THE OSTEOLOGY AND ARCHAEOLOGY OF THE CROW CREEK MASSACRE

P. Willey and Thomas E. Emerson

ABSTRACT

The Crow Creek site is a massive village on the Missouri River in south-central South Dakota. The Initial Coalescent component covers 7.3 ha (18 acres) and is enclosed by a large, bastioned fortification ditch. The size of the village and the presence of the ditch suggest intergroup hostilities. In 1978 excavations at the northwest end of the fortificaton ditch recovered the remains of at least 486 individuals dated to AD 1325. Analysis of the skeletal material indicates that men, women, and children were present. Many were scalped, decapitated, and dismembered, and there are other indications of violence. Chewing on many of the elements demonstrates that the remains were exposed above ground for some period before burial. The Crow Creek crania are metrically most similar to those from St. Helena and early Arikara sites, suggesting affinities with those groups. Crow Creek has important implications for understanding intergroup relations and warfare in the Missouri River trench during the thirteenth and fourteenth centuries.

Keywords:* *Arikara; Initial Coalescent; massacre; scalping; warfare.

INTRODUCTION

In May 1978 Robert Alex discovered eroding human skeletons while leading a South Dakota Archaeological Society tour of the massive, well-preserved Crow Creek site in south-central South Dakota. Alex initiated efforts to recover the skeletons, have them analyzed, and reburied. He contacted the Corps of Engineers, Omaha District and the Crow Creek Sioux Tribal Council to make them aware of the problem. The local coroner and the Registry of Historic Landmarks were also contacted for permission to excavate the skeletons. The contract to excavate the remains went to University of South Dakota (USD) with Larry Zimmerman as principal investigator and Thomas Emerson as field director. P. Willey and John B. Gregg were consulting osteologists.

Before clearances and funding could be obtained, however, some of the remains were looted, chunked from the bank, and strewn down the erosional cut (Emerson 1978). As unfortunate as this destruction was, at least it allowed a preliminary assessment of the partial skeletal remains of nearly 45 individuals, including women, men, and children. Our initial inspection of the remains established that they had been killed, mutilated, and scavenged before being buried. Formal excavations began in August with a variable number of crew members until political conditions on the reservation became so uncertain that an archaeological "strike" occurred. A meeting between the USD archaeologists, the Corps of Engineers, the Crow Creek Sioux Tribal Council and Alex in September resulted in negotiation of the terms of the excavation, analysis, and reburial. Alex continued to visit the site as the excavations went on into early December and visited the laboratory at

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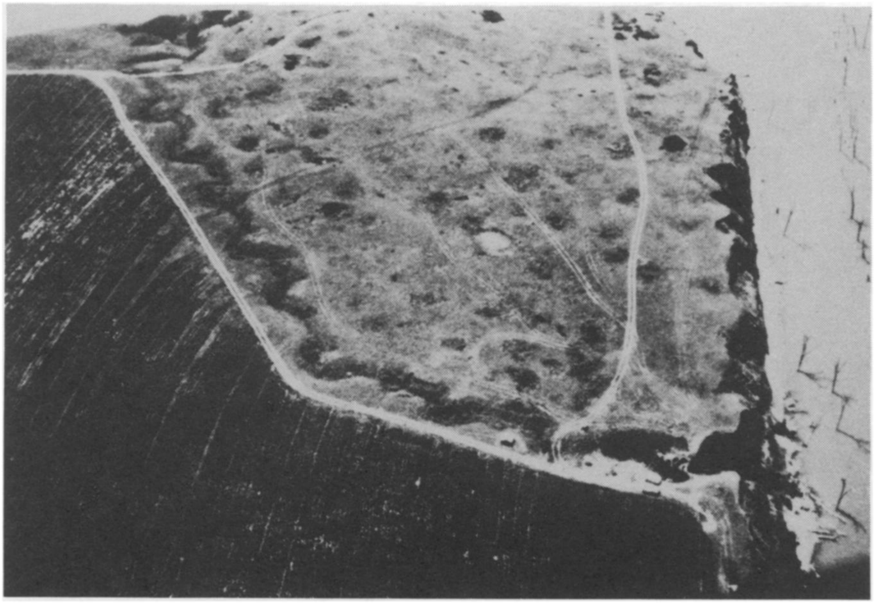


Figure 1. Aerial view of the Crow Creek site. Lodge depressions are surrounded by a serpentine fortification ditch. The 1978 USD excavations are in the lower right. View is south. (After Zimmerman et al. 1981:11, plate 1.)

USD where the remains were studied until May 1979. He was also present when the bones were reburied in an old excavation unit at the Crow Creek site in August 1981.

ARCHAEOLOGICAL BACKGROUND

The multicomponent Crow Creek site is on the east bank of Francis Case Reservoir, 16.9 km (10.5 mi) north of Chamberlain, South Dakota. It lies on the first and second terraces above the confluence of Crow and Wolf (Elm) creeks. Crow Creek is a perennial stream some 62 km (50 mi) in length, while the latter is a shorter, seasonal stream. Before impoundment, these two creeks joined on the Missouri floodplain just south of the site.

The site (Figs. 1 and 2) covers a triangular area of around 7.3 ha (18 acres). The western base is formed by a terrace edge that drops almost vertically into the reservoir basin. The southeastern border is another terrace edge that slopes into the narrow and now often inundated Crow Creek floodplain. The northeastern limit is defined by a deep fortification ditch depression 381 m (1500 ft) long that links these two terrace edges. The majority of the site is on federal land managed by the Corps of Engineers while the easternmost area is privately owned.

The earlier archaeological investigations at the Crow Creek site were part of a large-scale program to gather data from sites before their submergence or destruction by the impounded waters of the Missouri River behind the Fort Randall Dam. A report of these archaeological investigations has been published (Kivett and Jenson 1976).

Major excavations completely exposed six structures while 15 smaller tests revealed portions of numerous houses, middens, and two fortification ditches. This effort demonstrated the presence of two prehistoric aboriginal occupations at Crow Creek. The earlier twelfth century Crow Creek component belongs to the Initial Middle Missouri variant while the later fourteenth century Wolf Creek component belongs to the Initial Coalescent variant. Excavations and surface features of the later Wolf Creek component indicated a settlement of at least 50 dwellings clustered inside a heavily entrenched perimeter.

The Wolf Creek component village was in an excellent defensive location. The view of the river

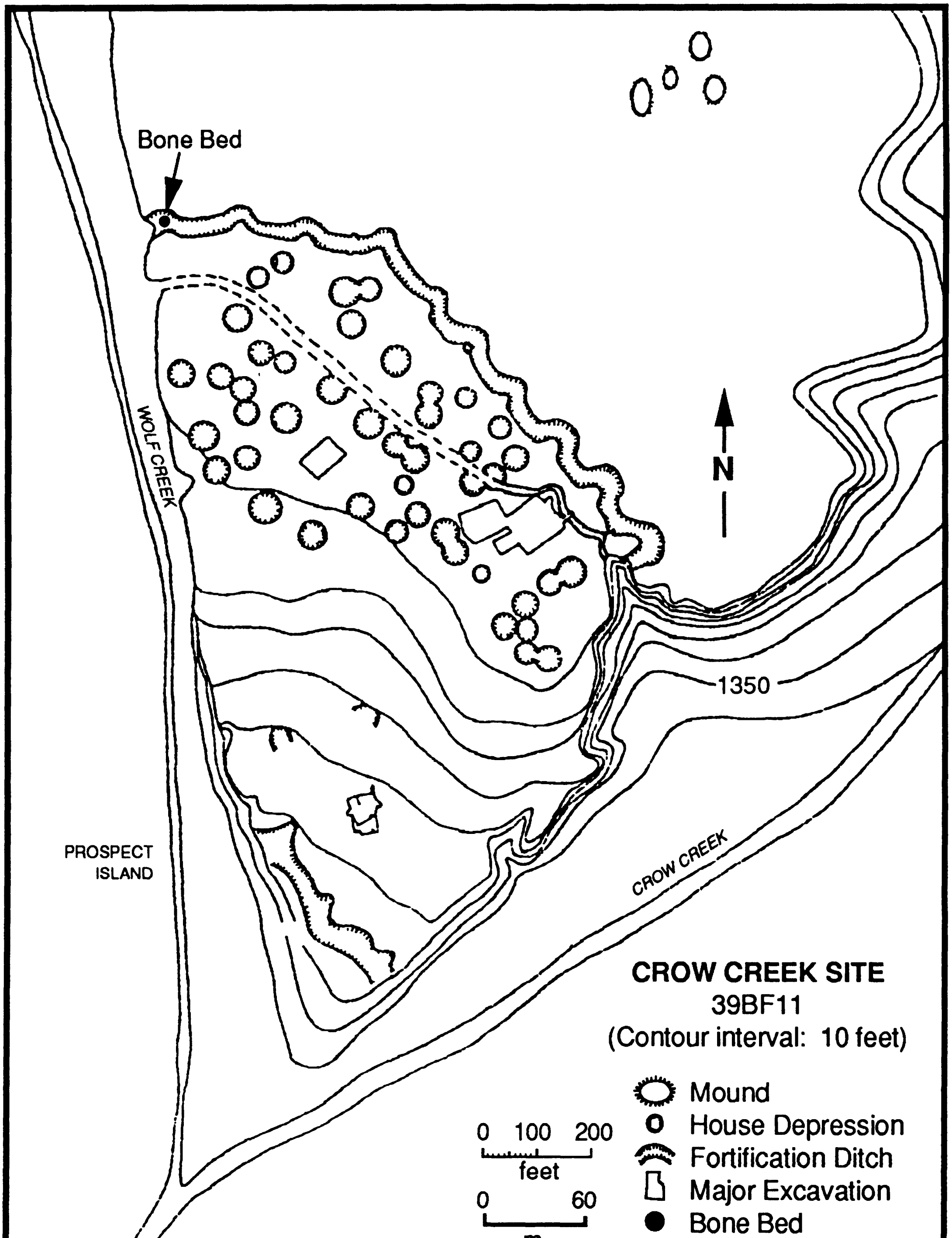


Figure 2. Plan of the Crow Creek site. Arrow indicates 1978 USD excavations. (After Kivett and Jensen 1976, figure 1.)

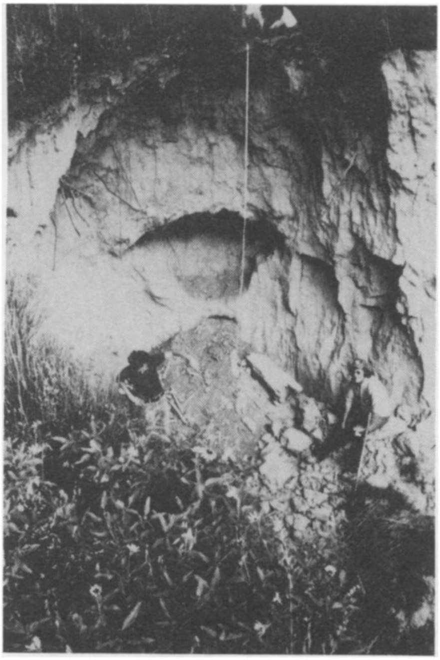


Figure 3. Northwest end of the Crow Creek site fortification ditch before USD excavation. Note vandal's hole, human bones in vandal's backdirt, and Tom Emerson's knee. View is east. (After Zimmerman and Alex 1981:5.)

valley and most of the surrounding uplands was unobstructed. The terrace bluffs of Wolf and Crow creeks prevented easy access to the village from the west and south. The northern and eastern extremities of the village were protected by extensive fortifications. The depression of the outer ditch is still clearly visible, linking the two terrace bluffs in a sinuous path created by the presence of 10 bastions. Excavations in the outer ditch uncovered a low density of cultural material, perhaps indicating a relocation of the Wolf Creek inhabitants after its construction. No evidence of a palisade was located. The less apparent inner ditch was filled with refuse diagnostic of the Wolf Creek component. This fortification ditch had apparently been constructed during the earliest part of the Wolf Creek occupation but was later abandoned and used as a refuse dump. Bastions and a palisade were associated with the inner ditch. There are 12 house depressions lying between the inner and outer ditches. One possible explanation for the abandonment of the inner ditch and its subsequent use as a refuse dump is the expansion of the village. The danger of enemy attack may not have been imminent during part of the occupation, but

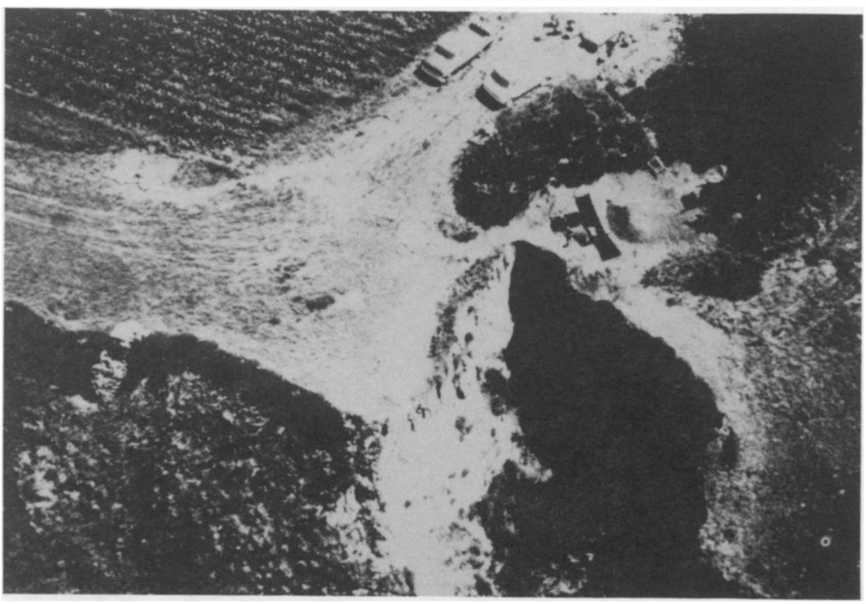


Figure 4. Aerial view of the northwest end of the Crow Creek site fortification ditch showing headwardly eating gully and initial stage of USD excavations. (After Zimmerman et al. 1981:19, plate 2.)

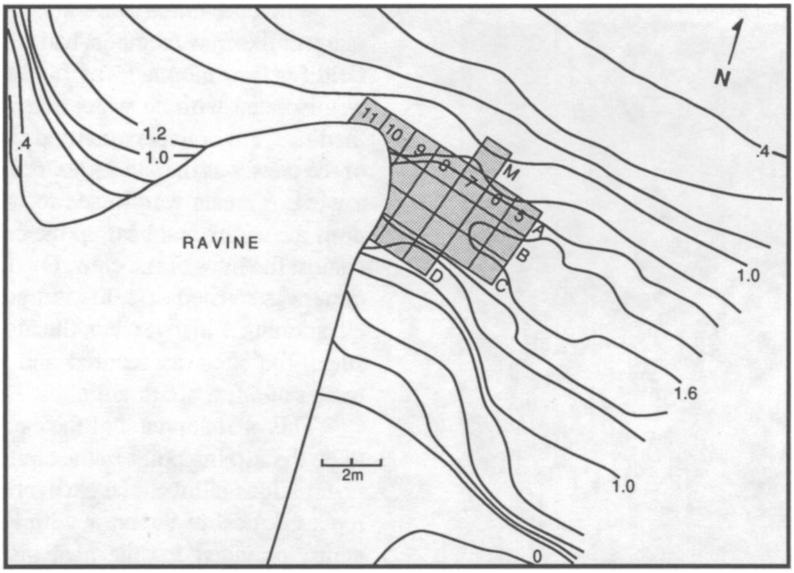


Figure 5. Map showing location and layout of 1978 USD grid system. Contour intervals are 0.20 meter and are depths below an arbitrary datum of 0. (After Zimmerman et al. 1981:22, figure 2.)

later became a threat requiring construction of the new outer ditch. It is clear that the village was destroyed, however, before the outer fortification could be completed.

The artifact assemblages, settlement patterns, and permanent dwellings of the component are typical of the Plains Village pattern. Body sherds from the Wolf Creek occupation exhibit roughly equal percentages of cord-roughened, smooth, and simple stamped finishes. Eighty-three percent of the rims in the assemblage are Campbell Creek, Talking Crow, or Grey Cloud types. These types place the Wolf Creek component squarely within the Campbell Creek phase of the Initial Coalescent variant as defined by Carlyle Smith (1977).

Before AD 1400 the people responsible for the Initial Coalescent variant had entered the southern part of the Middle Missouri subarea and were settled in the Big Bend region. Lehmer (1971:125) postulates there were two Middle Missouri village groups in the area north of the Initial Coalescent area. The Modified Initial Middle Missouri villages were located in the Big Bend and lower Bad-Cheyenne regions along with the fortified southern villages of the Extended Middle Missouri variant. Although the existence of the Modified Middle Missouri variant has been questioned by Johnson (1979), it is possible that there are contemporary Initial Coalescent and Middle Missouri villages in the region. Such groups may have been in conflict with the Wolf Creek people.

THE UNIVERSITY OF SOUTH DAKOTA'S EXCAVATIONS

Excavations in the fortification ditch area began in early August 1978 and continued into early December, when freezing conditions finally brought them to a halt. During this roughly four month period, the skeletal remains of almost 500 individuals were removed for examination at the USD Archaeology Laboratory. The skeletal remains in the outer fortification ditch were clearly a unique and irreplaceable source of data relating to the biological history of the early Initial Coalescent populations in the Missouri Trench. It was critical that the archaeological excavations delineate the cultural context of the massacre victims. There were, however, a number of constraints placed on the project that affected the data recovery strategy. These included the safety of the excavators, the complexity of the bone bed deposits, the restriction of the excavations to the minimal

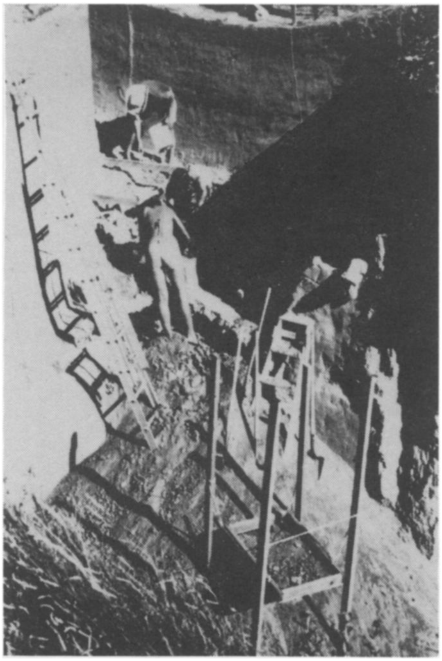


Figure 6. Excavation, screening, and mapping in progress. View is east.

area required to remove the skeletal material, severe time and funding restraints, and the political uncertainty of the situation.

We initially planned and budgeted the work at Crow Creek expecting to remove an isolated burial from the bluff-face. After the vandalism occurred, exposing the remains of nearly 50 individuals (Willey 1978), we raised our time and cost estimations accordingly. Given our inability to test the ditch before planning the excavation, however, we were unprepared for the scale of the bone deposits. As might be expected, this created havoc for the administrative and field personnel of both the Corps of Engineers and USD.

The Crow Creek excavations became a political and emotional issue between various tribal factions and governmental groups with the archaeologists as pawns. Constantly conflicting information and orders flowed from various sources. During some periods it became impossible to predict if the excavations would continue from day to day. Some of these difficulties have been printed elsewhere (Zimmerman and Alex 1981a, 1981b).

When the initial work at Crow Creek began, many of the crew members had already been in the field for four months. The field camp at the site was isolated with no water and inadequate toilet facilities. For both personal and site security, most of the crew was on-site 24 hours a day, seven days a week. Threats were made to take the remains, burn the camp, and beat up the crew, and finally, against the lives of the crew. On one occasion, the crew was rousted at 2:00 am by tribal police for questioning. Finally, when threats reached a crisis stage, the site was secured and abandoned in a matter of a few short hours.

This abandonment of the excavations proved to be the turning point in the conflict. Subsequent negotiations allowed the excavations to continue, replaced most of the crew with local Indian residents, provided for the analysis of the skeletal remains, mandated the reburial, and created an uneasy truce among the groups. It was within this context that the archaeological investigations of the Crow Creek massacre took place in the fall and early winter of 1978 (Emerson 1980; Emerson et al. 1979).

The skeletal deposit was first observed in the bluff-face about 2.5 m (8 ft) below the surface, at the head of a deep ravine eroding away the westernmost bastion in the outer fortification ditch (Figs. 3 and 4). Access to the exposed bones was limited to a narrow ledge a meter below the deposit, reachable only by being lowered by ropes from above or making a precarious climb up the 20 m slope from the bedrock outcrops below. These dangerous working conditions were exascerbated by the occasional fall of massive blocks of the unstable bluff-face.

Recognizing the National Historic Landmark status of the site, all excavations were kept to the minimum required to remove the bones. Originally a short, narrow, stepped trench was planned. As the larger size of the bone deposits became clear, it became unfeasible to maintain steps. The exposure of the face of the fortification ditch by erosion allowed it to be cleared and profiled by hanging a ladder (to which a crew member clung) over the bluff-face. Once the ditch profile was visible, it became possible to lay out the grid system immediately over the suspected position of the buried skeletal deposits.

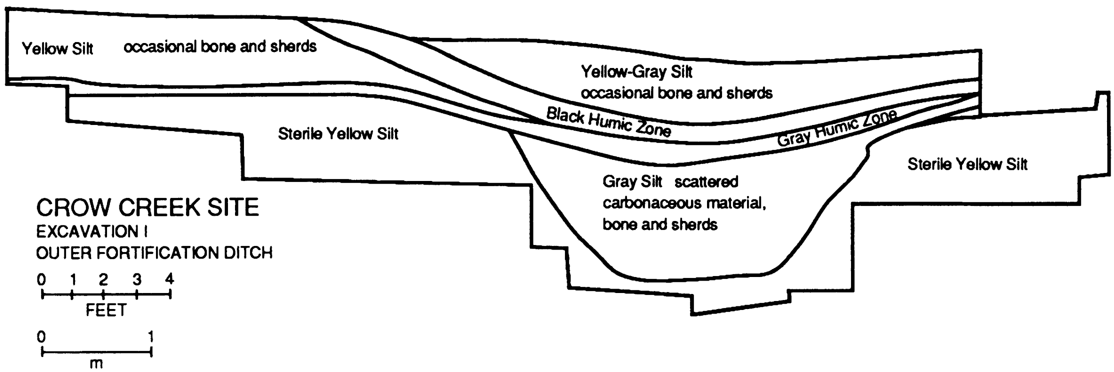


Figure 7. Profile of the west face of the Nebraska State Historical Society's Excavation I in the outer fortification ditch. (After Kivett and Jensen 1976, figure 2.)

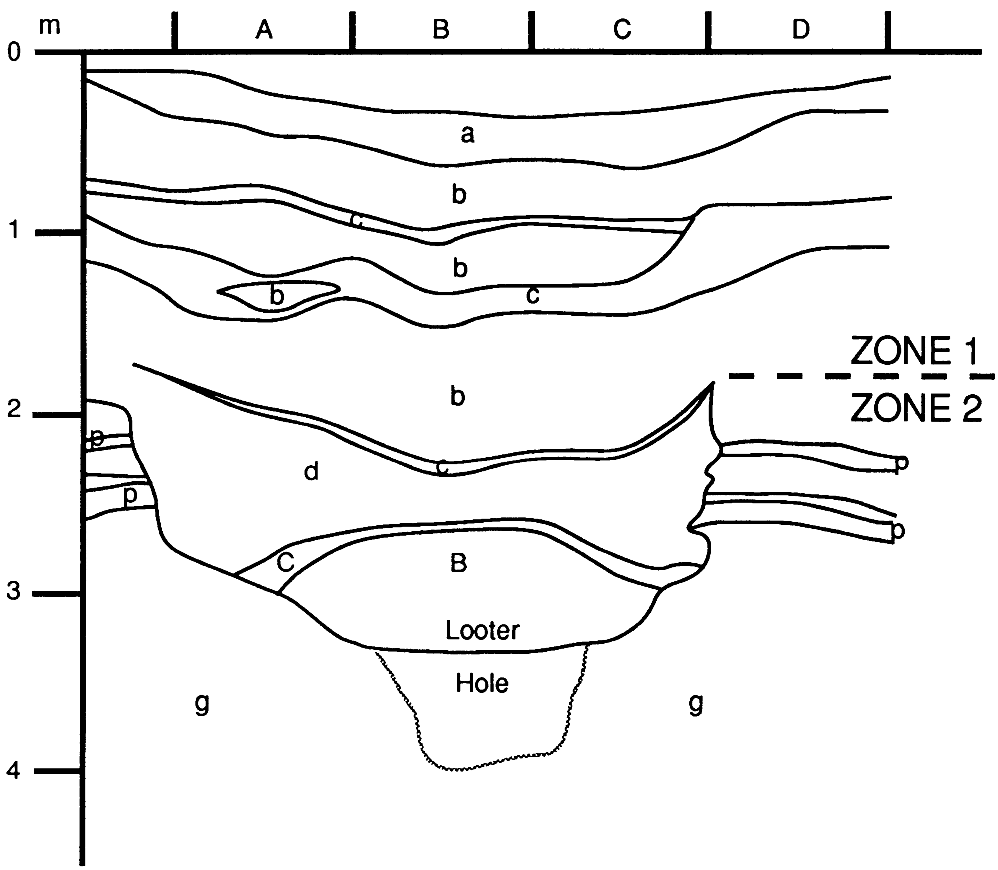


Figure 8. Profile of the USD excavation of the east wall of 9A-9D. Key: (a) dark gray silt (10YR 4/1); (b) pale brown silt (10YR 7/4); (c) dark gray silt (10YR 3/1); (d) light gray silt (10YR 6.5/1); (C) clay layer (10YR 3/2); (B) bone bed; (p) buried paleosols; (g) sterile subsoil. (After Zimmerman et al. 1981:30, figure 5.)

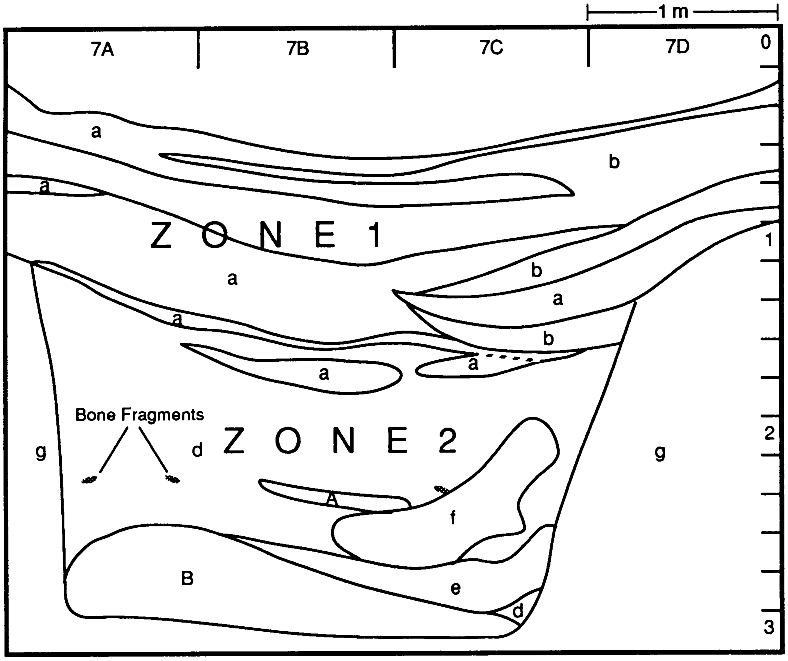


Figure 9. Profile of the USD excavation of the east wall of 7A-7D. Key: (a) dark gray silt (10YR 4/1); (b) pale brown silt (10YR 7/4); (c) dark gray silt (10YR 3/1); (d) light gray silt (10YR 6.5/1); (e) dark gray silt (10YR 2.5/1); (f) identical to (e) but with large fragments of burned clay; (g) sterile subsoil; (A) bone bed A; (B) bone bed B. (After Zimmerman et al. 1981:32, figure 6.)

Figure 10. Profile of the USD excavation of the east wall of 7A-7C. Note the major Bone Bed B in the middle of the photograph and the minor Bone Bed A in the upper right portion.

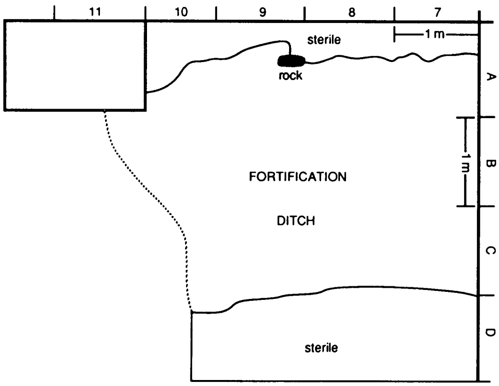


Figure 11. Horizontal plan of the lower portion of the fortification ditch at 1.6 m below southwest corner of 7B. Plan shows position of metate at apex of Bone Bed B and width of fortification ditch at that level, i.e., at base of Zone 1. North is up. (After Zimmerman et al. 1981:26, figure 3.)

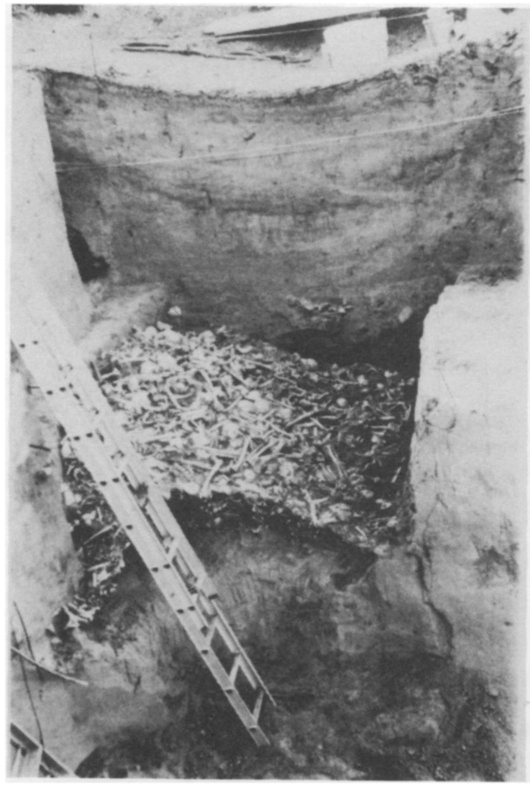


Figure 12. View of Bone Bed B. Note looter's hole in foreground and present-day swale indicating ditch at ground surface. View is east.

One meter grid squares (Figs. 5 and 6) were established using numerical designations for east-west and letters for north-south coordinates. Artifacts were collected by elevation and quadrants within the squares. Material concentrations and material in direct association with the human bone deposits were piece-plotted. In the on-going field analysis of the material, it was determined that such detailed provenience data did not significantly contribute to our interpretations due to the paucity and the nondiagnostic nature of the recovered cultural items. In the upper part of the fortification ditch, the sediments and materials were wind and water deposited. A similar situation existed in the lower zones of ditch fill that consisted primarily of erosionally redeposited midden from the Wolf Creek component.

When human remains were encountered, a slightly different recording method was used. Bone Bed A, a thin scattering of human bone overlying the main deposit (Bone Bed B), was individually piece-plotted. When the extensive Bone Bed B was reached, procedures were modified to cope with its much larger quantity. The upper level of Bed B was mapped and photographed square by square (Fig. 6). All articulated skeletal elements were given a specific articulation number and collected as a unit, while unarticulated elements were collected by square quadrants and level. The lower levels of Bone Bed B were dealt with similarly except that they were not mapped, only photographed.

A total of 18 entire and four partial squares was excavated to expose a roughly rectangular area 6 m east-west and between 1.5 m to 3 m north-south. Excavation depth varied from 1.5 m to 3 m. In the upper portions of the ditch fill (Zone 1), the soil was removed completely from the squares, even when they contained sterile subsoil, to provide access to the lower ditch area. In the lower, narrower portion of the fortification ditch, only the ditch fill was removed, excavations following the actual edges of the prehistoric Wolf Creek period ditch. The soil from Zone 1 was removed by shovel skimming, troweling, or both and dry screened through a 64 mm (1/4 in) screen. Selected samples were water screened. Zone 2 was hand excavated with trowels and various picks to avoid damage to the human remains. Portions of

Figure 13. View of Bone Bed B. Note looter's hole at left and metate at apex of cone-shaped bone bed. View is north. (After Zimmerman and Whitten 1980:100-101.)

Zone 2 were also dry screened as a check on the completeness of material recovery. Extensive soil samples were taken for processing by flotation.

Archaeological Context

The depositional history of sediments in the Crow Creek locality was studied by Cogan and Irving (1959). One of the sections they used in their study of cut-and-fill terraces on the Missouri River was the south bluff of Wolf (Elm) Creek 91.4 m north of 39BF4 (Cogan and Irving 1959:320-321). In this area, they identified four depositional units overlying the bedrock Pierre Shale and forming an upper terrace, Mt-2, on the left bank of the Missouri River. The upper unit consists of as much as 8.2 m of aeolian silty sand with numerous humic horizons defining former surfaces. The Crow Creek site rests on the silt cap of this 24.4 to 30.5 m upper terrace. The outer fortification ditch is excavated into this silt.

In 1955 Kivett (Kivett and Jensen 1976:8) tested the outer fortification ditch with a trench 12.2 m long and 2.4 m wide. It was placed at right angles to the ditch about 100 m east of the 1978 USD excavations. They found that aboriginally the ditch varied in width from about 1.4 m at the bottom to 3.7 m at the top and was 1.8 m deep (Fig. 7). The ditch fill was relatively clean, containing only a few animal bones, charcoal, and Wolf Creek sherds. No evidence of an inner stockade line was found in this unit. Consequently, another 1.5 by 3 m unit was opened in a bastion to search for a palisade line, but none was found. The absence of this palisade was confirmed by the USD excavations.

The 1978 USD excavations provide additional opportunities to examine the outer ditch form and construction. The first profile was at 9A-9D along the eroding face of the bluff (Fig. 8). It shows the western extent of the bone deposits and the vandalized portion. It also reflects the basic dichotomy in all of the outer fortification ditch profiles between the upper and lower fills. The upper levels, labeled Zone 1, are humic layers interspersed with layers of wind-deposited loess. These layers reflect periods of stability and instability in previous land surfaces. These lenses have also been disturbed by subsequent wind and water erosion and redeposition. The lower ditch fill, Zone 2, is fairly homogeneous, suggesting it filled

Table 1. Body sherd surface treatment.

	Zone 2		Zone 1		Total	
	no.	%	no.	%	no.	%
Simple Stamped	29	15.1	36	19.1	65	17.1
Cordmarked	105	54.7	118	62.4	223	58.5
Plain	56	29.2	29	15.3	85	2.1
Decorated Shoulder	2	1.1	6	3.2	8	
Total	192		189		381	

Table 2. Ceramic types based on rim sherds.

	Zone 2	Zone 1	Total	Per cent
Talking Crow Straight Rim	0	3	3	10.3
Campbell Creek Pinched	1	0	1	3.5
Campbell Creek Plain	1	5	6	20.7
Campbell Creek Cordmarked	12	1	13	44.8
Campbell Creek Indented	5	1	6	20.7
Total	19	10	29	100.0

rapidly.

A similar profile was present at the east wall of 7M-7D. This profile, shown in Figures 9 and 10, was exceptional for its sharp delineation of the uneroded aboriginal ditch. It also shows evidence of the two human bone deposits, Bed A and Bed B, and the clay layers, e and f, that covered Bone Bed B. This distinctive clay layer appeared to be a deliberate cover over almost all the major bone deposit. During the course of the excavations, Everett M. White, a soil scientist from South Dakota State University, Brookings, examined this clay layer in an exposed ditch profile at 5A-5C. White noted that

> The layer contains massed and contorted seams of soft clay (about 50-60% $<2\mu$ size) which have distinct boundaries with the silt....The clay masses could not have been transported intact by wind or water from the source 50 to 100 feet below the site. No known soil weathering process could create and deposit clay especially where soil formation has been very weak. At the same level adjacent to the pit face, another clay-rich mass contained a fragment of fissel shale which was unweathered. Thus, the clay must have been originally slack-water sediment from the adjacent creek and river floodplain or shale ground by humans. If the clay masses had not been deposited contemporaneously with the silt, rains would wash the clay over the silt to cause layering of clay with silt as loess increments were added. Thus the clay and the silt must have been deposited together by humans (White 1979).

Field observations confirm that the clay (with some mixed midden fill) was brought in to create a hard-packed layer, approximately 30 cm thick, over the human remains in Bone Bed B. As White observed, the closest source of this clay was from the floodplain and would have had to be laboriously carried up the bluff to the ditch. This layer suggests that Bone Bed B was a deliberately placed "burial area" covered by the hard clay, protecting the remains from scavengers and erosional exposure. It also suggests that there were villagers who survived the slaughter and were able to return to bury their dead.

The human remains were recovered in two layers, the upper or Bed A and the lower or Bed B. Bone Bed B was deposited in a large cone-shaped mass with its apex in squares 8A and 9A (Figs. 11, 12, and 13). From this apex, it fanned out, covering the remainder of the exposed fortification ditch bottom. The bone deposit reached a thickness of 1.5 m at its apex and then dramatically thinned to the east, south, and west. The distribution of the bones indicated that the dismembered and decayed remains had been carried to the outer edge of the fortification ditch and dumped in the same spot, gradually developing its fan-shaped distribution. The apex of this deposit was "marked" by the presence of a large granitic metate jammed along the north face of the ditch. Whether the presence of this item was fortuitous or deliberate is impossible to determine.

The clay layer covered Bone Bed B to within 0.5 m of the apex, where it thinned and disappeared. This clay layer thickened toward the bottom of the deposit, suggesting erosional redeposition. There was also some evidence suggesting that the upper layer of Bone Bed B may have been disturbed. When excavators exposed the top of the clay layer, it had a scattered deposit of human bones on it. This scatter was designated Bone Bed A and contained only scattered, disarticulated human remains and a number of bison scapula hoes. The absence of clay on the Bone Bed B apex and the disarticulated human remains scattered down the surface of the clay layer suggest that Bone Bed B was disturbed by scavengers soon after the interment. The bison scapula hoes likely

Table 3. Bison remains from the outer fortification ditch.

Elements	Zone 1	Zone 2
Phalanges	18	51
Radii	3	1
Astragali	1	2
Ulnae	3	0
Vertebrae	30	24
Femora	2	0
Scapulae	1	5
Ribs	16	9
Nav/Cub	2	6
Other Carpals	3	15
Mandibles	1	2
Calcanea	1	3
Sesamoids	3	25
Magnum Carpals	2	0
Metatarsals	2	5
Metacarpals	0	14
Ilia	2	0
Sacra	1	0
Innominates	0	41
Patellae	1	2
Unidentified	900	788
TOTALS	992	993

represent the discarded tools used to bury the victims.

The 1978 excavations confirmed Kivett and Jensen's (1976:8) findings that the outer fortification ditch contained little cultural material, especially when compared to the refuse-laden inner ditch fill. Despite the almost 50 m^3 of fill removed by USD from the outer ditch, only a moderate amount of pottery, lithics, bone, and fire-cracked rock was recovered.

The depositional and postdepositional history of Zone 2 has a strong bearing on the analysis of the recovered material. The primary source for material in Zone 2 is redeposited midden fill from the Wolf Creek component. While cultural material in the midden is roughly contemporaneous with the massacre and the skeletons, its provenience within the fortification ditch has little meaning. The situation is aggravated by the movement of materials by erosion, animal disturbance, and settling of the burial mass with the decomposition of the human remains. Artifact provenience within zones appears to have little importance. The zonal provenience of the material, however, can provide useful information. That Zone 2 represents a rapid filling episode supports this view and it provides important data for corroborating the Initial Coalescent dating for the burial of the skeletal material. In the following discussions of cultural material recovered, the basic fill units, Zones 1 and 2, will be used as the units of analysis.

Ceramics

Analysis of the recovered ceramics from Zones 1 and 2 by Carlyle Smith (Zimmerman et al. 1981:40-46) demonstrated that the 407 body sherds and 29 rim sherds consisted primarily of the Campbell Creek phase (Smith 1977:63-67) of the Initial Coalescent variant. Several sherds of Talking Crow Straight Rim (Smith 1977:58-59) were also recovered. The ceramic assemblage is characterized in Tables 1 and 2.

Lithic Artifacts

There were few lithics in Zone 1. Fragments of two thumbnail scrapers, one small piece of scoria, one broken fragment of a plate chalcedony knife and 23 pieces of debitage were recovered. Fire-cracked cobbles were plentiful. Three projectile points were located in Zone 1. Two of these are straight-based triangular points, while one is triangular with a concave base and side notches.

Despite the overwhelming evidence of violent death inherent in the Zone 2 skeletal deposits, the only weapons recovered were four projectile points. Two white chert points are triangular with straight bases. The remaining two projectile points are side-notched with flat bases. One is made from white chert and the other is from a yellow-brown chert. The other Zone 2 lithic materials include 21 chert and quartzite pieces and one small fragment of a plate chalcedony knife. Fire-cracked rock was plentiful throughout the fill.

Lithic typology has never been adequately developed for the Plains Village tradition. Smith (1977:82) noted that the Campbell Creek phase is characterized by plain triangular points with straight bases and by side-notched points. The chronological significance of the points is tenuous at best.

Worked Bone

Zone 1 lacked worked bone. Zone 2 included a number of polished animal bone fragments and bone tools. The main concentration of worked bone was in Bone Bed B.

Other bone tools from Zone 2 include an awl, a projectile point, an ulna pick, and hoes. The single awl, made from a large mammal ulna, was recovered from Bone Bed A. A single socketed, conical bone projectile was found with the human bone. Similar points have been recorded from Initial Coalescent sites. A single bison ulna pick was recovered from the fill between Bone Beds A and B.

Some of the most interesting bone tools were five bison scapula hoes found in Zone 2. Four of these were mixed in Bone Bed A and were lying atop the clay layer covering Bone Bed B. All four show wear and have the spines removed. The remaining hoe was found under the clay layer, immediately on top of the Bone Bed B deposit. Although the spine was removed, the glenoid fossa was not modified. All of the hoes were broken. These hoes appeared to have been used in the burial of the villagers and then abandoned.

Bone artifacts that were not discussed in the preliminary report (Zimmerman et al. 1981) were human skull bowls. At least two bowls were found mixed with the Bone Bed B skeletal deposit. The two bowls were fashioned from the top of the cranium; cut marks were evident along the edge where the rest of the skull had been removed. The cut edges were carefully ground and smoothed. Both the cut edges and portions of the skull bowls were colored with red ocher. Most likely the skull bowls were possessions of the villagers that were accidentally or purposefully gathered and interred during the burial.

Diagnostically and chronologically, the bone tool assemblage contributes little information. All of the bone tool forms could be from an Initial Coalescent context. The prevalence of hoes with basically unmodified articular ends supports a Campbell Creek phase association (Smith 1977:107). This contention is supported further by data collected by Kivett. He (Kivett and Jensen 1976:62) reports that all of the bison scapula hoes from the Wolf Creek component had retained the articular ends, many of which show wear along the posterior edges, anterior edges, or both. Only the spines were removed.

All of the hoes and a pick were found only in Zone 2 and in every case they were in direct association with the human burial deposits. Four of the hoes came directly from the packed clay surface, while the other hoe was directly on top of the bone deposits. It is clear that these hoes were the very tools used to spread the clay over the human remains interred in Bone Bed B.

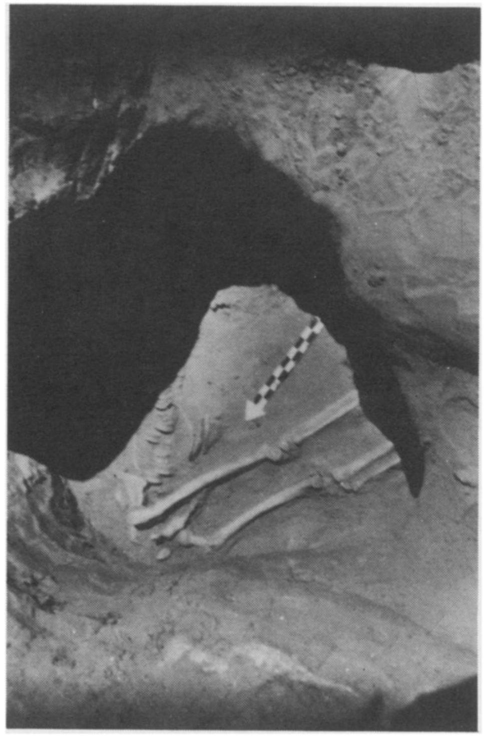


Figure 14. Disarticulated skeleton found in Nebraska State Historical Society's excavation near House IV. (After Kivett and Jensen 1976:126, figure 16B.)

The evidence available from the meager cultural inventory is compatible with an Initial Coalescent affiliation for the outer fortification ditch and the victims buried in it.

Faunal and Floral Remains

A number of faunal remains were collected from the fill of the outer fortification ditch and were identified by Jo Anne Emerson (Zimmerman et al. 1981:51-60). The presence of these remains appears to be fortuitous and results from the redeposition of village midden in the ditch. Consequently, their interpretive value is minimal.

The predominant remains from the fill of Zone 1 (992 elements) are bison (Table 3). The remainder of the faunal material consisted primarily of deer bones (19 elements), either white-tailed or mule deer since both were in the area. The upper level of Zone 1 also included a medial long bone fragment of an unidentifiable bird species and two probable duck bones.

Faunal remains were more varied in Zone 2. This probably results from the inclusion of faunal remains in the village refuse that formed the major portion of the fill in the lower ditch zone. Again, bison (Table 3) was the predominant species (993 elements). A few deer remains (11 elements), small mammal bones (1 *Marmota* sp.; 1 *Reithrodontyomys* sp.), possible amphibian (2 elements), and bird bones (11 elements) were also present.

A number of elements (24) of genus *Canis* were found in the matrix of Bone Bed B. Based on their size, these bones are probably those of domesticated dogs. The elements characteristically show evidence of butchering cut marks and gnawing. The close association of the dog bones with the human burials was at first thought to have some religious significance. The gnawing of the elements by scavengers, however, suggests that it is more likely that the dog remains represent meals and accidental inclusions from the village midden.

Soil samples were collected during the excavations. In general, little carbonized material was noted in the field and the identification process by Thomas Haberman verified this observation (Zimmerman et al. 1981:60-71). He identified the carbonized specimens of *Chenopodium* sp. (goosefoot), *Zea mays (maize)*, cf. *Helianthus annuus (common sunflower), Prunus americana (wild plum), and Prunus virginiana* (chokecherry) as being present in Zone 2. Cutler (1976) previously identified corn, squash, wild plum, and goosefoot as present at the site. Since all of the botanical remains were redeposited in the ditch fill from the village midden, their interpretive value is limited.

Cultural and Chronological Affiliations of the Victims

The cultural affiliation of the massacre victims is critical to our understanding the physical anthropology and ethnic archaeology of the early Plains Village groups in South Dakota. Several lines of evidence indicate that the victims were, in fact, the Initial Coalescent occupants of the Wolf Creek village. All of the cultural material found in association with this ditch and the bone deposits is identifiable with the Initial Coalescent variant. The outer ditch represents an expansion of the Wolf Creek component village, indicating a lengthy occupation by Initial Coalescent people before the massacre. This occupation was sufficiently long to entail the construction of the outer houses and fortification ditch.

In addition, there are now a series of three radiocarbon dates for the Crow Creek component that indicate it predates the Wolf Creek occupation by several centuries. A sample from the Crow Creek House VI provided a date of AD 1050±200 (M-836) (Kivett and Jensen 1976:67), which corrects to AD 1056±105 (Thiessen 1977:61). Subsequent salvage excavations in 1981 provided two more C-14 dates for this early component (Haug 1986:271) of AD 1100±80 (I-13,577) and AD 1050±80 (I-13,578). Haug (1986:272) notes that using a weighted average technique these three samples produce a mean date of AD 1071. Based on the archaeological contextual information and these dates, the scenario that the burials are those of the previous Crow Creek component people is not feasible.

There is corroborative evidence from the 1954 to 1955 excavations by Kivett (Kivett and Jensen 1976) that the Wolf Creek village was destroyed by a hostile group. Every Wolf Creek component structure excavated or tested showed indications of burning. Some human bone was recovered from a number of features. A human mandible and cranium came from the inner ditch fill. Skull fragments were found in six of the post holes for the inner ditch palisade. Various human remains were noted in refuse pits. Two bell-shaped pits near House V contained a human skull and pelvis. Another pit near House IV held a human femur and several phalanges. Testing of a depression adjacent to the west end of the outer fortification ditch revealed a house floor and associated bell-shaped pit. Near the bottom of the pit were the semiflexed, partially articulated remains of an individual (Fig. 14). The skull, right arm and hand, the left forearm and hand, and the feet were missing. This pattern of mutilation was repeated in the human remains recovered in the outer fortification ditch, thus reinforcing the conclusion that it was the villagers who came to an untimely death. Such evidence ties the burning of the village with the massacre of its inhabitants.

The material culture items recovered from the fortification ditch securely associate the death and burial of the human remains with the Initial Coalescent occupation of the Crow Creek site. The excavation and subsequent filling of the inner fortification ditch with midden in conjunction with the village expansion indicates that the village had been occupied for a considerable period before the massacre. The presence of some Coalescent ceramics in Zone 1 suggests some minor post-massacre habitation on the site.

Kivett and Jensen (1976:64) submitted charcoal from a post mold found in the basin of House IV for dating. A date of AD 1390±150 (M-1079a) was obtained. A series of dendrochronology dates on wood from the site have been presented by Weakley (1971:30-31). Unfortunately, few of these specimens can be assigned to a component. Weakley was able to date 12 juniper specimens which had a range from AD 1385 to 1508. All but two of these dates were earlier than AD 1440. The only juniper specimen that can be securely correlated with the Initial Coalescent component ranges from AD 1340 to AD 1435.

During the course of the 1978 excavations in the outer fortification ditch, sufficient carbonized wood was collected to run a C-14 date. The carbonized wood used in this sample included only those specimens that were directly from the soil matrix in the lower levels of Bone Bed B. The University of Wisconsin Radiocarbon Laboratory processed the sample and provided a date of AD 1340±55 (WIS-1074). The calibration of the radiocarbon dates (after Stuiver 1982) indicates a fourteenth century date for the demise of the fortified Initial Coalescent Crow Creek village.

The incongruities of the radiocarbon and dendrochronological ages of the Wolf Creek component have been addressed by Donald Blakeslee (personal communication, 1989). Using a C-14 simulation program that he designed, (see Blakeslee, this volume) Blakeslee determined that

> The C-14 dates from Crow Creek could be from the dendro-dated wood in spite of the apparent differences. That is, I entered the reported range of observed dendro dates from the site into the program, which simulated all of the parameters that normally affect C-14 dates. The dendro dates of AD 1385-1508 yielded simulated C-14 dates between 71 and 756 BP in 100 runs.
>
> The probability that both C-14 dates are from wood the same age as the reported dendro dates is very low. Both are more than one standard deviation older than the mean of the dendro dates.
>
> In terms of relationships within [the] Initial Coalescent, the type site (Arzberger) with C-14 dates of 500±75 and 430±100 (from the same sample) is definitely at the late end of the five sites with dates. The earlier dates from Crow Creek are not out of line with the total sample. The Crow Creek dates do fall at the early end of the range of "acceptable" dates—that is, at the early end of those not affected by a wiggle in the calibration curve.

The radiocarbon determinations suggest a much earlier beginning date for the Initial Coalescent in South Dakota than generally accepted. Lehmer (1971:114) favored a beginning date of AD 1400 while Smith (1977:152) placed his early Campbell Creek phase of the Initial Coalescent between AD 1425 and 1500. It appears that the primary reliance on these dates is based on dendrochronological information combined with relative dating. The tree-ring dates are consistently late, ranging from the late fourteenth to early sixteenth centuries. Given the often questionable contextual setting of samples, however, the absence of rigorous methodological analysis and the tendency of tree-rings to provide later dates than analogous C-14 samples (Caldwell and Snyder 1983), these dendrochronology dates are of questionable reliability in dating the component.

Although the data gathered in this limited excavation can in no way resolve the problems relating to the dating of the Initial Coalescent, they can make a contribution. The radiocarbon determination from Bone Bed B seems acceptable. The minimal work done at Initial Coalescent components indicates that the dating problems are much more complex than has been indicated in the past. The limitations of the data available from previous testing at the Wolf Creek component of the Crow

Creek site have forced researchers to treat it as a single occupational event. Considering the wide range of dates, the sequence of fortification constructions, the village expansions, and the demonstrated variation in intergroup relationships, the Coalescent occupation of Crow Creek has a much more complex history than has been indicated in the past. Unfortunately, to unravel this complex pattern, new excavations in the habitation areas of the site will be required. It is clear, however, that Initial Coalescent peoples were present and constructing a large fortified village at Crow Creek by at least AD 1300.

The Initial Coalescent-Central Plains appearance in the Big Bend area probably began in the late thirteenth century and by the early to mid 1300s was present in its developed form of large fortified villages. This early date seems feasible in terms of what is now known about the origination of the Coalescent tradition in the Nebraska-South Dakota region. Current data suggest that this process of cultural amalgamation was underway by the mid 1200s (e.g., Kivett and Jensen 1976:64-67; Steinacher 1984; Ludwickson et al. 1981:161-168). The 1978 Crow Creek excavations and analysis lend further support to the thirteenth century origins of the Initial Coalescent tradition in this region.

HUMAN OSTEOLOGY

The human skeletons were prepared for analysis at the USD Archaeology Laboratory. Most of the analyses of the remains took place between January and March 1979, with a less concerted effort beginning in the fall of 1978 and continuing through May 1979, when the bones were returned to the Crow Creek Sioux Reservation. Despite the brief period the material was available, much valuable information was recovered. John B. Gregg, a physician from Sioux Falls, gathered skeletal paleopathology data. Julie Sieh, a student at USD, collected dental data. M. Pamela Bumsted, a student at University of Massachusetts, Amherst, collected samples for trace element analyses. And Richard McWilliams, a professor at the University of Nebraska, collected discrete trait observations. Many publications have reported these observations (eg., Gregg 1982; Gregg and Gregg 1979, 1987; Gregg et al. 1981; Gregg and Zimmerman 1986; Loveland et al. 1984; Symes 1983; Willey 1982, 1990; Zimmerman et al. 1980, 1981). Most of these studies emphasize the antemortem paleopathologies.

The kinds of antemortem diseases included congenital malformations, trauma, infectious processes, tumors, metabolic disturbances, and degenerative diseases (Gregg et al. 1981). The most common congenital diseases involved the vertebral column. Antemortem trauma included healed fractures, a few dislocations, and an embedded projectile point. Tumors were found on various bones, the most common location being the external auditory canals. Most of the infectious lesions were identified as periostitis, although a few instances of sinusitis and osteomyelitis were noted. The most frequent metabolic disease was iron deficiency anemia as indicated by cribra orbitalia and/or porotic hyperostosis. Finally, degenerative diseases were represented by osteoporosis, vertebral osteophytosis, and other hypertropic joint changes.

The day-to-day data collection was conducted by Willey and Mark Swegle with the able assistance of Jeff Buechler, Roger Williams, Max Schmeling, and many USD students. We gathered data for basic element counts, paleodemography, craniometric affinities, and mutilations. Results of these analyses are presented following the methods employed in gathering the information. The methods and results are from Willey (1982, 1990).

Element Counts

The bone study began with the element inventory. The purpose of the element count was to determine the number of people present, a first step toward the demographic analysis. The element count was also necessary for determining the proportions of the different elements present. Element proportions differing from the expected ratios might indicate dismemberment and removal by the raiders, consumption by scavengers, or omission by the gatherers who buried the remains.

Bone elements were counted in two different ways. First, an inventory of each bag containing remains was made, listing the elements present. Because parts of the same bone may have been in two or more bags, a summation of this inventory yielded a "maximum" count.

The second way bone elements were counted was a minimum count. The minimum count was made only for the long bones and the petrous portion of the temporal. For each element, a single point was selected to make sure no duplication could occur. The points and their selection are presented in more detail elsewhere (Willey 1990:10-11).

Paleodemography

The purposes of this analysis were to describe the Crow Creek paleodemography and compare the Crow Creek age distribution with those of other skeletal samples from the same region. Based on the description and comparisons, the nature of the Crow Creek sample as mortality (death count) and census ("life" count) data was examined. A final purpose was to estimate the number of people living in the Crow Creek Village so that the number could be contrasted with the number of archaeologically recovered individuals.

Age and sex were determined from the remains. Age was estimated using dental development for subadults and pubic symphysis morphology for adults. Sex estimation was done only for adults, employed the pubis, and used the most accurate criteria (Phenice 1969).

The age distribution for the combined Crow Creek sexes is compared with that of other skeletal samples from the same region. The comparative samples include Larson Cemetery (Owsley and Bass 1979:149, Table 2), Larson Village (Owsley et al. 1977:126, Table 3), Mobridge 1, and Mobridge 2 (Palkovich 1978:148, Table 6; 149, Table 7). A two-tailed Kolmogorov-Smirnov two-sample test (Thomas 1976) was used to compare Crow Creek with the combined cemetery samples and the Larson Village sample.

Craniometric Affinities

All relatively complete Crow Creek skulls were measured and employed in the analyses. Fifteen measurements were taken on 30 female and 33 male skulls, with regression analyses providing missing values for two additional females and two additional males, a total of 67 (32 female, 35 male) skulls. Measurement descriptions and comments have been published elswhere (Jantz 1970; Willey 1990:64-68; Zimmerman et al. 1981:125-129).

The craniometric sample was homogeneous (Willey 1982:72-74; 1990:66, 74-76), so the Crow Creek craniometrics were compared to those of other samples from the region. All of the comparative crania were measured by Jantz using the same measurement techniques employed here. Information concerning those samples was presented elsewhere (Jantz 1972, 1974).

Two approaches were used to establish morphological distances between Crow Creek and the comparative samples from the Central and Northern Plains. The craniometric distances were estimated using the canonical variates calculated from the raw measurements and the discriminant program of SPSS. The other way to examine intersite and intergroup differences using craniometrics is classifying individuals into the group with the closest group centroid. So, rather than simply examining the location of group centroids, individual variability was shown by the pattern of correct and incorrect classifications and summarized in a hit-miss table. These statistical manipulations were performed using SPSS (Nie et al. 1975).

Mutilations

Skulls and mandibles were systematically inspected for cuts, fractures, and evulsions. Cutting on the cranial vault was generally interpreted as scalping. The frequency of scalping was based on the presence/absence of cuts on the frontal.

Cuts on the base of the skull (near the foramen magnum, especially the occipital condyles) and the first and second cervical vertebrae were observed and interpreted as decapitation. A few cuts were noticed on the alveolar portions of the mandible and maxilla and near the nasal aperture, and these were recorded, but no frequency data were taken.

Fractures of the cranial vault were also noted, although only depressed fractures—not linear fractures—were systematically examined. Max Schmeling examined 101 relatively complete skulls, and the fractures' locations, shapes, sizes, and axes were noted. Evulsions were noted on both maxillary and mandibular teeth.

Bone ends adjacent to missing parts were inspected for chewing, splintering, and postmortem breaking. Chewing was indicated by small

Table 4. Minimum element counts of major human bones from Crow Creek. (From Willey 1990:16, Table 2.)

Bone	Left	Right	Right minus Left
Temporals	477	486	9
Humeri	200	213	13
Ulnae	113	131	18
Radii	91	115	24
Femora	367	367	0
Tibiae	262	269	7
Fibulae	156	143	-13

puncture marks or broad grooves that were most likely caused by canids gnawing or eating the remains. The marks are similar to those observed on modern dog or coyote-scavenged forensic cases (Haglund et al. 1988) and those left by wolves on deer bones (Willey and Snyder 1989). Splintering was indicated when the bone end was not chewed, but formed a jagged projection or projections while the cortical surface of the break was smooth. Splintering may have resulted from direct pressure, especially by some tool or when the bone fell against a hard object. Many splintered bones may have actually been chewed, but lack the identifying puncture marks or grooves of chewing. In addition to the skull, mandibles, and limb bones, some irregular bones were inspected for chewing.

Results and Discussions

Elements were inventoried in two ways: namely, minimum and maximum counts. The minimum count is considered first, then the maximum.

The greatest minimum count (n=486) was from the right temporal (Table 4) and indicated that at least 486 individuals were represented in the sample taken from the ditch. At the other extreme, the least minimum count was the 91 left radii. The differences among the counts of the various elements appears to be a function of size, density (Willey et al. 1991, 1992), and proximity to the torso. In general, the larger, denser bones, closer to the torso were more frequently present than the smaller, lighter, more distal ones. The proximity to the torso is important. For instance, the humerus was more common than the ulna or the radius, and the femur was more common than the tibia or the fibula.

The maximum element count is employed for the other analyses. The analyses performed with the maximum element count included the elements present and the differences in the two bone beds.

Inspecting Table 5, the impression is that generally the torso (vertebral column and hips) are better represented than most of the other parts. The elements seem to become less and less frequent the more distally they occur, but element size and density are factors that compound this generalization. The smaller, less dense bones were less frequently found than the larger, more dense ones. The same generalizations concerning size, density, and proximity to the torso are also demonstrated in the wrist and hand elements and the ankle and foot elements when these parts are considered separately. Most of the deviations from this generalization in the hand and foot are probably from the small numbers recovered (Willey 1990:20, 22-23).

There are five taphonomic factors that probably were major influences on the element frequencies observed. Elements may have been (1) lost during the mutilation and dismemberment by the raiding group; (2) destroyed or removed by the raiding group; (3) destroyed or removed by scavengers; (4) overlooked when the body parts were gathered for burial; (5) differentially preserved; or (6) lost during excavation, processing, and inspection procedures. The events of the raid and between the raid and the burial of the victims probably played the greatest roles in determining the observed frequencies. These include loss of bones caused by mutilation and dismemberment, loss caused by removal of trophies, loss caused by scavenging, and omission of body parts while being gathered for burial.

Element counts were also used to investigate and make inferences about the archaeological context of the remains. There are statistically significant differences between the maximum element counts of Bed A and B. The maximum element counts by bed are presented in Table 6. All elements whose expected frequency was five or

Table 5. Crow Creek maximum element counts for adults and subadults. Elements from Beds A and B are combined. Skull fragments are omitted. Percentage of expected individuals is based on 476 adults, 144 subadults, 578 total. From Willey 1990:21, Table 4.

Elements	Number of Elements			Number/ Individual	Minimum Number of Individuals			Percentage of Expected		
	Adult	Subadult	Total		Adult	Subadult	Total	Adult	Subadult	Total
Innominate	952	203	1155	2	476	102	578	100.0	70.8	100.0
Mandible	309	144	453	1	309	144	453	64.9	100.0	78.4
Femur	706	200	906	2	353	100	453	74.2	69.4	78.4
Sacrum	347	58	405	1	347	58	405	72.9	40.3	70.1
Lumbar vert.	1498	173	1671	5	300	35	335	63.0	24.3	58.0
Tibia	505	90	595	2	253	45	298	53.2	31.3	51.6
Thoracic vert.	3132	304	3436	12	261	26	287	54.8	18.1	49.7
Scapula	453	56	509	2	227	28	255	47.7	19.4	44.1
Fibula	426	51	477	2	213	26	239	44.7	18.1	41.3
Cervical vert.	1318	290	1608	7	189	42	231	39.7	29.2	40.0
Humerus	393	82	475	2	197	41	224	41.4	28.5	38.8
Ulna	251	17	268	2	126	9	135	26.5	6.3	23.8
Radius	234	21	255	2	117	11	128	24.6	7.6	22.1
Ribs	2505	260	2765	24	105	11	116	22.1	7.6	20.1
Clavicle	197	31	228	2	99	16	115	20.8	11.1	19.9
Tarsals	548	10	558	7	79	2	81	16.6	1.4	14.0
Metatarsals	294	3	297	5	59	1	60	12.4	0.7	10.4
Sternum	44	10	54	1	44	10	54	9.2	6.9	9.3
Patella	38	2	40	2	19	1	20	4.0	0.7	3.5
Carpals	93	1	94	8	12	1	13	2.5	0.7	2.2
Coccygeal vert.	46	0	46	4	12	0	12	2.5	0.0	2.1
Metacarpals	51	1	52	5	11	1	12	2.3	0.7	2.1
Hand phalanges	44	0	44	14	4	0	4	0.8	0.0	0.7
Foot phalanges	11	1	12	14	1	1	2	0.2	0.7	0.3

greater, an important assumption in using the chi-square test, were included in the analysis (Willey 1990:24, 26). The distribution is statistically significant ($\chi^2 = 150.95$, DF = 9, $P < 0.001$). The overrepresentation in Bed A of skull fragments and underrepresentation of cervical and thoracic vertebrae, and the reverse representations in Bed B, appear to contribute the most to this difference.

More skull fragments than any other part were included in Bed A. If Bed A represents a second, subsequent pick-up of bones and a second burial following the massive burial of Bed B, the relative frequency of skull fragments is understandable. Skull parts were infrequently chewed or consumed by scavengers and thus would have been left exposed for recovery. Also, skull parts are fairly easily identifiable as human or not, further expediting their recovery, and there appears to be an emphasis on recovering skulls, as the skull bowls demonstrate. The relative absence of other identifiable parts, such as mandibles, femora, and some other large, durable bones, from Bed A is difficult to interpret in this manner. Some of the meatier bones, such as the femora, may have been chewed, splintered and carried away by the scavengers, thus less frequently available for recovery and burial. On the other hand, it is also possible that Bed A represents elements which canids dug from Bed B, as the archaeological context suggests. Bed A, according to this explanation, are those bones the canids dug from Bed A but left scattered and not consumed. The absence from Bed A, however, of some other elements, especially the mandibles, is difficult to account for using either of these explanations. The small sample size of Bed A makes assessing any explanation based solely on osteological data difficult.

Paleodemography

The Crow Creek age distribution for the sexes

Table 6. Crow Creek maximum element count for Beds A and B. Adults and subadults are combined, although categories consisting of both adults and subadults are omitted. (From Willey 1990:25, Table 7.)

	Bed A		Bed B	
Elements	no.	%	no.	%
Skull	55	31.4	1097	6.3
Mandible	2	1.1	451	2.6
Cervical vertebrae	7	4.0	1601	9.2
Thoracic vertebrae	22	12.6	3414	19.6
Lumbar vertebrae	15	8.6	1656	9.5
Coccygeal vertebrae	0	0.0	46	0.3
Sacrum	2	1.1	403	2.3
Scapula	1	0.6	508	2.9
Clavicle	0	0.0	228	1.3
Sternum	0	0.0	54	0.3
Ribs	25	14.3	2740	15.8
Humerus	4	2.3	471	2.7
Radius	1	0.6	254	1.5
Ulna	0	0.0	268	1.5
Carpals	1	0.6	93	0.5
Metacarpals	1	0.6	51	0.3
Hand Phalanges	0	0.0	44	0.3
Innominate	12	6.9	1143	6.6
Femur	0	0.0	906	5.2
Patella	0	0.0	40	0.2
Tibia	8	4.6	587	3.4
Fibula	8	4.6	469	2.7
Tarsals	6	3.4	552	3.2
Metatarsals	5	2.9	292	1.7
Foot Phalanges	0	0.0	12	0.1
Total	175	100.2	17,380	100.0

combined is presented in Table 7, then compared with those from the other sites. In both age distributions, unadjusted and unsmoothed, and adjusted and smoothed, there are deviations for the combined sexes from the expected consistent decrease in numbers as age increases. Inspecting the adjusted and smoothed distribution number, increases occur from the immediately preceding interval in the 5-9, 40-44, 50-54, and 55-59 intervals. As an example, it is also unlikely that a normal population would have more females in the 55-59 interval than in the 15-19. These instances differ from the expected distributions if Crow Creek were a normal census sample because a normal census sample would consistently decrease in numbers as age increased. Therefore, the Crow Creek age distribution cannot be considered census data.

The next paleodemographic result considered is the Crow Creek sex ratio, using all adult ages together. Of the 181 adults sexed by pubic morphology, 99 (54.7%) are males and 82 (45.3%) are females. There is no statistical evidence that the sex ratio deviated from a 1:1 ratio when the ages are combined ($Z = 1.264$, $F(Z) = 0.896$, $P < 0.10$).

If the sex ratios are divided into age intervals, however, then differences are noted (Table 7). Using the adjusted and smoothed age distribution as an example, males outnumber females by or almost by 2:1 in the intervals from 15 to 34 years. In the older age intervals, on the other hand, females outnumber males by or almost by 2:1 in the intervals from 45 to 59 years. To summarize, although there is no difference in the overall sex ratio, a significant difference does exist when age is considered. It is difficult to imagine a living population having such disproportionate numbers of each sex. The differences appear to be from

Table 7. Adjusting and smoothing the Crow Creek age distribution counts. (From Willey 1990:47,Table 13.)

Age Interval	Unadjusted and Unsmoothed			Adjusted and Smoothed		
	Male	Female	Total	Male	Female	Total
0-1	0	0	10	6.44	6.44	12.9
1-4	0	0	38	24.47	24.47	48.9
5-9	0	0	79	32.32	32.16	64.3
10-14	0	0	29	34.82	28.51	63.5
15-19	24	12	36	28.24	15.78	44.2
20-24	19	7	26	27.65	11.77	39.4
25-29	11	4	15	20.45	8.70	29.2
30-34	10	6	16	16.39	10.75	27.1
35-39	11	11	22	12.80	10.24	23.0
40-44	4	3	7	10.75	13.84	24.6
45-49	6	13	19	8.70	14.35	23.0
50-54	7	12	19	10.24	19.98	30.2
55-59	7	14	21	10.75	21.50	32.3

events that happened during or after the raid, and these deviations from a normal population further eliminate Crow Creek as census data.

The likely reasons for these sex discrepancies are interesting. The relative lack of young females may have been caused by them being taken captive by raiders, escaping from the village and the massacre, or being killed but not recovered, or a demographic reality. Historic accounts occasionally mention Indian battles when raiders attacked a group of men, women, and children. If the attack occurred in an exposed area or the defending group was outnumbered, the men often attempted to delay the attackers, providing the women and children a chance to escape (e.g., Henry in Coues 1897:263). There is also historic mention of raiders killing men, but taking some women and children captive (Able 1939:150) and presumably transporting them to the camp of the raiders. The third explanation for the absence of the younger females—that they were killed but not recovered—is a possibility, but seems less likely than the other explanations. Finally it is possible that the female age distribution reflects the actual demographic situation at Crow Creek; the expected age distribution being absent because of short-term demographic fluctuations in this small population.

The relative absence of older males might be explained by there being fewer old males alive at the time, by their escaping from the village and thus from the massacre, or by their being killed but not recovered in the excavations. Of the three explanations, the most intriguing is that the absence of older males was a demographic reality, indicating that the males had a higher mortality rate at least during younger intervals, if not throughout their lives. This situation may well exist in a group whose males are actively involved in warfare. Consequently, according to this explanation, there were few older males present to be killed in the raid. It is also possible that this deviation was caused by other short-term demographic fluctuations.

Having described and discussed the within-site paleodemography, Crow Creek is now compared with other sites. When Crow Creek is compared with the Larson Village massacre sample (Fig. 15), no statistically significant differences are observed in the age distribution. This result suggests that massacre age distributions are similar in both prehistoric and protohistoric times.

On the other hand, when the Crow Creek age distribution is compared with the age distributions at the Mobridge and Larson cemeteries (Fig. 16 and Table 8), highly significant differences are observed. The Crow Creek sample generally is underrepresented in the 0 to 9 interval and overrepresented in nearly all of the older intervals. These results suggest that the Crow Creek age distribution is dissimilar from mortality data and cannot be considered a normal mortality sample.

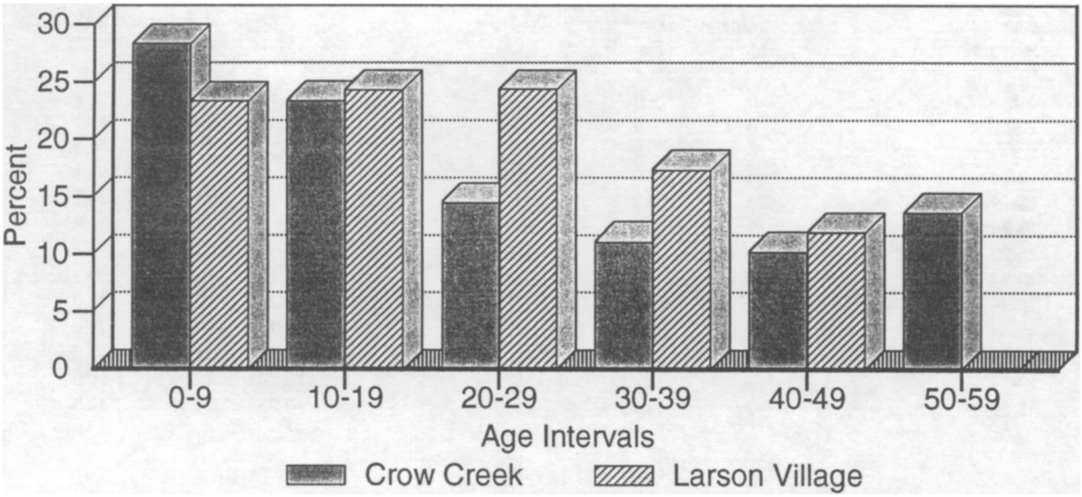


Figure 15. Crow Creek and Larson Village age intervals. No statistically significant differences.

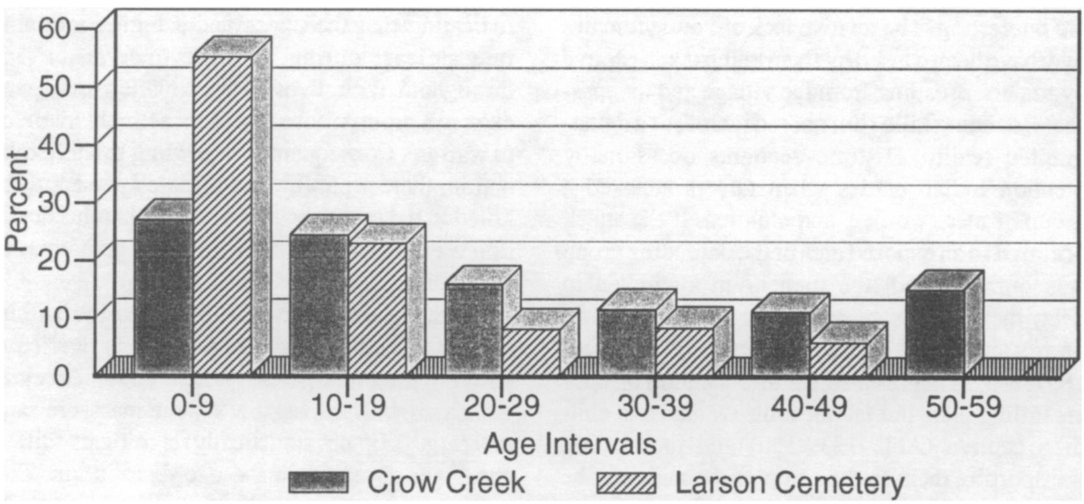


Figure 16. Crow Creek and Larson Cemetery age intervals. Statistically significant differences exist. Note Crow Creek's underrepresentation in the 0 to 9 year interval.

Similarities between the Crow Creek and Larson Village age distributions and their differences from those of the cemetery samples indicate that Middle Missouri Region massacre age distributions are similiar regardless of the time period and different from cemetery age distributions.

The next question to be approached is what proportion of the total Crow Creek village population was included in the bone bed. To answer this question, an estimation of the number of people living in the village is needed to contrast with the number recovered in the bone beds.

An estimation of the number of people living at Crow Creek is possible based on the number of lodges at the site and the number of people living in each lodge. To make this estimation, assump-

Table 8. Smoothed age distribution of Crow Creek compared with those of Middle Missouri Region cemetery samples. Maximum differences are italicized. (From Willey 1990:54, Table 17.)

Age in Years	Crow Creek Cumulative %	Mobridge 1 Cum. %	Mobridge 1 Diff.	Mobridge 2 Cum. %	Mobridge 2 Diff.	Larson Cemetery Cum. %	Larson Cemetery Diff.
0-9	27.38	69.94	*-42.56**	48.20	*-20.82**	53.88	*-26.50**
10-19	50.77	74.54	-23.77	59.71	-8.94	76.01	-25.24
20-29	65.53	80.29	-14.76	70.81	-5.28	83.54	-18.01
30-39	76.32	86.53	-10.21	80.18	-3.86	90.57	-14.25
40-49	86.56	92.61	-6.05	91.16	-4.60	96.60	-10.04
50-59	100.00	100.00	0.00	100.00	0.00	100.00	0.00
Sample size	467	203		249		735	
0.001 critical value			16.39		15.30		11.54

* Significant at 0.001 level of confidence.

tions must be made that the average number of people living in each lodge was the same as it was during the historic period, the lodges at Crow Creek were all inhabited at the same time, and all lodges at the site were included in the count.

Given these assumptions, the two critical numbers in estimating the Crow Creek population are the number of lodges at the site and the number of people per lodge. Kivett and Jensen (1976:68) write that there were at least 50 lodges from the Initial Coalescent component at the Crow Creek site. To estimate the number of individuals per lodge, Roberts (1977:174, fig. 35) provides formulae based on historic accounts. His figure for the number of people per lodge for Arikara is 16.62. Multiplying this figure by the 50 lodges indicates that at least 831 people lived at the site.

That these are minimum figures cannot be stressed enough. These numbers must be considered minimal because the village appears to have been expanding at the time of the raid, suggesting that all or nearly all of the lodges were inhabited. The 50 lodge count is considered minimal by Kivett and Jensen. And there are indications, at least for the Central Plains (W.R. Wedel 1979), that the average number of individuals inhabiting each lodge was higher than the figures used here.

Using the estimation of village population (831) and the minimum number of skeletons (486), about 60% of the village population is represented by the skeletons in the ditch. There are a number of possible explanations why the other 40% are missing.

First of all, it is possible that the number of skeletons represented in the ditch or the estimation of the number of people living at Crow Creek are inaccurate. Perhaps there are many more individuals present in the minimum count than the 486 number indicates, and, perhaps the estimated village population is greater than the actual number. Secondly we know that there are additional, unrecovered skeletal remains continuing east in the fortification ditch from the rest of the bone deposit, thus indicating more individuals than those in the minimum count. It is also likely that additional unrecovered skeletons are present elsewhere in the ditch, in the village, or outside the village. And it is possible that some skeletons may have been destroyed or removed by natural causes and were thus excluded from the archaeological record. Additional possibilities are that some of the village members were absent from the village during the raid, or some were taken captive—most notably the subadults and young females. While minimizing the proportion of dead individuals, the incredible number of dead and the portion of the village population that is represented should not be minimized. There is substantial evidence that the majority of the Crow Creek villagers died in the massacre.

Craniometry

The Crow Creek cranial measurements are compared with those from other sites using canonical variates. The first four canonical variates are employed because they are significant for both sexes, and the results between the sexes are so similar that the sexes can be discussed together. The first canonical variate (CV I), which explains 35.7% and 43.1% of the female and male variability, respectively, primarily separates Crow Creek and to a lesser extent the St. Helena sites (25DK9 and 25DK13) from the Mandan (Fig. 17). It may be that some of these differences are from interobserver error (cf. Utermohle and Zegura 1982), although both observers who measured these samples were trained by the same instructor and they communicated so interobserver errors should be minimal. CV I arranges the Arikara sites from northern South Dakota (Mobridge, Rygh, Larson, and Leavenworth) in chronological order, and it appears to be doing the same with Crow Creek and possibly the St. Helena sites.

The second canonical variate (CV II) explains 33.3% and 24.3% of the female and male variability, respectively (Fig. 17). Generally CV II seems to be geographically influenced, with the southern groups at one end of the distribution and the northern groups at the other end, with the Mandan a notable exception.

The third canonical variate (CV III), which explains 13.2% and 10.7% of the female and male variability, respectively, separates the Mandan and St. Helena (25DK9 and 25DK13) samples from the Omaha, Ponca, and at least some of the Arikara samples (Fig. 18). There is no clear patterning to this distribution.

The fourth and final statistically significant canonical variate (CV IV) explains 6.0% and 7.9% of the female and male variability, respectively. CV IV is difficult to interpret, in part because the females and the males are distributed somewhat differently (Fig. 18).

Each CV is interesting in itself, but discussing them individually makes trends difficult to grasp. CV's can be combined in three dimensional plots, thus making the patterns more apparent. Simultaneously plotting CV I, CV II, and CV III displays the maximum variability on three axes—82.2% and 78.1% of the female and male variability, respectively (Figs. 19 and 20). Both of the Crow Creek sexes rest closest to the St. Helena sites (25DK9 and 25DK13); next closest are the earlier Arikara sites.

In addition to examining the distribution of the group centroids, hit-miss tables can be employed (Tables 9 and 10). Inspecting the hit-miss tables provides a means of evaluating the variability around the group centroids.

The Crow Creek female and male crania are correctly identified in 78.1% and 65.7% of the cases, respectively. These correct identification frequencies are better than most of the other groups. The high frequency of correct Crow Creek identifications is expected because it fell at one extreme of CV I, the CV explaining the greatest amount of variability. Although the correct identifications are interesting in themselves, the pattern of incorrect identifications is even more useful.

The Crow Creek crania generally misclassify as St. Helena (25DK9 and 25DK13) or early Arikara (Mobridge, Rygh, and Sully). One Crow Creek male, an exception to this generalization, is incorrectly identified as Pawnee. The hit-miss table supports what the group centroids indicated: namely, Crow Creek is most similar to the St. Helena and early Arikara samples.

Key (1983:92) suggests that the St. Helena samples used in his analysis and here are late in the St. Helena sequence, making them roughly contemporaneous with Crow Creek. Key further suggests that the similarities between Crow Creek and these St. Helena samples result from interaction between the two groups rather than an ancestral-descendant relationship. The early Arikara samples, on the other hand, are considerably later in time than Crow Creek and could represent a descendant group. It seems most likely that the Crow Creek villagers were members of a Caddoan-speaking group, such as the Arikara or Pawnee, but even this conclusion is questionable.

It was anticipated that the Crow Creek craniometrics would clarify the relationship between the Arikara and Pawnee. The relationship, however, is not clarified by this analysis. Not until CV III are Crow Creek and the Pawnee associated, and when the first three CVs are displayed, Crow Creek and Pawnee are a considerable distance

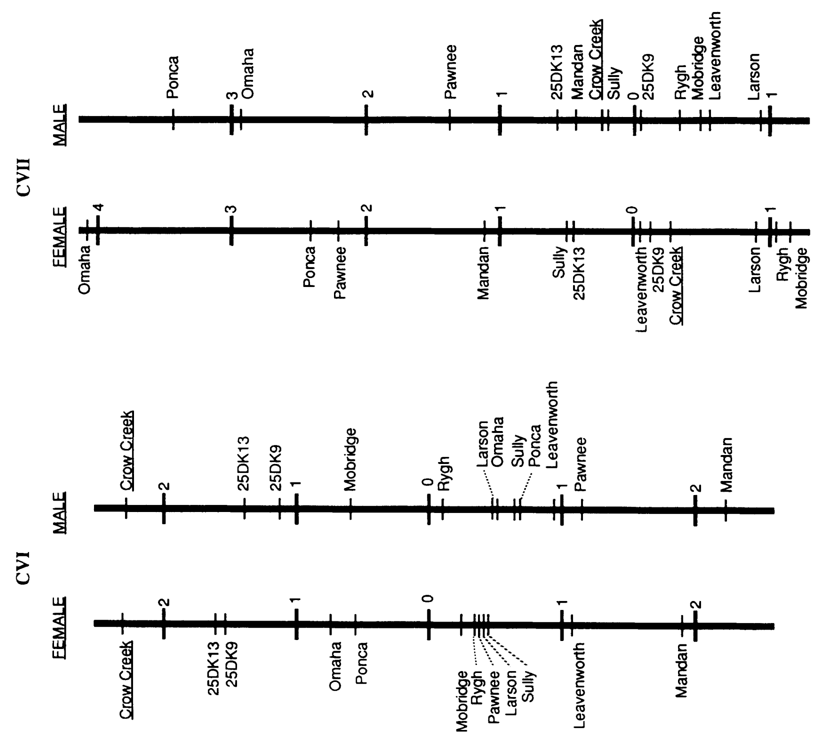


Figure 17. Comparison of Crow Creek and other craniometric samples on canonical variates I and II. (After Willey 1982:76, figure 3.)

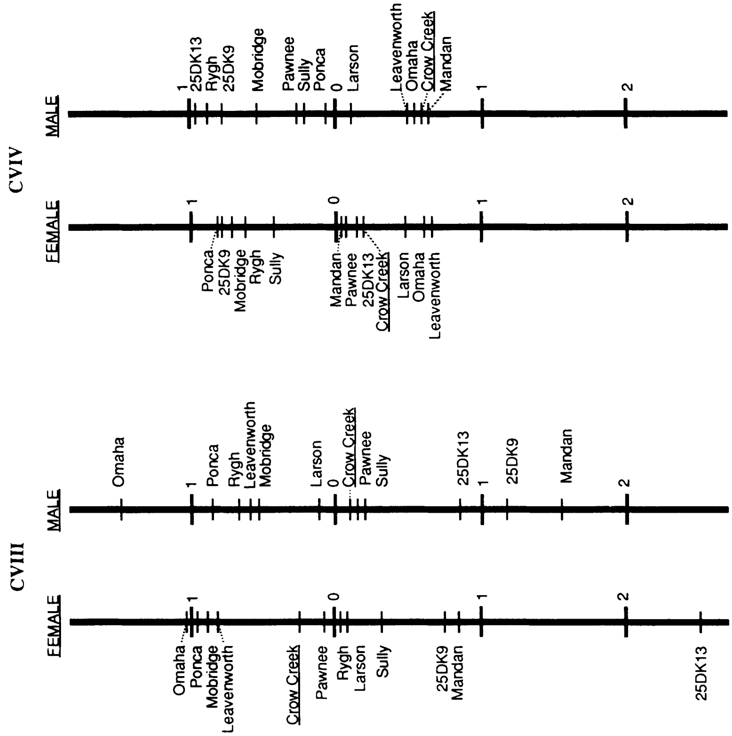
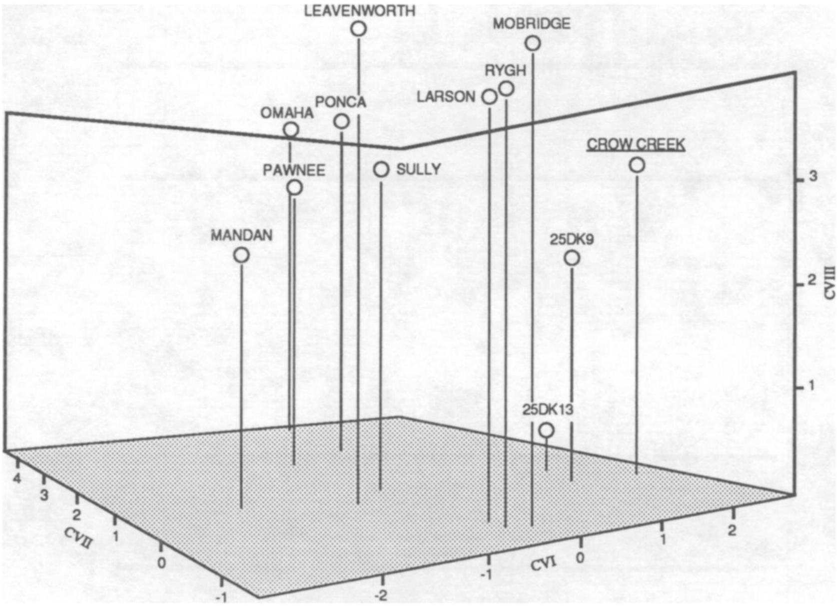


Figure 18. Comparison of Crow Creek and other craniometric samples on canonical variates III and IV. (After Willey 1982:78, figure 4.)



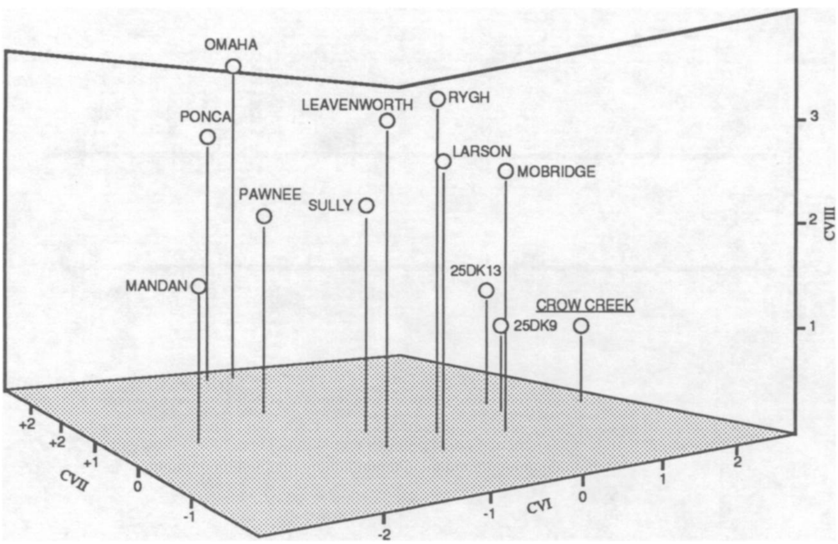


Figure 19. (Top) Crow Creek female and other female craniometric group centroids displayed on canonical variates I, II, and III. (After Willey 1982:80, figure 5.)

Figure 20. (Bottom) Crow Creek male and other male craniometric group centroids displayed on canonical variates I, II, and III. (After WIlley 1982:81, figure 6.)

Table 9. Hit-miss distribution of female Crow Creek and other female cranial samples. Numbers in parentheses are percentages. (From Willey 1990:83, Table 28.)

	Crow Creek	Leaven-worth	Larson	Sully	Mobridge	Rygh	Ponca	Omaha	Mandan	Pawnee	25DK9	25DK13
Crow Creek (39BF11)	25 (78.1)	0	0	0	2 (6.3)	1 (3.1)	0	0	0	0	3 (9.4)	1 (3.1)
Leavenworth (39CO9)	0	12 (63.2)	2 (10.5)	0	2 (10.5)	1 (5.3)	0	0	1 (5.3)	1 (5.3)	0	0
Larson (39WW2)	0	4 (8.5)	27 (57.4)	2 (4.3)	3 (6.4)	8 (17.0)	0	0	0	2 (4.3)	0	1 (2.1)
Sully (39S1.4)	1 (3.6)	3 (10.7)	2 (7.1)	8 (28.6)	1 (3.6)	2 (7.1)	1 (3.6)	0	6 (21.4)	2 (71.)	2 (7.1)	0
Mobridge (39WW1)	1 (5.9)	1 (5.9)	1 (5.9)	0	11 (64.7)	3 (17.6)	0	0	0	0	0	0
Rygh (39CA4)	0	0	3 (17.6)	1 (5.9)	2 (11.8)	7 (41.2)	0	0	1 (5.9)	0	1 (5.9)	2 (11.8)
Ponca	0	0	0	0	0	0	5 (62.5)	1 (12.5)	1 12.5)	0	1 (12.5)	0
Omaha	0	0	0	0	0	0	1 (14.3)	6 (85.7)	0	0	0	0
Mandan	0	1 (5.6)	1 (5.6)	1 (5.6)	0	0	0	0	15 (83.3)	0	0	0
Pawnee	0	0	0	1 (20.0)	0	0	0	0	0	4 (80.0)	0	0
25DK9	0	0	0	0	0	0	0	0	0	0	2 (50.0)	2 (50.0)
25DK13	0	0	0	0	0	0	0	0	0	0	2 (22.2)	7 (77.8)

apart. In the hit-miss tables (Tables 9 and 10), only one Crow Creek male misclassifies as Pawnee; no Crow Creek females are misclassified as Pawnee and no Pawnee males or females are misclassified as Crow Creek. Part of this lack of association may be the small sample size of the Pawnee, originating from two different sites. A further complicating factor is that no crania from the Lower Loup, thought to be predecessors to the Pawnee, are included in this analysis. Larger Pawnee samples, the addition of Lower Loup samples, and including the Crow Creek material should clarify the relationship between the Pawnee and Arikara.

Mutilations

The great majority of the Crow Creek frontals display cuts suggesting scalping (Fig. 21). Of the frontals in Bed A, 17 (94.4%) are cut and one (5.6%) may have been cut (Table 11). In Bed B, 354 (89.2%) are cut, 24 (8.1%) may have been, and 19 (4.8%) are not (Table 11). There seems to be no age or sex exempt from scalping: women and children as well as men display the distinctive cuts.

When cuts observed on all cranial bones and fragments (Table 17) are tabulated by age (adult, adolescent, and child), there are statistically significant differences by age groups and bones cut (Willey 1990:105, 108-109). The largest differences from expected values are found in the relative lack of cut adult parietals and child temporals, and the abundance of cut adult temporals and child parietals. It appears that more of the scalp of adults and adolescents was taken, while only the top-lock of the scalp of children was removed. There are four possible explanations. The hair on the sides of the children's heads may have been undesirable, or perhaps the scalp could be ripped more easily from their heads than that of adolescents and adults. It is also possible that the hair style of the children differed from those of the adolescents and adults; the typical child's hair style may have been a "Mohawk." Finally the differences may be from the children's temporals being proportionately smaller than their parietals when compared to adult bones. Being smaller, the temporals may have been less likely cut than their proportionately

Table 10. Hit-miss distribution of male Crow Creek and other male cranial samples. Numbers in parentheses are percentages. (From Willey 1990:84, Table 29.)

	Crow Creek	Leaven-worth	Larson	Sully	Mobridge	Rygh	Ponca	Omaha	Mandan	Pawnee	25DK9	25DK13
Crow Creek	23 (65.7)	0	0	2 (5.7)	2 (5.7)	3 (8.6)	0	0	0	1 (2.9)	2 (5.7)	2 (5.7)
Leavenworth	0	14 (70.0	3 (15.0)	2 (10.0)	0	0	0	0	0	1 (5.0)	0	0
Larson	3 (6.7)	7 (15.6)	18 (40.0)	2 (4.4)	8 (17.8)	5 (11.1)	0	0	0	2 (4.4)	0	0
Sully	1 (2.7)	4 (10.8)	6 (16.2)	7 (18.9)	0	7 (18.9)	0	0	5 (13.5)	4 (10.8)	3 (8.1)	0
Mobridge	2 (11.8)	0	3 (17.6)	1 (5.9)	8 (47.1)	2 (11.8)	0	0	0	1 (5.9)	0	0
Rygh	1 (6.7)	1 (6.7)	0	1 (6.7)	2 (13.3)	8 (53.3)	0	0	0	0	0	2 (13.3)
Ponca	0	0	0	0	0	0	4 (67.7)	2 (33.3)	0	0	0	0
Omaha	0	0	0	0	0	0	0	4 (80.0)	0	1 (20.0)	0	0
Mandan	0	0	0	1 (8.3)	0	0	0	0	10 (83.3)	1 (8.3)	0	0
Pawnee	0	0	0	0	1 (11.1)	0	0	0	0	8 (88.9)	0	0
25DK9	1 (25.0)	0	0	0	0	0	0	0	0	0	2 (50.0)	1 (25.0)
25DK13	1 (7.1)	0	0	1 (7.1)	0	0	0	0	0	2 (14.3)	2 (14.3)	8 (57.1)

Table 11. Mutilations of skulls from Crow Creek. Percentages are in parentheses. (From Willey 1990:106, Table 32.)

	Bone Bed A			Bone Bed B		
Mutilations	Present	Present?	Absent	Present	Present?	Absent
Scalping	17 (94.4)	1 (5.6)	0	354 (89.2)	24 (4.8)	19 (6.0)
Cut Noses	0	0	0	4 (4.5)	0	85 (95.5)
Evulsions	3 (75.0)	1 (25.0)	0	35 (23.5)	7 (4.7)	107 (71.8)
Decapitation						
Occipital	2 (66.7)	0	1 (33.3)	31 (13.6)	6 (2.6)	191 (83.8)
C-1	1 (100.0)	0	0	56 (24.5)	3 (1.3)	170 (74.2)
C-2	0	0	0	31 (16.5)	4 (2.1)	153 (81.4)

larger parietals.

The typical Crow Creek scalping has two parts: the circling primary cuts, and the scattered secondary cuts. The circling cuts begin with the deepest, most frequent cuts slicing transversely across the frontal midway between nasion and bregma. Sometimes the circling cuts are single and long, but usually there are several groups of short cuts. As the circling cuts proceed posteriorly, the cuts generally become fewer and shallower on the

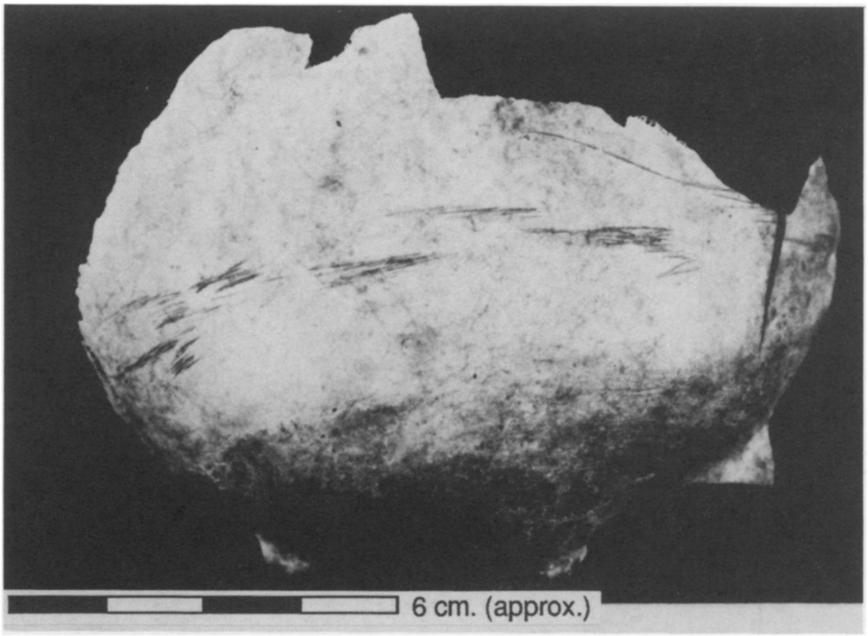


Figure 21. Frontal of a Crow Creek child showing cut marks indicating scalping.

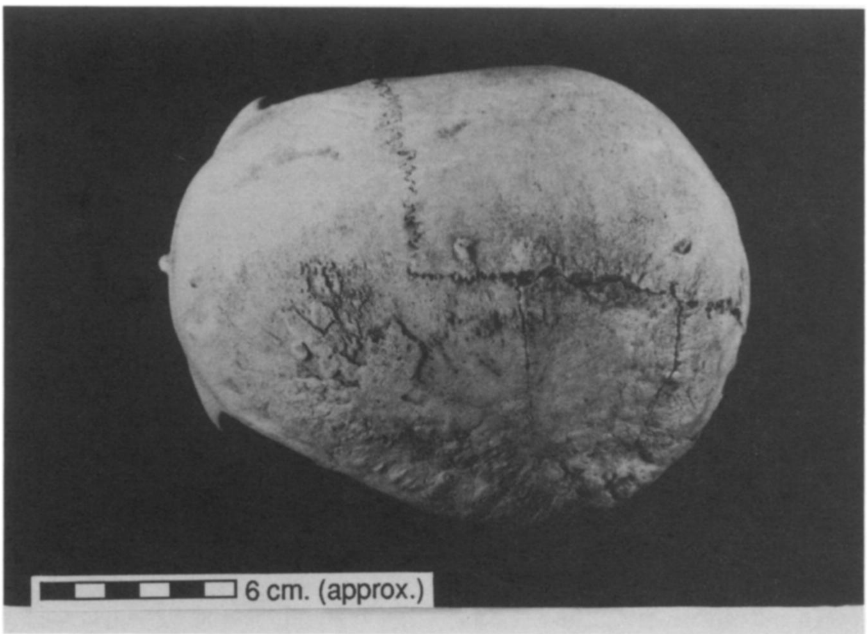


Figure 22. View of skull top (Skull 264) with remodeling consistent with survival following scalping.

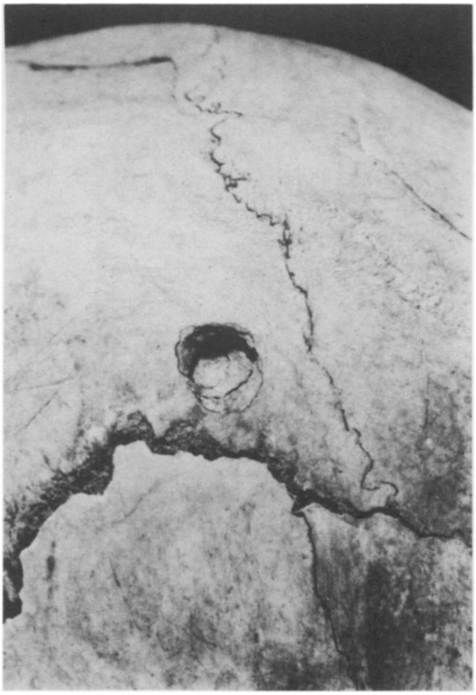


Figure 23. Round depressed fracture in right parietal. No healing present. (After Zimmerman et al. 1981:174, plate 8.)

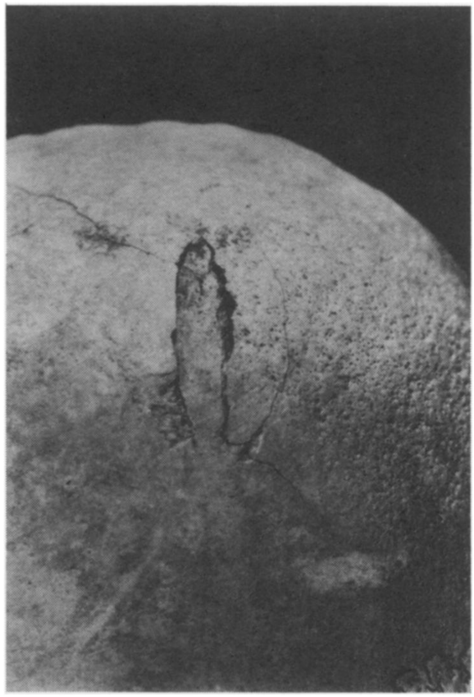


Figure 24. Ellipsoid depressed fracture in parietal. No healing present. Fracture length 35 mm. (After Willey 1982:110, figure 12.)

Figure 25. Evulsion of mandibular premolars and molar. Scale is 6 cm long. (After Zimmerman et al. 1981:191, plate 12.)

lateral and posterior parts of the vault. These cuts are usually best displayed on osseous lines, crests, and processes, especially the squamosal portion, temporal line and sometimes the mastoid of the temporal, and the squamosal portion of the occipital.

In addition to these primary circling cuts, there are often secondary cuts scattered over the vault. The most likely purpose of the secondary cuts was to separate the "skin" of the scalp from the bone within the boundaries scribed by the circling cuts. Usually these secondary cuts are in

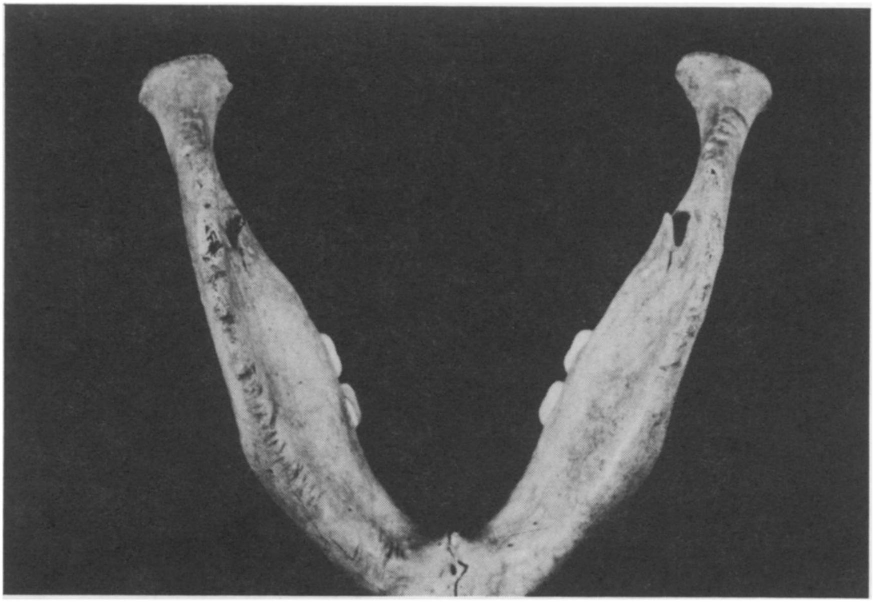


Figure 26. Cuts on the medial inferior border of the mandibular corpus suggesting throat slashing, tongue cutting, or decapitation attempts. (After Zimmerman et al. 1981:192, plate 13.)

Table 12. Skulls with and without depressed fractures from Crow Creek. Percentages are in parentheses. (From Willey 1990:115, Table 37.)

	Skulls with Fractures				Skulls without Fractures
		Number of Fractures			
1	2	3	4	5	
28 (66.7)	8 (19.0)	2 (4.8)	2 (4.8)	2 (4.8)	
Total count		42 (41.6)			59 (58.4)

a transverse direction, but there is much variability in their orientation. Differences from the just-described typical scalping are present, and they are described in Willey (1990:111-113).

There are indications of scalping other than the cut marks just discussed. Some historic accounts (e.g., Catlin 1844:238) tell that people occasionally lived through the scalping ordeal. At Crow Creek two skulls (numbers 13 and 264, Fig. 22) show osseous remodeling comparable to what has been identified as survival following scalping (Hamperl and Laughlin 1959). Neither of these two skulls retain any cut marks, the marks apparently having been destroyed by remodeling. The importance of these two skulls is that they indicate that violence was not limited to the Crow Creek massacre itself but was more long term, perhaps preceeding the massacre itself by years.

That nearly 90% of the skulls show indications of scalping is all the more remarkable when two things are considered. First, the two skulls that appear to have been victims of previous scalpings are omitted from the count of those skulls with cut marks and consequently not included with those scalped. Second, Hamperl (1967) demonstrated that it was possible to scalp a person and leave no

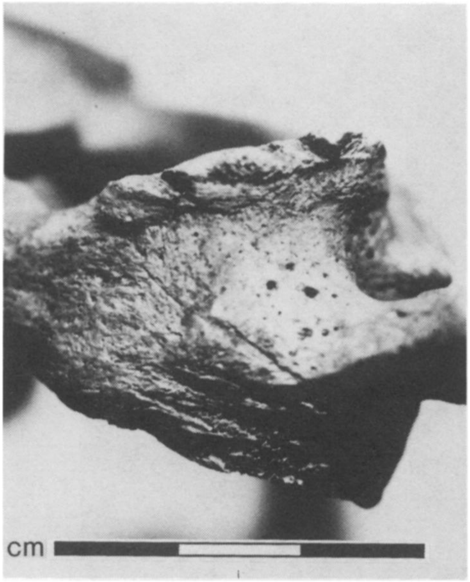


Figure 27. Close-up of cut on superior articular surface edge and anterior transverse surface of adult first cervical vertebra.

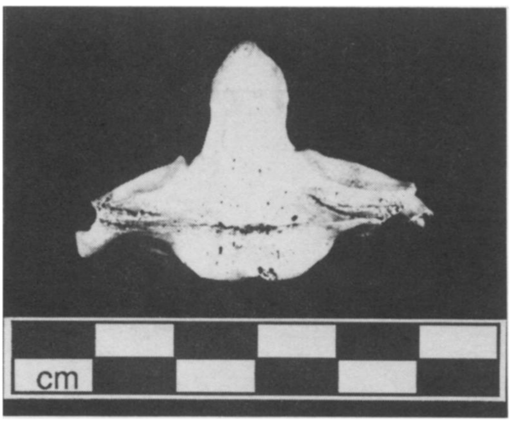


Figure 28. Cut on anterior surface of child's second cervical vertebra.

marks on the bone. If this happened at Crow Creek, then the frequency of cut frontals is a conservative estimation of the number scalped. The nearly 90% scalped frontals must be considered a minimum figure; the actual count may well have approached 100%.

About 40% of the skulls have depressed fractures (Table 12). Most of the skulls with fractures had one, although two skulls had as many as five. Bluntly speaking, the blows seem most common

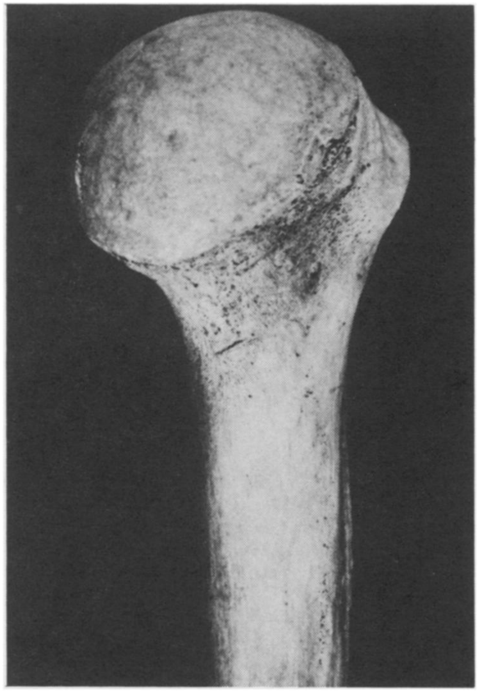


Figure 29. Cut on medial surface of proximal right humerus of an adult.

Figure 30. Splintered distal adult radii. Splintering may indicate dismemberment by raiders or consumption by scavengers.

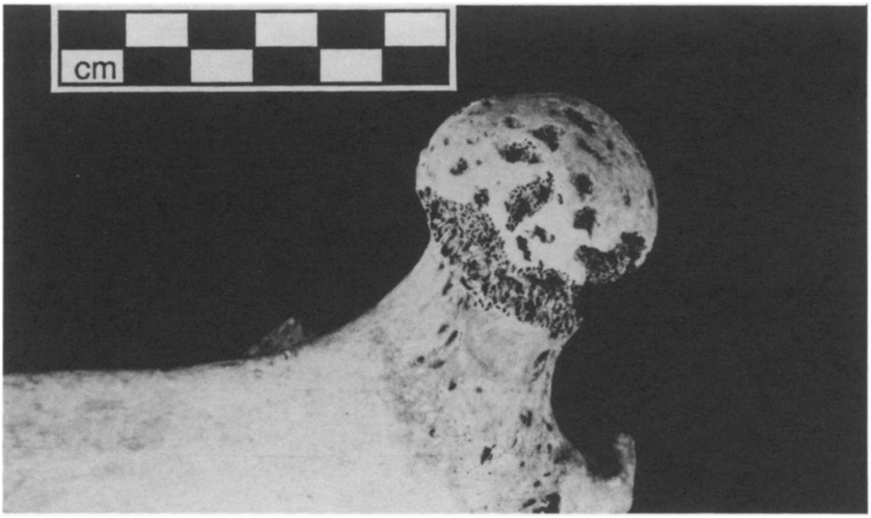


Figure 31. Head of left femur chewed by scavenger, most likely by a dog, wolf, or coyote. (After Zimmerman et al. 1981:162, plate 5.)

Table 13. Number of Crow Creek long bones with cuts. (From Willey 1990:125, Table 41.)

Elements	Left	Right	Total
Humerus	1	5	6
Ulna	2	1	3
Radius	0	1	1
Femur	1	6	7
Tibia	0	1	1
Fibula	0	1	1
Total	4	15	19

on the top and top-sides of the vaults.

The outline of the depressed fractures could be observed in some instances. The most complete outlines were either round or ellipsoid. Of the 66 depressed fractures with identified outlines, one-third were round (Fig. 23) and the other two-thirds were ellipsoid (Fig. 24). In other instances it was apparent that the tool used to make the ellipsoid depression had an axe-like cross section. These ellipsoid depressions, when the depressed bone plug was left intact, have a linear crack running the long axis of the ellipsoid (Fig. 24). No axes with a cross section like this have been recovered archaeologically from this time period on the Middle Missouri (Alex, personal communication, 1979), suggesting that the weapon used was probably constructed of perishable material.

Evulsion, breaking the teeth (Fig. 25) or alveolus, occurs fairly frequently among the Crow Creek specimens (Table 11). Tongues may have been cut from the mouths of the Crow Creek victims as indicated by cuts on the ascending ramus of the mandible, or on the inferior border of the corpus (Fig. 26) and on the medial surface of the mandibular corpus. The most reasonable explanation for these marks is that some tongues were cut loose by slicing transversely through the throat under the chin. This pattern was noted in historic accounts of bison butchering (Wheat 1972:103). The tongue removal, decapitation, and dismemberment of the Crow Creek victims may have been based on standard aboriginal butchering practices developed on large game animals.

Decapitation was indicated by cuts around the foramen magnum and cervical vertebrae 1 (C-1) and 2 (C-2) (Figs. 27 and 28). If the greatest frequency is taken as an accurate reflection of decapitation attempts, then nearly a quarter were mutilated in this manner. The cuts tend to be on the anterior surfaces of all of these bones, similar to most scalping cuts.

Besides decapitation, other dismemberments were indicated by cuts on other postcranial bones. Cuts were present on all major upper and lower

Table 14. Crow Creek long bone modifications from Bed B. Questionable identifications are omitted. Numbers in parentheses are percentages for that bone. (From Willey 1990:127, Table 42.)

Elements	Chewed		Snapped and Splintered		Crushed		Not Modified		Total	
Humerus										
Proximal	50	(4.2)	83	(7.0)	4	(0.3)	214	(18.1)	351	(29.6)
Shaft	1	(0.1)	24	(2.0)	0		384	(32.4)	409	(34.5)
Distal	168	(14.2)	82	(6.9)	4	(0.3)	170	(14.4)	424	(35.8)
Total	219	(18.5)	189	(15.9)	8	(0.6)	768	(64.9)	1184	(99.9)
Radius										
Proximal	27	(5.0)	28	(5.2)	2	(0.4)	129	(24.0)	186	(34.6)
Shaft	0		24	(4.5)	2	(0.4)	158	(29.4)	184	(34.2)
Distal	17	(3.2)	86	(15.9)	0		65	(12.1)	168	(31.2)
Total	44	(8.2)	138	(25.6)	4	(0.8)	352	(65.4)	538	(100.0)
Ulna										
Proximal	75	(12.8)	52	(8.9)	7	(1.2)	86	(14.7)	220	(37.5)
Shaft	2	(0.3)	32	(5.5)	1	(0.2)	176	(30.0)	211	(36.0)
Distal	13	(2.2)	76	(12.9)	1	(0.2)	66	(11.2)	156	(26.5)
Total	90	(15.3)	160	(27.3)	9	(1.6)	328	(55.9)	587	(100.1)
Femur										
Proximal	250	(12.7)	36	(1.8)	11	(0.6)	373	(18.9)	670	(34.0)
Shaft	7	(0.4)	14	(0.7)	0		629	(31.8)	650	(32.9)
Distal	183	(9.3)	169	(8.6)	13	(0.7)	291	(14.7)	656	(33.3)
Total	440	(22.4)	219	(11.1)	24	(1.3)	1293	(65.4)	1976	(100.2)
Tibia										
Proximal	69	(5.1)	102	(7.5)	8	(0.6)	273	(20.0)	452	(33.2)
Shaft	4	(0.3)	49	(3.6)	3	(0.2)	413	(30.3)	469	(34.4)
Distal	87	(6.4)	125	(9.2)	9	(0.7)	222	(16.3)	443	(32.6)
Total	160	(11.8)	276	(20.3)	20	(1.5)	908	(66.6)	1364	(100.2)
Fibula										
Proximal	5	(0.7)	30	(4.5)	0		175	(26.0)	210	(31.2)
Shaft	0		23	(3.4)	1	(0.1)	219	(32.5)	243	(36.0)
Distal	29	(4.3)	62	(9.2)	3	(0.4)	127	(18.8)	221	(32.7)
Total	34	(5.0)	115	(17.1)	4	(0.5)	521	(77.3)	674	(99.9)

limb elements (Table 13 and Fig. 29).

In addition to cutting, it is possible that some of the splintered and snapped bones (Fig. 30) may represent dismemberment. Some of the limb bones may have been smashed, then cut through the tissue and shattered bone fragments, thus severing the distal member from the body. There is some support for this possibility because nearly all limb bones are more frequently snapped or splintered at the distal end than the proximal, the humerus being the only exception (Table 14).

Many bones were chewed. The bones most commonly having puncture marks were the cancellous bones that project and the ends of long bones. Chewing occurred most frequently on the calcaneus, followed by the acromial process, ischium, patella, iliac crest, and talus (Table 15). If some of the snapped and splintered bones were actually chewed, as they probably were, then metacarpals and metatarsals should be added to the list of frequently chewed bones.

The ends of long bones (Table 14) were commonly chewed, though less frequently than the bones already mentioned. The long bones most frequently chewed were the femur (Fig. 31), humerus, ulna, and tibia. Even on these long

Table 15. Modifications of postcranial bones other than long bones from Crow Creek. Questionable identifications are omitted. Numbers in parentheses are percentages for that bone or feature. (From Willey 1990:123, Table 43.)

Locations	Chewed		Snapped and Splintered		Not Modified		Total	
Acromial process	55	(40.1)	47	(34.3)	35	(25.5)	137	(99.9)
Sternum	4	(10.3)	0		35	(89.7)	39	(100.0)
Sacrum	15	(15.3)	0		83	(84.7)	98	(100.0)
Patella	14	(35.0)	0		26	(65.0)	40	(100.0)
Iliac crest	138	(33.7)	1	(0.2)	271	(66.1)	410	(100.0)
Ischium	143	(35.7)	0		258	(64.3)	401	(100.0)
Carpals	2	(2.7)	0		72	(97.3)	74	(100.0)
Metacarpals	3	(6.1)	11	(22.4)	35	(71.4)	49	(99.9)
Hand Phalanges								
Proximal row	4	(16.0)	0		21	(84.0)	25	(100.0)
Middle row	0		0		5	(100.0)	5	(100.0)
Distal row	0		0		4	(100.0)	4	(100.0)
Talus	38	(29.0)	0		93	(71.0)	131	(100.0)
Calcaneous	79	(79.8)	0		20	(20.2)	99	(100.0
Other Tarsals	8	(3.2)	0		241	(96.8)	249	(100.0)
Metatarsals	40	(18.3)	110	(50.2)	69	(31.5)	219	(100.0)
Foot Phalanges								
Proximal row	1	(14.3)	1	(14.3)	5	(71.4)	7	(100.0)

bones, the shaft was virtually ignored by the scavengers in favor of the bone ends. If snapping and splintering can be considered caused by chewing, then a distribution somewhat similar to the tooth marks was observed on the long bones (Table 14). The shafts were at least as frequently snapped or splintered as they were chewed.

It was noted above that the missing hands and feet may have been taken by the raiders, but it is also possible that these parts were devoured by the scavengers. The chewing on the bones of the hands, feet, lower arms, and lower legs may testify to this suggestion.

The scavengers most likely responsible were the ubiquitous village dogs, wolves, and coyotes. Although no indications were found on the bones, it is also likely that carrion-feeding birds feasted as well. It is entirely possible that as large as the canids were and as small as an infant is that the bodies of some of the infants and small children may have been completely devoured by the scavengers (cf. Miller 1975:213) or dragged elsewhere, scattered, and not recovered for burial. If scavengers did remove the smaller bodies, then this loss would affect the Crow Creek paleodemographic profile.

The burned human bone was observed and reported by Mark Swegle (in Zimmerman et al. 1981:184-187). He reported that all observed burning was relatively light; the remains were charred, but not calcined. At least seven individuals were charred: three adults, three adolescents, and a child. Of the seven charred skulls, all appear to have been scalped before being burned. Usually when long bones were burned, the distal ends were charred rather than the proximal. Most of the burned remains seemed to have been incidentally burned, perhaps during the burning of the lodges, rather than intensely and systematically burned.

CROW CREEK AND ARIKARA CULTURE HISTORY AND PHYSICAL ANTHROPOLOGY

The identification of various archaeological manifestations as Arikara is a classical example of the "direct historic approach" implemented by Strong (1933, 1940). This approach uses evidence from traditional and historic documentation, ethnography, linguistics, archaeology, and physical anthropology, to work from a known historic group, extending it back in time. In the following discussion, we examine these various lines of evidence.

Most Plains researchers have accepted the Arikara as ultimately derived from the Pawnee, most likely the Skiri band. Pawnee myth (Grinnell 1961) variously identifies their ancestral homeland as being to the southwest across or to the southeast along a great river. Interpretations suggest this homeland as possibly being in the Oklahoma-Texas region or the lower Mississippi Valley. From these locations they moved northward into the Central Plains. After their arrival in the Nebraska area, the Pawnee Skiri band diverged from a portion of this group eventually becoming the Arikara (Dorsey 1904). Tradition indicates the Arikara moved into the Nebraska-South Dakota region, eventually moving to the Missouri Trench, where they were found historically. Neither the location of the Skiri-Arikara split nor its date are evident from the traditional sources.

The pre-eighteenth century historic documents concerning the Arikara are virtually absent (Deetz 1965:5-7; M. Wedel 1979:193-194). The first reliable account, by Bourgmond in 1714, placed the Arikara in the Missouri River Trench, perhaps above the Niobrara River. From that time until their encounter with Lewis and Clark near the Grand River in 1804, they were reported to have occupied various locations along the Missouri Trench in South Dakota. In their journal, Lewis and Clark (Coues 1893:162-163) noted the Arikaras were formerly "colonies of the Pawnee" and that their recent general northward movement and consolidation was due to increasing pressure from the Sioux. While the historic accounts confirm the Arikara presence in South Dakota in the eighteenth and early nineteenth centuries, they provide no evidence for earlier locations.

Some of the most challenging insights concerning the Arikara have come from studies by Douglas Parks (1979a, 1979b) based on ethnohistoric and linguistic information. In reviewing past Arikara linguistic research, Parks (1979a) noted continuing validity of the Lesser and Weltfish (1932) and Taylor (1963) analyses. Lesser and Weltfish recognized four Caddoan languages: a Northern Group consisting of Pawnee, Kitsai, and Wichita, and a Southern Group consisting of Caddo. Pawnee contained three dialects, including South Band Pawnee, Skiri Pawnee, and Arikara. As Parks (1979a:199) stresses,

> One conclusion first reached by Lesser and Weltfish (1932:3) and corroborated by Taylor's study is particularly noteworthy: Arikara is not a branch of Skiri Pawnee, as both tradition and many writers in the past have claimed. The Arikara-Pawnee split was the first division within Pawnee, and later the Skiri-South Band division occurred.

An impressionistic date for the Pawnee-Arikara division is given as 500 years BP and a glottochronological date as 300 BP (Parks 1979a:205). Citing an unpublished glottochronological comparison by Swadesh and Weltfish that placed the separation at 500 BP, Parks (1979a:207) suggested that 500 BP (about AD 1450) was the more plausible date.

Another approach to the study of Arikara cultural identity involved the investigation of band, village, and bundle names, and locational data preserved in historic sources (Parks 1979b:215-219). The conclusions of this study deserve to be quoted in full:

> The standard interpretation of Northern Caddoan culture history has treated the Arikara as a small northerly off-shoot of the larger Pawnee groups in the south. Early historical references and native tradition, however, indicate otherwise. The area of South Dakota in which the Arikara lived in the 18th century was undoubtedly more socially diverse than 20th century writers allowed. The review above consistently indicates 7 to 10 bands, each speaking its own dialect and each apparently politically autonomous. The total number of villages seems to have been even greater: the figures range from 18 to as many as 45. The population, too, seems to have been significantly greater than previous estimates: it was possibly as much as 10,000 and perhaps even larger. Furthermore, based on Tabeau's [1939:124-136] statement of major dialectal contrast within the surviving Arikara community in 1802, it appears that there was a major social and political contrast: some groups were more properly Arikara, while others were more like the Panian groups to the south (Parks 1979b:236).

The ethnohistoric and linguistic data gathered by Parks (1979a, 1979b) indicate an early linguistic split between the Pawnee proper and the Arikara, sharply contrasting with the traditional view that the Arikara were a late off-shoot of the Skiri.

In addition, there seems to be good evidence that the historic Arikara were an amalgamation of previously diverse groups forced together by depopulation and warfare. This strongly suggests that structurally and culturally the protohistoric and prehistoric "Arikara" may have been very different from what we see in the historic period.

The association of the Arikara peoples with the material culture identified as the Initial Coalescent variant is one that has long standing in Plains archaeology. More than half a century ago, Strong (1933) was able to delineate the cultural assemblage of the historic Arikara based on his excavations at the Leavenworth Village. He was the first to look to the Central Plains for the origins of this assemblage and to suggest that sites such as Arzberger represented a stage in the transition from earlier "Upper Republican-like" cultures to the later Caddoan Pawnee and Arikara (Strong 1933, 1935, 1940). Additional arguments for this cultural continuum model were provided when Wedel (1938) demonstrated the Lower Loup phase was the archaeological expression of the late seventeenth century Pawnee.

Building on the identification of early nineteenth century Arikara at Leavenworth, Lehmer (1954) began the task of extending the sequence back in time. His work defined Phillips Ranch, Dodd, and possibly Buffalo Pasture as eighteenth century Arikara sites. He (Lehmer 1971:202) subsequently delineated these components as comprising the Bad River phase (ca. AD 1675 to 1795) of the Post-Contact Coalescent. Furthermore, he identified a Talking Crow phase (AD 1700 to 1750) in the Big Bend area. Lehmer (1971:201-202) hesitantly suggested it might be ancestral Arikara, but noted its very strong similarities with Pawnee Central Plains materials. A Bad-Cheyenne and Grand-Moreau regional Le Beau phase (AD 1675 to 1780) with close ceramic connections to Talking Crow phase assemblages was also suggested as possibly being Arikara (Lehmer 1971:202-203). There appears to be convincing evidence to link at least one (Bad River) of these archaeological phases with the eighteenth century Arikara.

The evidence for extending Arikara ceramic connections into the prehistoric period has been discussed by a number of regional scholars, but it is primarily Deetz (1965) and Lehmer (1971) who are followed here. Deetz (1965:22) sees the critical ceramic assemblage linking the Arikara with the past as Component B at the Talking Crow site, part of the Stanley phase (now the Talking Crow phase, AD 1725 to 1750; Smith 1977:5). This component contains a few later "Arikara" ceramic forms, but most lack rim bracing. The multiple components analyzed as part of Deetz's study of Medicine Crow provide the transitional ceramic link (e.g., increased neck bracing) with the historic Arikara Bad River phase.

Working further into the past, Deetz interprets the seventeenth century La Roche phase sites (Lehmer's Extended Coalescent variant) with their straight rimmed vessels, simple stamped surfaces, incised or tool impressed decorations, and few collared wares as trending toward the Arikara pattern. The earliest, totally prehistoric assemblage characterized (Strong 1940) as Arikara, primarily from ceramic similarities with Upper Republican and Lower Loup pottery, was recovered from the large fortified Arzberger site. A more complete analysis of the site by Spaulding (1956) led to further strengthening of the Arikara relationship—again on the basis of the Central Plains Upper Republican cultural resemblances. Sites such as Arzberger and, of course, the Wolf Creek component at Crow Creek are critical to the definition of the Initial Coalescent variant that, for many, signals the actual movement of Central Plains peoples into the Missouri Trench. Deetz (1965:14) places the Arzberger phase during the fourteenth to sixteenth centuries while Lehmer (1971:114) would see it (i.e., the Initial Coalescent variant) begin in the fifteenth century.

The archaeological dilemma posed by these data is not whether the historic Arikara represent an outgrowth of the Coalescent Tradition in South Dakota, but rather at what point they can justifiably be recognized as a meaningful entity within that material culture tradition. There is a very real question of the heuristic usefulness of the causal one-to-one correlation that has evolved between the archaeological manifestation, the Coalescent Tradition, and the ethnic, racial, and linguistic group that emerges in the eighteenth and nineteenth centuries as the Arikara. Archaeologists are certainly well aware that there is no rigid correlation between material culture and characteristics such as language or ethnicity and that is certainly demonstrated in this instance.

A number of other language and ethnic groups are believed to have participated in the Coalescent Tradition. The most recognized of these are the Pawnee sites in Nebraska identified as Lower Loup and historic Pawnee (Wedel 1938, Grange 1968). This similarity of the material culture of the prehistoric Pawnee and the Initial Coalescent sites in South Dakota has been noted by virtually every early researcher. The prehistoric participation of Pawnee in the prehistoric and protohistoric Coalescent Tradition sites in South Dakota is likely from the linguistic evidence for continued relationships noted by Parks (1979b).

Even more sobering is the argument by Wood (1971) that the Cheyenne, Algonkian speaking immigrants from Minnesota, were participants in the Coalescent tradition. His excavations at the Cheyenne-occupied Biesterfeldt site in North Dakota recovered a material assemblage virtually identical to that of Arikara villagers on the Missouri. Grinnell (1961) records a number of tribal traditions that indicate the Cheyenne also had later villages along the Missouri Trench, presumably still bearing the same material culture.

Blakeslee (1981:101-104) has provided convincing arguments that some Mandan probably actively visited, lived, or cohabitated with Arikara peoples in Post-Contact Coalescent Le Beau phase villages in South Dakota.

As an archaeological construct, the Coalescent tradition has also been under recent discussion. Ludwickson et al. (1981:161-168) have suggested that conceptually Blakeslee's (1975) model of a broad interaction network based on trade between diverse groups should be applied to the definition of the Coalescent tradition. This leads them to remove both the St. Helena and Loup River phases from the Central Plains tradition and add them to the Coalescent tradition. They created a Basal Coalescent variant, dating between AD 1250 and 1400, to include the Loup River and St. Helena phases and preceding the Initial Coalescent variant.

What are the implications of the archaeological record for the Arikara-Coalescent tradition correlation? It is clear that the Arikara can be comfortably traced in the archaeological record from historic sites, such as Leavenworth, back to the beginnings of the Bad River phase of the Post-Contact Coalescent at ca. AD 1675 to 1700. Even at this recent date, however, there are questions concerning our ability to recognize Arikara assemblages, for example, the tribal identity of the early eighteenth century Le Beau phase peoples (Owsley et al. 1981; Lehmer 1971:203). The extension of Arikara ethnic identity into the Extended Coalescent becomes even more tenuous as noted by both Deetz (1965) and Lehmer (1971). Pioneering archaeological research in Initial Coalescent variant sites (e.g., Spaulding 1956; Kivett and Jensen 1976; Smith 1977) has only been able to deal with the broad parameters of chronology and taxonomic position. This work has been critical, however, in demonstrating both the intra- and intersite complexity and diversity during this time period. Until the archaeological investigation and analysis of Initial Coalescent variant sites has progressed to the point of documenting this internal diversity, it is premature to equate this entire variant with the Arikara.

It is obvious that the biological information contained in the skeletons from the Central Plains and Coalescent traditions holds the key for unraveling the actual movement and change of peoples in the region. Almost exclusively craniometric data have been used in these assessments. The relationship between Central Plains tradition and the Coalescent tradition crania has been examined by several authors. The first thorough examination of these traditions' craniometrics was by Bass (1964), who concluded that any relationship between the Central Plains tradition and the Arikara and Pawnee was a distant one. Since that initial study, Jantz and coworkers (Jantz 1977:164; Jantz et al. 1978:150, 151-152, 1981:29; Jantz and Willey 1983; Ubelaker and Jantz 1979) have found general similarities among Central Plains St. Helena, other Central Plains, and Coalescent tradition crania.

Key conducted the most thorough and complete craniometric analysis and concludes that there "is a strong temporal trend evident, beginning with the Nebraska and St. Helena Phases of the Central Plains Tradition and stretching throughout the Coalescent Arikara sequence"

(1983:106). The primary morphological complexes involved with this temporal trend are increase in face height and decrease in cranial vault height. Although not inconsistent with these conclusions, plotting the first canonical variate on one axis and the specimens' temporo-spatial determinations on the other for his Caddoan sample alone (Key 1983:100, fig. 23), and the first two principal coordinates for the full samples (Key 1983:94, fig. 22) shows a clear gap between the Central Plains and Coalescent samples. The only exception to this generalization is that the single Initial Coalescent cranium included—one from northeastern Nebraska (25BD1), geographically well within the Central Plains samples—is placed morphologically with the Central Plains. Other than this exception, there is a clear separation between the Central Plains and Coalescent crania.

Further complicating this assessment, as Key and others have noted, most of the Coalescent tradition skeletal samples are from northern South Dakota, thus spatially separated from the more southerly Central Plains tradition. It is obvious that to have a more precise understanding of the biological relationship between the Central Plains and northern Coalescent, additional samples, intermediate in time and space, are required. Initial Coalescent remains from central and southern South Dakota are crucial.

The Crow Creek sample, it was hoped, would provide one of these needed Initial Coalescent samples. As shown here in the craniometric relationships, Crow Creek is most similar to early Arikara and the Central Plains St. Helena sites. The problem with the St. Helena samples is that they are late in the Central Plains sequence and may be contemporaneous with or even later than Crow Creek. Thus, the morphological similarities between Crow Creek and St. Helena may be more from contemporaneity and gene flow rather than an ancestor-descendant lineage relationship.

SUMMARY

The Crow Creek site is a large, well-preserved site in south-central South Dakota. Previous excavations found the Initial Coalescent component to have burned earth lodges and scattered human skeletal elements. In 1978 skeletons were discovered eroding from the northwest end of the fortification ditch. Before the remains could be excavated by the USD Archaeology Laboratory, the remains of nearly 50 individuals were looted from the bank. The USD excavations began in early August and sputtered to a stop in December.

The excavations uncovered two bone beds. The lower, more massive deposit, Bone Bed B, was in the bottom of the ditch, and it was cone-shaped, with a maximum thickness of 1.5 m. Bed A was the higher and more scattered of the two deposits. It contained proportionally more skull fragments than Bed B, while Bed B contained proportionally more cervical and thoracic vertebrae than Bed A. Bed A represents either a secondary pickup of remains following the primary deposit of Bed B or remains pulled from Bed B by scavengers. Relatively few artifacts were found with the bones. A metate was at the apex of the bones of Bed B. Most of the ceramics represented Initial Coalescent types. There were four stone points and one bone point in Bed B. Other worked bone artifacts included an awl, ulna pick, and scapula hoes. Most of the unworked and butchered bones were bison and canid.

The partial, disarticulated remains of at least 486 individuals—at least 60% of the Crow Creek villagers—are present. There is incomplete representation of elements. The most frequently represented elements are the proximal, larger, and denser ones, while the distal, smaller, and porous ones are less frequently present. Missing elements were most likely lost during mutilation, were severed and taken as trophies, omitted when the body parts were being collected for burial, or consumed by scavengers.

The Crow Creek age and sex structure deviates from normal. There are irregularities in the age distribution with some of the older age intervals being better represented than some of the younger intervals. While the overall sex ratio is normal, when both age and sex are considered together, there are greater than expected numbers of young males and old females. The most likely explanations for this distribution are that the young females were taken captive by or escaped from the raiders, or that male mortality was greater throughout the younger ages so few males lived to an old age. When the Crow Creek paleodemography is compared with other samples from the region, it differs from cemetery samples but is comparable to another massacre.

Most of the remains show indications of mutilation and scavenging. At least 90% of the skulls were scalped. There was no preference for a particular age or sex; the only difference by age is that the scalped children were cut higher on the skull vault than the adolescents or adults. The typical scalping included two elements: namely, primary circling cuts which intiated and limited the area of scalp taken, and scattered secondary cuts which aided skinning the scalp from the head. Several skulls have possible healed scalpings. Depressed fractures are present on 40% of the more complete skulls. Decapitation is indicated by cuts on the bones of the upper neck, with nearly 25% of the first cervicals cut. Other mutilations include cut noses, tooth evulsions, cut tongues, dismemberments, and burnings. Finally, scavenging is indicated by chewing, most likely by canids, on many of the elements. In addition to those elements with chew marks, it is possible that some of the missing elements were devoured, excreted elsewhere, and not recovered for burial.

Chronologically the massacre dates to the mid AD 1300s. This date is earlier than the beginning date previously assigned the Initial Coalescent. It is clear from the chronometric dates and the artifactual remains and supported by the craniometric analyses that the skeletons are from the Initial Coalescent component. The craniometric analyses indicate that the skulls are homogeneous and are most similar to St. Helena and early Arikara samples. However, the problems of cultural and morphological variability within the Initial Coalescent and the contemporary and subsequent variants have been noted and emphasize the need for continuing research on these questions.

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