Van Gerven, 1979). Jantz (1973) recorded microevolutionary changes in Arikara crania and attributed these changes to gene flow. Carlson and Van Gerven (1979) documented increasing height and breadth in Nubian cranial vaults through time and hypothesized this was the result of reduced masticatory stress related to changes in diet. Laughlin et al. (1979) reported a clinal distribution in the length/breadth indices of the Aleuts and Eskimos, but offered no causal explanation. In other areas, notably Texas, there appears to be a persistence of a type, specifically dolichocrany, but as yet the evolutionary forces behind this remain a mystery. In using cranial measurements to determine biological distance then, alternative explanantions must also be considered and eliminated.

The evolutionary forces acting upon blood groups are also unclear. Laughlin (1967) hypothesized that the present distribution of the ABO and Diego blood groups reflect a record of past migrations. O'Rourke et al. (1985), however, have offered the suggestion that selective forces may operating. They examined 57 North American populations for ABO and Duffy blood groups and found that the blood types were consistently associated with climate, as defined by precipitation, temperature, and elevation. They did caution that this may not be a causal relationship and also noted the confounding factor of the "collinearity of the
north-south migration of the New World founding fathers and the climatic
gradients" (O'Rourke, et al., 1985:249). The point remains however,
that the distribution of blood groups in Native Americans has not been
definitively explained.

The distribution of GM allotypes, also offered as evidence of past
migrations (Williams et al., 1985), has not been definitively explained
either. Steinberg and Cook (1981) reported a regularity in the
distribution of allotypes and haplotypes among the "races" (sic) but
also noted the presence of clines in the distributions of haplotypes
within races. This suggested to them that some selective force has
played a role. They had however, "no idea what force or forces of
selection are in operation" (Steinberg and Cook, 1981:10).

Interestingly, over thirty years ago, Birdsell had noted that selection
as an evolutionary force on human populations had been largely ignored
and suggested that "one of the most important tasks for the next
generation of physical anthropologists is to define and evaluate the
magnitude of selective forces upon human populations" (Birdsell,
1951:55).

Turner (1971, 1979, 1983) and Turner and Bird (1981) who based their
three migration hypothesis on dental evidence may have the strongest
case. Turner (1971, 1979, 1983) has suggested dental traits and their
expression have a high genetic component and that there is a basic
evolutionary stability in various crown and root traits within Asian and
North American Indians populations. Sofaer et al. (1972) however, could
only say that at least a proportion of observed dental variation
appeared to be genetic; they further noted that the actual mode of
genetic control for dental traits had yet to be established, and strongly suggested that analysis of family data must be done.

Work on the genetic component of dentition has been done to a limited extent. Dietz (1944) suggested the Carabelli trait was a Mendelian dominant, but that the types and intensity of expression probably involved complex genetic factors. Kraus (1951) examined eight pedigrees and suggested Carabelli's trait was a trait of intermediate dominance, with cc and CC denoting absence and pronounced tubercle respectively. He suggested the genotype Cc would result in a wide variety of expression. Blanco and Chakraborty (1976) examined the trait of shovel-shaped incisors in Chilean families and concluded that "68% of the total variability in the expression of shovel-shaped incisors could be ascribed to the additive effect of genes" (Blanco and Chakraborty, 1976:233).

Sofaer et al. (1972) did evaluate the present effectiveness of dental traits as indicators of biological distance by testing "tooth-based" distances between various populations (Pima, Papago and Zuni, as well as seven world population, e.g. Caucasian, Negro, etc.) against the distances suggested by blood group and serum proteins. (Evidently they assumed that blood groups were not under any selective force.) Though they did note that four out of the ten dental traits they examined provided evidence contrary to expectations based on studies of gene frequencies and geographical relationships, they concluded that tooth morphology as an indicator of biological distance could be viewed with "cautious optimism".

Despite questions then, Turner's approach to defining the affinities
of the Paleoindians seems to offer the most promise, and his three
migration hypothesis appears to be the best explanation of the present
dental data. His hypothesis, gladly in terms of the present Paleoindian
sample, may also be testable using modern blood group and even mtDNA
data, if the evolutionary forces that have affected the present
distributions of these can be definitively identified.

Cranial data, the focus of the early racial typologies, would appear
to offer little or no information on the population affinities of the
Paleoindians. From an admittedly limited analysis, based on only six
Paleoindian crania, there is apparently nothing diagnostic to
distinguish early man from more recent aboriginals. Whereas Hrdlička
concluded that skeletal data bore evidence against geological antiquity,
this study suggests the opposite, that the geological or archaeological
context must prove the antiquity of the skeletal remains.
LITERATURE CITED


Berry, AC and Berry, RJ (1967) Epigenetic variation in the human


thesis, University of Texas, Austin, Texas.


Neumann, GK (1952) Archeology and race in the American Indian. In JB


Orr, PC (1968) Prehistory of Santa Rosa Island. Santa Barbara: Santa Barbara Museum of Natural History.


Sofaer, JA, Niswander, JD, Maclean, CJ, and Workman, PL (1972) Population studies on Southwestern Indian tribes: tooth morphology


Steele, DG and Bramblett, C (n.d.) The Anatomy and Biology of the Human Skeleton. manuscript in press. College Station, Tx.: Texas A & M Press.


Turner, CG (1979) Sinodonty and sundadonty: a dental anthropological view of Mongolid microevolution, origin, and dispersal into the Pacific basin, Siberia, and the Americas. Presented at XIV Pacific Science Congress, Khabarovsk, USSR. (Abstract courtesy of author, Department of Anthropology, Arizona State University, Tempe, Arizona, 85287.)


White, G and King, R (n.d.) Revision to age and attribution of the Mostin site, Clear Lake, California. Manuscript in preparation. Courtesy of G White, Department of Anthropology, University of California, Davis, California, 95616.

Willey, GR and Phillips, P (1958) Method and Theory in American


APPENDIX A
THE STRATIGRAPHY OF HORN SHELTER NO. 2, THE SOUTH END.
(after Redder, 1985)

**Stratum 1:** "Bottom sand", a sterile, compacted fine dark red sand covering the bedrock floor of the rockshelter.

Dates: *

Material: *

**Stratum 2:** "River gravel", course limestone gravel and sand.

Dates: *

Material: split bone fragments, a human (?) tooth, ground sloth (Nothrotherium) tooth, mountain lion (*Felis concolor*) and other herbivore teeth.

**Stratum 3:** "Yellowish clay", yellow clay mixed with red sands, small limestone fragments, and caliche nodules.

Dates: 10,150±120 (bone)

Material: fire hearth with flint and bone, exoskeleton of a large turtle (*Geochelone* or *Gopherus*).

**Stratum 4:** "Shaley red", thin slabs of limestone, covered by thin coating of red clay.

Dates: *

Material: small concentration of numerous small animal bones.
Stratum 5: "Cave deposit", composed of "rock flour" and limestone fragments. This stratum is up to 145 cm thick and has been divided further into seven substrata.

Sub-stratum 5A: "Clean cave fill", a white fill.

Date: *

Material: a Folsom point and an unidentified dart point.

Sub-stratum 5B: "Third red", a thin layer of red clay.

Date: *

Material: small animal bone fragments.

Sub-stratum 5C: "Second red", a second layer of red clay, separated from 5B by up to 16 cm of "clean" deposits.

Date: *

Material: a fire hearth, a "scraper-graver", 33 fragments of an Alibates-looking flint, many small animal bones, including a few with cut marks.

Sub-stratum 5D: "Ash lens drag down", a red clay layer containing a dark occupation zone. This sub-stratum is separated from sub-stratum 5C by 16 cm of "clean" deposits.

Date: *

Material: fire hearths, flint scrapers, gravers, a large knife, worked bone fragments, bone needle fragments. Faunal remains recovered were bison, deer, and numerous small animals including rabbit, mice, rats, turtle, fish, snakes, and birds. Many of the bones were charred.

Sub-stratum 5E: "Clean cave fill", described as clean and white, and containing a layer, 5 to 30 cm thick, comprised of cemented cave
deposits.

Date: *

Material: one graver.

Sub-stratum 5F: "Light gray", a light gray deposit, laying directly above sub-stratum 5E.

Date: *

Material: a Brazos Fishtail point, the mid-section of a Scottsbluff point, gravers, worked bone fragments. Faunal material included turtle, fish scales, snake, rodents, deer, birds and rabbits.

Sub-stratum 5G: "Heavy gray", a very dark "midden-appearing" cave deposit.

Date: 9,500±200 BP (TX-1830) and 9,980±370 BP (TX-1722) (charcoal), 10,030±130 BP (TX-1998) and 10,310±150 BP (TX-1997) (shell).

Material: the double burial and associated grave goods, Brazos Fishtail points, and 53 various scrapers.

Stratum 6: "Red gray mix", cave deposits and red river sands, apparently mixed through aboriginal activities. (Redder suggests this stratum marks the end of a "dry" period.)

Date: *

Material: a Scottsbluff point, gravers, scrapers, knives, utilized flakes, and two fragments of eggshell.

Stratum 7: "Rocky red", a 1.2 m thick layer of reddish brown sandy clay and limestone fragments. It is positioned in front of the "Cave deposits, and described as an enigma by Redder (1985). It contained
both Paleoindian and Archaic materials.

Date: *

Material: a Brazos Fishtail, an "Edgewood-looking" dart point, a scraper assemblage similar to sub-stratum 5C, worked and polished bone fragments, utilized flakes, a chopper and a core.

Stratum 8: "Red sand", a layer of clean red river sand, located in the posterior half of the rockshelter, evidently having been truncated. It's approximately 90 cm thick and Redder has divided it into 4 substrata.

Sub-stratum 8A: "Double cemented", two thin lens of hard cemented sand separated by a thin layer of red clay. Below the lower cemented lens, there is an occupation zone less than 2.0 cm thick.

Date: *

Material: red ochre, a flint hammerstone.

Sub-stratum 8B: "Plainview 2", an occupation lens, capped by a thin layer of cemented sand. Most of the cultural material was adhered to the bottom of this cap. This sub-stratum is separated from 8A by 15.0 to 20.0 cm of red sands.

Date: 8,400±110 BP (TX-1996) (shell)

Material: two Plainview points, two "like Meserve" points, red ochre, utilized flakes, and a flint hammerstone.

Sub-stratum 8C: "Plainview 1", two thin layers of red clay, separated by a layer of red sand with limestone roof spalls.

Date: *

Material: a Plainview point, a point that resembles Dalton varieties, bifaces, scrapers, gouge, red ochre, utilized flakes, and a fragment
of an eggshell.

Sub-stratum 8D: "Red, white spotted", it appears to be a forward extension of the Plainview sands but separated from those sands by an Archaic midden. This substratum contains small nodules of caliche.

Date: *

Material: scrapers, bifaces, knives, chopper, gouge, utilized flakes, worked bone, red ochre, and a mussel shell scraper.

Stratum 9: "Yellow clay", 30.0 cm of yellow, waxy, clay.

Date: *

Material: no artifacts, a few small animal bones, bits of charcoal.

Stratum 10: "Archaic midden", a black, sandy soil located in front of the Plainview sands. This stratum was truncated either by flooding or Archaic digging. The depth of this stratum varies between 30.0 and 120.0 cm

Date: 4,145±190 BP (TX-1995) and 2,635±185 BP (TX-2000) (shell) 3,855±205 BP (TX-1720) and 2,405±170 Bp (TX-1999) (charcoal).

Material: 40 points including Perdianes, Travis, Uvalde, Gary, Kent, and Yarborough, two manos, gravers, two metate fragments, over 175 utilized flakes, 33 fragments of bone fish hooks, and bone pins. Faunal remains includes white tail deer, gar, catfish, turtle, rabbit, birds, mussels, snail shells, hackberry and one charred wild onion.
Stratum 11: "Compact red", compacted red layer.

Date:*  

Material: Gary, Kent, Ellis, Langtry, and Yarborough points, a drill, bifaces, gravers, utilized flakes, hammerstones, a mano, red ochre, bone hook fragments, and an awl fragment. Faunal remains include deer, rabbit, birds, fish, and turtle.
February 20, 1986

Ms. Diane Young
Department of Anthropology
Texas A&M University
College Station, TX 77843

Dear Ms. Young:

This letter grants permission for your use of Albert Redder's research in "Horn Shelter Number 2: The South End, a Preliminary Report," Central Texas Archaeologist, no. 10, in your thesis. We understand that you will also be reproducing in your thesis figures 1 and 2-1 from that article. You also have permission to use this same material in publication, if your thesis or some form of your thesis should be published.

We appreciate your care in requesting permission for the use of our published material and trust that your work will further our interest in the topic of Central Texas archaeology.

Sincerely,

Melanie B. McQuere
Academic Publications Coordinator
VITA

Diane Elizabeth Young was born in Minneapolis, Minnesota in 1951. She received her undergraduate degree in social sciences in 1974 from James Madison College, an interdisciplinary residential college program within Michigan State University. Her major area of study was socio-economics. In the summer of 1980, she finally pursued a long held amateur interest in archaeology by working as an Earthwatch volunteer with the Texas A & M University archaeological field school in southwestern New Mexico. She enjoyed the work so much that she asked to return the following summer; and by the fall semester of 1982, she was officially enrolled in the Anthropology Department's master's program at Texas A & M. Since that time, she has worked on excavations in Belize as well as southwestern New Mexico, as a graduate assistant to Anthropology Department faculty, and most recently, has been teaching an undergraduate course in physical anthropology. Her permanent address is 3635 Kingler Spring Place, Tucson, Arizona, 85718.